

Beyond Simpler Syntax: Complexity and Explanation

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1. Introduction

Recent proposals of Hawkins, Kluender, Hofmeister/Sag et al. and others suggest that to some extent, the explanation for linguistic structures, and constraints on such structures, can be found in processing complexity. Building on this work, I argue that Simpler Syntax (Culicover and Jackendoff 2005) offers a framework of form/meaning correspondences on the basis of which we can formulate an explanatory theory of islands and related phenomena.

§2 sets out some assumptions about the architecture of the grammar and the relationship between unacceptability, ungrammaticality and complexity. §3 reviews briefly a range of complexity factors that interact to produce graded judgments of acceptability. §4 uses evidence from parasitic gaps to show that island effects can in fact be reduced to complexity. §5 shows how complexity may produce the appearance of an island violation when none exists.

2. Architecture and complexity

Simpler Syntax (Culicover and Jackendoff 2005) takes the following view about syntactic representations:

Simpler Syntax Hypothesis (SSH): The most explanatory syntactic theory is one that imputes the minimum syntactic structure necessary to mediate between phonology and meaning.

Simpler Syntax takes the architecture of a grammar to consist of the following.

- (1)
 - a. structural principles governing phrase structure, morphology and agreement;
 - b. conceptual structure (CS);
 - c. phonological structure;
 - d. correspondence rules that state regular correspondences between the three representations a-c;
 - e. primitive grammatical functions (GFs) such as Subject and Object, that mediate correspondences between conceptual structure arguments and syntactic representations;
 - f. a lexicon that catalogues the unpredictable interfaces between phonological, syntactic, and semantic structures for particular words and phrases;
 - g. functional principles that govern the alignment of syntactic structure with prosody and information structure.

Four main features of SS that are particularly relevant to the question of processing complexity and acceptability.

- It is a radical WYSIWYG (what-you-see-is-what-you-get) architecture, at least as far as the syntax is concerned. Overt forms are interpreted to construct meanings; meanings that do not correspond to overt forms, such as control, are projected into conceptual structure on the basis of lexical correspondences.
- Thus there are no empty heads, no empty pronouns, no PRO.
- There is no movement; A' chains link constituents to gaps through a variable binding relation at CS.
- There is no empty structure. Ellipsis and related constructions are interpreted on the basis of the form and meaning of the antecedent.

By and large, the syntactic structures posited by SS are essentially those assumed in many studies of sentence processing, such as those of Gibson 1998, 2000, Hawkins 1994, 1999, 2004, Kluender 1998, 2004. This is not accidental. Our hypothesis that these are not only the minimal structures necessary to account for the processing phenomena, but are also sufficient to do so. Moreover, while SS does not entail that apparent grammatical constraints, such as island constraints, are not part of grammar, this is a perfectly natural consequence of the SS perspective and is the one that I will explore further here.

3. Factors contributing to complexity and island violations

- There are well-formedness constraints, or rules, that specify what the syntactic structures of a language are. These are formulated in terms of configuration, hierarchy, and linear order.
- The computation of every correspondence between such a structure (or more precisely, the phonological string that corresponds to such a structure) and a meaning, what we call 'processing', falls somewhere on a complexity scale, say, 0 to 100.
- Some point on this scale correlates with speakers' judgments that there is something not quite right about a sentence, a further point on the scale correlates with speakers' judgments that a sentence is unacceptable, and a still further point on the scale correlates with speakers' judgments that a sentence is really bad.

Unacceptability			
0	something is not quite right	unacceptable	really bad 100

Complexity factors (Kluender, Gibson, Hofmeister/Sag)

- Constructing an A' chain.
- Identifying the gap in an A' chain.
- Hypothesizing the position of a gap that turns out to be filled already. (Clifton and Frazier 1989:292).
- Garden paths, the repair of.
- Processing referring NPs.
- Processing embedded tensed Ss.
- Processing inside of subjects.
- Self-embedding.

- Crossing dependencies.

Some examples (ranging from ‘really bad’ to ‘not really that bad’).

