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Filler–gap dependencies and the remnant–correlate dependency in backward sprouting: Sensitivity to distance and islands[1]

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The relationship between the *wh*-remnant and the null correlate in the type of ellipsis known as backward sprouting is superficially almost identical to the relation between a *wh*-filler and a gap in a *wh*-question. In both cases, there is a dependency between the *wh*-phrase and a later null element. We conduct a sentence acceptability experiment to test whether the remnant–correlate dependency in backward sprouting exhibits two well-known properties of a filler–gap dependency in *wh*-questions: sensitivity to clause boundaries (distance) and sensitivity to islands. The results show that both dependency types are sensitive to clause boundaries, although the effect is larger in the case of filler–gap dependencies, but that only filler–gap dependencies are sensitive to islands. These results present a challenge to analyses of sprouting in which the ellipsis site contains a full representation of the structure of the antecedent clause, since such analyses predict island-sensitivity for remnant–correlate dependencies. The results also suggest that island-sensitivity cannot be reduced to simple processing demands without regard to the syntactic representation of the dependency, since such a view would predict greater similarity between filler–gap dependencies and remnant–correlate dependencies than is found.

Keywords: adjunct extraction, backward sprouting, dependency distance, ellipsis, experimental syntax, filler–gap dependency, island, locality, remnant–correlate dependency

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1. Introduction

Filler–gap dependencies, as seen in the dependency between *what* and the gap in (1), are one of the most widely studied phenomena in syntax.

(1) It's unclear **what** Jill was drinking _ on the bus.

What is interpreted as the object (i.e. an argument) of the verb *drinking* in (1), and in that sense there is a dependency between *what* and the gap in the object position. Two of the many well-known properties of this type of dependency are that it is sensitive to clause boundaries in general and to island structures more specifically. The sensitivity to clause boundaries may be observed most directly in the decline in acceptability that occurs in cases like (2), where *what* is in a separate clause from the gap.

(2) It's unclear **what** Eli believes [that Jill was drinking _ on the bus].

Formal acceptability experiments show consistently that this type of long-distance dependency results in a degradation of acceptability when compared to matched sentences without such a dependency (e.g. Cowart 1997; Alexopoulou & Keller 2007). The sensitivity to islands is exemplified in (3), where the gap is inside an island (in this case, a complex NP).

(3) *It's unclear **what** Eli believes [the report that Jill was drinking _ on the bus].

Islands are structures that resist having a gap, in the sense that speakers find sentences like (3) substantially less acceptable than long-distance dependencies without an island, as in (2). This is true whether the gap is in an argument position, as in (1)–(3), or an adjunct position, as in (4) – although there has been very little experimental work on the acceptability of sentences like (4).[2]

(4) (a) It is unclear **with what money** Jill bought a ferry _.
(b) It is unclear **with what money** Eli believes [that Jill bought a ferry _].
(c) *It is unclear **with what money** Eli believes [the rumor that Jill bought a ferry _].

In this paper, we will use these two properties to compare filler–gap dependencies as in (1)–(4) with the superficially similar dependency seen in (5).

(5) (a) Although it's unclear **what**, Jill was drinking _ on the bus.
(b) Although it's unclear **with what money**, Jill bought a ferry _.

[2] The association of the filler in (4b, c) with a gap in the embedded clause is determined not by subcategorization, as in argument filler–gap dependencies, but by the plausibility of the association between the *wh*-adjunct and the embedded predicate (in this case *bought*). Despite this, both argument and adjunct filler–gap dependencies are well known to show very similar properties (see Stepanov & Stateva 2015).

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Example (5) shows instances of BACKWARD SPROUTING, a type of ellipsis structure. As in a filler–gap dependency, the *wh*-phrase *what* in (5a) is understood as the object of the verb *drinking*, and in this sense, there is a dependency here too. The *wh*-phrase is referred to as the REMNANT in the ellipsis literature and the missing object of *drinking* as the CORRELATE, so we refer to the dependency here as a remnant–correlate dependency.[3] Similarly, a remnant–correlate dependency exists in (5b) as well, where the remnant is an adjunct *wh*-phrase. In a filler–gap dependency, the filler requires a corresponding gap, as seen in (6a), and similarly in a remnant–correlate dependency, the sentence is ill-formed if there is no available correlate for the remnant, as seen in (6b).

(6) (a) *It's unclear **with what money** Jill bought a ferry <u>with the drug money</u>.
(b) *Although it's unclear **with what money**, Jill bought a ferry <u>with the drug money</u>.

The question we will ask, then, is whether remnant–correlate dependencies show the same sensitivity to clause boundaries and to island structures as do the more familiar filler–gap dependencies. Answering this question will have important implications for our understanding of ellipsis and of island phenomena, as will be discussed in detail below, but at this point one can imagine the answer going in either direction.[4]

On the one hand, there are reasons to expect that the two dependency types will show the same sensitivity. If the sensitivity of filler–gap dependencies to clause boundaries and island structures is due at least in part to the demands of processing, as has been argued (e.g. Kluender & Kutas 1993; Alexopoulou & Keller 2007; Hofmeister & Sag 2010; Fanselow 2021), then we might expect remnant–correlate dependencies to behave the same, given that the processing demands would appear to be similar. In both cases, the *wh*-phrase must be held in memory until the gap site is reached, where it must be retrieved and integrated into the linguistic representation in progress (Gibson 1998; Phillips, Kazanina & Abada 2005; Wagers & Phillips 2014). If clause boundaries, and especially island boundaries, make retrieval of the *wh*-phrase more difficult, then we might observe these effects with both types of dependencies.

In addition, some analyses of backward sprouting propose that the ellipsis site contains a covert representation of a full filler–gap dependency (Ross 1969; Chung,

[3] The main clause in backward sprouting must be well formed on its own, so remnant–correlate dependencies are not possible when the predicate is obligatorily transitive (e.g. with *hitting* instead of *drinking* in (5a)). The remnant must still be associated with a correlate, though, so the predicate must be optionally transitive (e.g. *drinking* in (5a), but not a predicate like *sleeping*), since only then will the main clause be well formed while still allowing the remnant to be associated with a correlate. See Chung et al. (1995) and AnderBois (2014).

[4] See Gullifer (2004), Yoshida et al. (2012), and Yoshida, Ackerman, et al. (2014) for the only experimental studies on this question to our knowledge. However, they explore backward sluicing where the correlate is not null but occupied by an indefinite element (see (14)), so backward SPROUTING remains unexplored.

Ladusaw & McCloskey 1995; J.-S. Kim 1997; Romero 1998; Merchant 2001). Example (5b), for instance, has a structure as in (7) under this analysis.

(7) Although it's unclear **with what money** [~~Jill bought a ferry _~~], Jill bought a ferry _.

If the sensitivity to clause boundaries and island structures results from the interaction of the dependencies with the syntactic structure, then we might expect to see that sensitivity for remnant–correlate dependencies under this type of analysis, given that the structure contains a covert filler–gap dependency.

For reasons relating to processing demands or to covert structure at the ellipsis site, then, one might expect that filler–gap dependencies and remnant–correlate dependencies would display similar sensitivity to clause boundaries and islands. On the other hand, there are good reasons to think that filler–gap dependencies and remnant–correlate dependencies would behave differently. From a syntactic perspective, for instance, the relation between *with what money* and the verb phrase *bought a ferry* in our examples in (4a) and (5b) must be very different in the two cases, regardless of the analytical framework that one adopts. In a minimalist approach, the filler–gap dependency in (4a) is produced by externally merging the *wh*-phrase, originally generated as an adjunct of the verb phrase, into its surface position at a higher point in the tree, while in a Head-driven Phrase Structure Grammar (HPSG) approach, it is produced by passing a SLASH value through the tree between the *wh*-phrase and the verb. Neither of these analyses is possible for a remnant–correlate dependency as in (5); the *wh*-phrase is inside its own clause, in a position not accessible to the verb phrase either through external merge or through passing of a feature value. This structural difference between filler–gap dependency and remnant–correlate dependency is schematized in (8) and (9).