Complex NP Constraint

- (2) a. *The campaign_i that [NP someone_j [RC who_j could actually spearhead t_i]] was finally thought of is now in total disarray. [processing in a subject; in a tensed clause]
- b. *The campaign_i that [NP someone [RC to spearhead t_i]] was finally thought of is now in total disarray. [processing in a subject]
- c. That’s the campaign_i [NP that I finally thought of someone [RC to spearhead t_i]]. (Kluender 2004) [processing in an object]
- (3) a. *That book_i that I finally met [NP the first reviewer [RC to actually rave about t_i]] at a party is finally in paperback. [processing in a subject; in a tensed clause]
- b. ?That’s the book_i that I finally met [NP the first reviewer [RC to actually rave about t_i]] at a party. [in a tensed clause]
- c. That’s just the latest book_i to completely mislead [NP the first reviewer [RC to actually rave about t_i]].

Subject island

- (4) a. *Who_i does [baking ginger cookies for t_i] give her great pleasure?
- b. ?Who_i does [baking ginger cookies for t_i] seem useless?
- c. Who_i does [being able to bake ginger cookies for t_i] give her great pleasure? (Kluender 2004)
- (5) a. *a person who_i that Robin attacked t_i so viciously didn’t surprise me [intervening subject; tensed clause]
- b. *a person who the fact that Robin attacked t so viciously didn’t surprise me [intervening subject; tensed clause]
- c. ??a person who_i for Robin to attack t_i so viciously wouldn’t surprise me [intervening subject]
- d. ??a person who_i Robin’s vicious attack on t_i didn’t surprise me [intervening subject]
- e. ?a person who_i Robin attacking viciously t_i would really bother me [intervening subject]
- f. a person who_i attacking viciously t_i would frankly give me great pleasure
- g. a person who_i vicious attacks on t_i really bother me

CED

- (6) a. *a person who_i Robin got real drunk [after she thought about t_i] [intervening subject; tensed clause]
- b. a person who_i Robin got real drunk [after thinking about t_i]
- (7) a. *a person who_i Robin went to Washington [so that her daughter could work with t_i] [intervening subject; tensed clause]
- b. ?a person who Robin went to Washington (in order to) for her daughter to work with t [intervening subject]
- c. a person who Robin went to Washington (in order to) work with t

Wh-island

- (8) a. *a person who_i I wonder [what_j I should give t_j to t_i for Christmas] [multiple chains; tensed clause]
- b. ?a person who_i I’m wondering what_j to give t_j to t_i for Christmas [multiple chains]
- c. ?a person to whom_i I’m wondering what_j I should give t_j t_i [multiple chains; tensed clause]
- d. a person to whom_i I’m wondering what_j to give t_j t_i
- (9) a. *a present_i that I wonder who_j I should give t_i to t_j for Christmas [multiple chains; tensed clause; crossing dependency]
- b. *a present_i that I wonder who_j to give t_i to t_j for Christmas [multiple chains; crossing dependency]
- (10) a. *a car_i that I wonder how_j you think you are going to fix t_i t_j [multiple chains; tensed clause; crossing dependency]
- b. a car_i that I can’t figure out how_j to fix t_i t_j [possible crossing dependency, but see Pickering and Barry 1991]
- (11) a. ?a person who_i I’m wondering whether I should talk to t_i [tensed clause]
- b. a person who_i I’m wondering whether to talk to t_i

Superiority

- (12) a. *What_i did who_j buy t_i ?
- b. ??Which book_i did who_j buy t_i ?
- c. ?What_i did which student_j buy t_i ?
- d. Which book_i did which student_j buy t_i ? [various factors, see Arnon et al. in press, Hofmeister et al. 2007, Sag et al. 2008, Featherston 2005]

Subject island and Wh-island

- (13) a. *She is a person who_i [whether or not the President should talk to t_i] is unclear. [intervening subject; tensed clause]
- b. (?)She is a person who_i [whether or not to talk to t_i] is unclear

Coordinate structure constraint

- (14) a. *Who_i did you make dinner and Robin talk to t_i all evening.
- b. ? Who_i did you make dinner and talk to t_i all evening.
- c. Who_i did you sit around and talk to t_i all evening. (Goldsmith 1985, Lakoff 1986, Deane 1992)

4. Parasitic gaps

4.1. Why parasitic gaps are important

There are basically two options available to us to explain the island phenomena. Either the unacceptability is due to ungrammaticality, that is, violation of one or more well-formedness conditions, or it is due to processing complexity. How do we go about choosing between these alternatives, besides demonstrating that there are gradient judgments for all of these island violations? One way to do it is to show that the same gradient judgments occur when there is no extraction, but there is formation of a chain. This is the case with parasitic gaps.