(8) filler–gap: [it's unclear [**with what money** [Jill bought a ferry _]]]
(9) remnant–correlate: [although [it's unclear **with what money**]] [Jill bought a ferry _]

Remnant–correlate dependencies must thus emerge syntactically through very different means than filler–gap dependencies, so to the extent that clause boundary and island-sensitivity is related to the syntactic representation of the dependency, one would not expect the two dependency types to behave the same in this regard.

Another reason to be doubtful concerning any similarity in behavior between filler–gap dependencies and remnant–correlate dependencies concerns the ellipsis site in sprouting. As we saw in (7), some analyses posit a covert filler–gap dependency at this site, but this is not the only possibility. Other analyses claim that the ellipsis site consists of either a null pro-clause (e.g. Barker 2013; Poppels 2020) or nothing at all (e.g. Ginzburg & Sag 2000; Culicover & Jackendoff 2005; Sag & Nykiel 2011; J.-B. Kim 2015). Under such analyses, there is no filler–gap dependency or internal structure within the ellipsis site, so no sensitivity to clause boundaries or island structures is predicted.

As we have seen, then, filler–gap dependencies are famously sensitive both to clausal boundaries and to islands, and the question is whether the superficially similar remnant–correlate dependencies found in backward sprouting show these same properties. If they do, this would lead us to at least one of the following two conclusions. First, it could suggest that filler–gap dependencies and remnant–correlate dependencies recruit very similar processing mechanisms and that these mechanisms are what give rise to the locality properties discussed (i.e. the sensitivity to clausal boundaries and islands). Second, it could suggest that backward sprouting contains a covert filler–gap dependency at the ellipsis site and that it is this covert dependency that makes the remnant–correlate dependency appear as if it has filler–gap dependency properties. Both of these conclusions are made plausible by some of the existing literature, but they would receive considerable additional support if filler–gap dependencies and remnant–correlate dependencies turn out to show very similar degrees of sensitivity.

If remnant–correlate dependencies turn out NOT to be sensitive to clause boundaries and island structures in the way that filler–gap dependencies are, however, this would lead us to a very different set of possible conclusions. First, it would suggest that if this sensitivity in filler–gap dependencies results from the processing mechanisms that filler–gap dependencies require, then remnant–correlate dependencies must make use of a different set of mechanisms, at least partially. This would make sense if the processing mechanisms needed are closely tied to the way that the dependencies are represented syntactically, since, as we have seen, filler–gap dependencies and remnant–correlate dependencies have very different syntactic representations. Second, it would suggest that backward sprouting does not contain a covert filler–gap dependency in that a lack of island effects would remove an important piece of possible evidence in favor of a filler–gap dependency and a full syntactic structure at the ellipsis site in backward sprouting.

This paper is organized as follows. In Section 2, we review what is known about filler–gap dependencies with regard to sensitivity to clause boundaries, which we will refer to as the distance effect, and to island structures, which we will refer to as the island effect. Section 3 explores in more detail the nature of ellipsis in backward sprouting and analyses that have been proposed. In Section 4 we present an acceptability experiment that directly addresses our primary research question: Do both filler–gap dependencies and remnant–correlate dependencies show distance effects and island effects? The implications of the experiment for our understanding of ellipsis and of island phenomena will be discussed in Section 5 and general conclusions will be presented in Section 6.

2. Sensitivity to distance and to islands in filler–gap dependencies

As is well known, filler–gap dependencies are able to occur across a clausal boundary, as in (10a), but with a decline in acceptability relative to matching filler–gap dependencies that do not cross a clausal boundary, as in (10b).

(10) (a) What does Eli believe [that Jill was drinking _ on the bus]?
(b) Who _ believes [that Jill was drinking beer on the bus]?