- (15) a class that I sat in on t without actually signing up for pg

Phillips 2006 shows that some gaps in subjects are accessible to the processor, as though the processor knows that such gaps are potential parasitic gaps that might be licensed by a true gap. Other gaps in subjects do not appear to be accessible to the processor.

- (16) a. What did the attempt to repair *pg* ultimately damage *t*? (Phillips 2006:796)
 b. *What did the reporter that criticized *pg* eventually praise *t*?

Not only is (16b) judged unacceptable, but there is no evidence for activation of a gap in on-line processing.

It is as though the processor knows that a configuration such as (16b) is ungrammatical, and therefore assumes that there is no gap.

In (16a) the complement of *attempt* is non-finite and lacks an overt subject. Both of these factors are present in (16b).

Let us assume that the level of complexity in (16b) is thereby sufficiently high that it blocks the hypothesis of a chain into the subject. This in turn produces a garden path (alternatively, a θ -criterion violation) when it is discovered that *criticized* lacks a direct object. Significantly, the subsequent true gap does not help, since the parasitic gap site comes first.

The key idea here is that chains are not built into forbidden territory when the complexity level is high enough.

4.2. Complexity factors in parasitic gaps

(a) *In a subject*

- (17) a. *What did the request for you to repair *pg* ultimately devalue *t*? [intervening subject]
 b. *What did Robin's attempt to repair *pg* ultimately damage *t*? [intervening subject]
 (18) a. *Who does [them baking ginger cookies for *pg*] give great pleasure to *t*? [intervening subject]
 b. ?Who does [baking ginger cookies for *pg*] seem useless to *t*?
 c. Who does [being able to bake ginger cookies for *pg*] give great pleasure to *t*?
 (19) a. *a person who that Robin attacked *pg* so viciously didn't bother *t* [intervening subject; tensed clause]
 b. *a person who the fact that Robin attacked *pg* so viciously didn't bother *t* [intervening subject; tensed clause]
 c. ??a person who for Robin to attack *pg* so viciously wouldn't bother *t* [intervening subject]
 d. ??a person who Robin's vicious attack on *pg* didn't bother *t* [intervening subject]
 e. ?a person who Robin attacking viciously *pg* would really bother *t* [intervening subject]
 f. a person who attacking viciously *pg* would really bother *t*
 g. a person who vicious attacks on *pg* really bother *t*

Non-subject cases.

- (20) a. Robin mentioned a plan to nominate Hillary to her.
 b. ?Who did Robin mention a plan to nominate Hillary to *t*?

We can improve the true gap by putting it inside of an NP.

- (21) Who did Robin mention a plan to nominate Hillary to supporters of *t*?

In this case, the parasitic gap appears to work.

- (22) Who did Robin mention a plan to nominate *pg* to supporters of *t*?

Reversing the order is better.

- (23) Who did Robin mention to supporters of *t* a plan to nominate *pg*?

And when we add other complexity factors, acceptability goes down, regardless of order.

- (24) a. *Who did Robin mention your plan to nominate *pg* to supporters of *t*? [overt subject]
 a'. *Who did Robin mention to supporters of *t* your plan to nominate *pg*? [overt subject]
 b. *Who did Robin introduce the politician that would nominate *pg* to supporters of *t*? [tensed S]
 b'. *Who did Robin introduce to supporters of *t* the politician that would nominate *pg*? [tensed S]

As we add referring NPs as subject and tensed Ss (26a,c), and more chains (26b,c), and crossing dependencies (26c), the parasitic gap becomes more unacceptable.

- (25) a. a person who complimentary stories about *pg* embarrass *t*
 b. a person who complimenting *pg* embarrasses *t*
 (26) a. ?a person who_i everyone that talks to me about *pg* praises *t* to the sky [indefinite subject; tensed clause]
 b. ??a person who_i everyone_i that I talk to *t_i* about *pg_j* says nice things about *t_j* [indefinite subject; tensed clause; nested dependency]
 [cf. ?a person who everyone that I talk to about says nice things about the department]
 c. *a person who_i everyone_i that I talk about *t_i* to *pg_j* says nice things about *t_j* [indefinite subject; tensed clause; crossing dependency]
 [cf. ?a person who everyone that I talk about to says nice things about the department]

(b) *Has an overt subject*

- (27) a. a person who I talked about *t* without recognizing *pg*
 b. ?a person who I talked about *t* without the people in the crowd recognizing *pg*
 (28) a person who I talked about *t* without anyone recognizing *pg* [less 'referential' subject]

(c) *In a tensed S*

- (29) a. a person who I talked about *t* immediately after recognizing *pg*
b. ?a person who I talked about *t* immediately after I recognized *pg*
c. ??a person who I talked about *t* immediately the cops recognized *pg*

(d) *Adjunct antecedent*

Identifying the gap in a chain headed by an adjunct is more difficult than identifying the gap in a chain headed by a bare NP argument, especially one that is subcategorized by a verbal or prepositional head, because only in the latter cases are the gaps visible as such.

In those cases where the adjunct (or PP) is not strongly selected, the parasitic gap construction appears to be impossible.

- (30) *To whom did the idea to talk *pg* ultimately appeal *t*?
[cf. The idea to talk to Otto ultimately appealed to him.]

This example is good without the parasitic gap.

Adjunct antecedents of parasitic gaps should be possible, but only when all complexity factors have been eliminated and there is strong subcategorization of the non-argument (Levine et al. 2001:185).

- (31) a. How harshly do you think we can treat THEM *t* without in turn being treated *pg* OURSELVES? (adverbial P-zap)
b. That's the kind of table ON WHICH it would be wrong to put expensive silverware *t* without also putting *pg* a fancy centerpiece. (PP P-gap)
c. I wonder just how nasty you can PRETEND to be *t* without actually BECOMING *pg*. (AP P-gap)
d. THAT DRUNK, it would be impossible for me to get *t* without ROBIN getting *pg* as well. (AP P-gap)
e. How drunk can you APPEAR (to be) *t* without actually BECOMING *pg*?/How drunk can you APPEAR (to be) *t* without ACTUALLY being *pg*? (AP' gap)
f. That's exactly how strange we got them to act *t* (after, of course, acting *pg* OURSELVES). (AP P-gap)
g. A doctor, you could spend your whole life trying to be *t* without ever becoming *pg*! (nonreferential NP P-gap)
h. That Robin is a spy would naturally be difficult to refute *t* without (someone) having first conjectured *pg*.

All of the parasitic gaps are in non-finite, subjectless adjuncts that follow the true gap. Any additional complexity factor renders them impossible, e.g.,

- (32) a. *How harshly do you think we can treat THEM *t* without them in turn being treated *pg*?
b. *That's exactly how strange we got them to act *t* (after, of course, we acted *pg* OURSELVES).

- c. *Without actually BECOMING *pg*, I wonder just how nasty you can PRETEND to be *t*.
d. *How harshly can we ask them *t* [whether they acted *pg*?]
e. *That Robin is a spy we had almost refuted *t* before we had learned *pg*.

4.3. Impossible parasitic gaps

The claim that parasitic gaps are licensed only if they are in a context that does not exceed some complexity threshold predicts that there will be some configurations in which parasitic gaps will be impossible.

- (33) *a person who I talked to *t* without recognizing the people who insulted *pg*

If we eliminate the complexity factors, the parasitic gap becomes acceptable.

- (34) a car that I made an offer on *t* without having any plans to repair *pg*

that-t and other complementizer-*t* effects.

- (35) a. a candidate that I believe (*that) *t* will win
b. *a candidate that I wonder whether *t* will win

These gaps are not ameliorated by a true gap when they appear as parasitic gaps (Culicover 1993).

- (36) a. I told supporters of Hillary [(that) she might actually win.]
b. the candidate that I told supporters of *t* [(that) *pg* might actually win]
(37) a. I asked supporters of Hillary [whether she might actually win]
b. *the candidate that I asked supporters of *t* [whether *pg* might actually win]

But *that-t* effects are ameliorated by an intervening adverb.

- (38) a. a person who I believe that most $\left. \begin{array}{l} \text{likely} \\ \text{certainly} \end{array} \right\} t$ will win
b. a candidate that I wonder [whether under some circumstances *t* might actually win]

And these effects are also seen in *that-pg* cases.

- (39) a. the candidate that I told supporters of *t* [(that) under some circumstances *pg* might actually win]
b. ?the candidate that I asked supporters of *t* [whether under some circumstances *pg* might actually win]

Culicover and Levine 2001. suggest that that *that-t* effect is a type of garden path.

We expect that problems caused by garden paths in the identification of gaps will not be ameliorated by true gaps. The processing complexity that arises from a garden path is local

complexity having to do with the identification of the gap itself, and not complexity that contributes to constructing the chain.

- (40) a. the customer who I sold a defective iPod to *t*
 b. ?the customer who I sold *t* a defective iPod
 (Jackendoff and Culicover 1972)

The parasitic gap is no more acceptable than is the true gap.

- (41) a. the customer who I sold a defective iPod to *pg* without even providing *t* with a receipt
 b. ?the customer who I sold a defective *pg* iPod without even providing *t* with a receipt.
 (42) a. the customer who I robbed *t* after selling a defective iPod to *pg*
 b. ?the customer who I robbed *t* after selling *pg* a defective iPod

5. Complex ellipsis

If this approach to complexity and acceptability is right, we should find that other cases of demonstrable complexity should produce the subjective experience of unacceptability. An interesting example noticed by Lasnik 2001 and discussed by Merchant 2008 is the following.

- (43) *They want to hire someone who speaks a Balkan language, but I don't know which (Balkan language) they do ('[_{VP} want to hire [_{NP} someone [_S who speaks *t*]]')
 (44) They want to hire someone who speaks a Balkan language, but I don't know which (Balkan language) ('they [_{VP} want to hire [_{NP} someone [_S who speaks *t*]]')

Merchant's solution is to posit that in the case of sluicing, the entire chain is absent at PF, but in the case of ellipsis, there is a remnant of the chain in the form of an intermediate trace that is attached to the VP, and this trace is sufficient to produce the violation.

Simpler Syntax says that there is no invisible structure, and no movement. Hence there is no island in (44). The question, then, is why there appears to be an island violation in (43). But what we actually know about (43) is that it is unacceptable.

In the case of sluicing, it is sufficient to find a match in the antecedent directly, and substitute the interpretation of the fragment for the interpretation of the match. The variable α corresponds to the argument, and the operator Q^α is applied to the result.

- (45) Ant.int.: **WANT**(THEY,**HIRE**(Y^β [INDEF;PROPERTY:**SPEAK**(β ,BALKAN-LG)]))
 Frag.int.: $Q^\alpha(\alpha)$
 $\lambda x.$ **WANT**(THEY,**HIRE**(Y^β [INDEF; PROPERTY:**SPEAK**(β ,x)]))

 Full int.: $Q^\alpha(\lambda x.$ **WANT**(THEY,**HIRE**(Y^β [INDEF; PROPERTY:**SPEAK**(β ,x)])(α))

This is a special case of Bare Argument Ellipsis, e.g., *Who did you see? – Robin*.
 In the case of VP ellipsis, the match is a bit different.

- (46) Brian speaks a Balkan language, but I don't.

The matches are

- (47)

Target	Fragment	
Brian	I	[matching subjects]
–	not	[matching polarity]

When there is an A' chain into an elliptical VP, we have to reconstruct the VP on the basis of the antecedent, find a position for the gap in this VP, reconstruct the A' chain, and construct the interpretation.

- (48) a. Mary was talking to someone, but I forget who.
 b. ?Mary was talking to someone, but I forget who she was ('[_{VP} talking to *t*']).
 (49) a. Mary talked to someone, but I forget who.
 b. ?Mary talked to someone, but I forget who she did ('[_{VP} talk to *t*']).
 (50) a. Mary was talking to someone, but who?
 b. *Mary was talking to someone, but who was she ('[_{VP} talking to *t*'])?
 (51) a. Mary wants to talk to someone, but who?
 b. *Mary wants to talk to someone, but who will she ('[_{VP} talk to *t*'])?)

In the case of (43) basically the same reconstruction process has to take place. In order to reconstruct the missing VP, it is necessary to identify the part of the antecedent VP that corresponds to the gap that forms a chain with *which*, construct the chain and interpret it.

- (52) want to hire someone who speaks a Balkan language

On the other hand, a gap that causes local complexity as a consequence of garden pathing should not be more problematic than these simple cases.

- (53) a. ?Mary gave somebody the money, but I forget who she did ('[give *t* the money]').
 b. ?Mary thinks that someone will call, but I forget who she does ('[think that *t* will call]').

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