This effect, which we will refer to simply as the DISTANCE EFFECT, is standardly assumed to be related to the fact that the *wh*-phrase is retained in memory until the dependency is resolved, as occurs when the relevant verb is encountered. If the *wh*-phrase is an argument (e.g. *who* and *what*; Garnsey, Tanenhaus & Chapman 1989), the relevant verb is the subcategorizing verb, and if it is an adjunct such as a manner adverb (e.g. *how quickly*; Stepanov & Stateva 2015), it is the verb that the adverb modifies. LONG filler–gap dependencies (i.e. those that cross clausal boundaries) are assumed to require more processing resources than SHORT ones, and this strain on processing is reflected in a decline in acceptability.[5]

Beyond any effect of clausal boundaries, filler–gap dependencies are known to be constrained by structures known as ISLANDS (Ross 1967). When the gap of a filler–gap dependency is inside a complex NP, for instance, as in (11a), the sentence is heavily degraded compared to a matching sentence where the filler–gap dependency is resolved outside of the complex NP, as in (11b).

(11) (a) *What does Eli believe [the report that Jill was drinking _ on the bus].
(b) Who _ believes [the report that Jill was drinking beer on the bus].

Unlike the distance effect in (10), the island effect in (11) is readily perceptible even without a formal experiment and sentences like (11a) are generally taken to be of very low acceptability. Speakers may be capable of positing a gap in sentences like these, but it appears to cause considerable difficulty (for discussion, see Stowe 1986; Kluender & Kutas 1993; Pickering, Barton & Shillcock 1994; Phillips 2006; Michel 2014; Chaves & Dery 2019; Kohrt et al. 2020).

Putting the contrasts in (10) and (11) together, previous studies (e.g. Sprouse, Wagers & Phillips 2012) have developed a 2 × 2 factorial design that can isolate the island effect separately from the distance effect. This is done by crossing the DISTANCE of the dependency (*short* vs. *long*) and the STRUCTURE of the embedded clause (*non-island* vs. *island*), as schematized in (12):[6,7]

[5] We will not be concerned here with the within-clausal distance of filler–gap dependencies, which also appears to have an effect, although perhaps not as great as that of cross-clausal distance. See Frazier & Clifton (1989) and Wagers & Phillips (2014) for discussion.

[6] As pointed out by an anonymous reviewer, the two levels of STRUCTURE here (*non-island* vs. *island*) refer simply to whether an island structure is present, not to whether the filler–gap dependency crosses an island boundary. The filler–gap dependency in the [short] conditions crosses neither a clausal nor an island boundary. Only the filler–gap dependency in the [long | island] condition (but not the [short | island] condition) violates an island.

[7] As noted by Liu et al. (2022), there remain some potential confounds in the factorial design in (12), which may make it difficult to truly isolate the effect of an intervening island. For example, the LINEAR distance between the filler and the gap is not completely controlled between the [long | non-island] condition in (10a) and the [long | island] condition in (11a): compared with (10a), (11a) has one more NP (i.e. *the report*) between the filler and the gap.

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(12)	(a)	[*short* | *non-island*]	(e.g. (10b))
	(b)	[*long* | *non-island*]	(e.g. (10a))
	(c)	[*short* | *island*]	(e.g. (11b))
	(d)	*[*long* | *island*]	(e.g. (11a))

This design recognizes that the low acceptability of the island-violating filler–gap dependency in (12d) results at least partly from two factors. The first is the effect of having a long-distance dependency relative to a short-distance one, which is known to lower acceptability. This DISTANCE effect can be isolated by comparing the difference between (12a) and (12b). The second factor is the effect of having a relatively complex embedded clause (i.e. an island) compared to a complement *that*-clause (i.e. a non-island), assuming that the more complex structure will also lower the acceptability of the sentence. This STRUCTURE effect may be isolated by comparing (12a) with (12c).

The very low acceptability of (12d) should thus be at least partially explained by the sum of the two individual effects, namely the DISTANCE effect (i.e. (12a)−(12b)) and the STRUCTURE effect (i.e. (12a)−(12c)). However, sentences like (12d) are of even lower acceptability than the sum of these two individual effects. They seem to have additional degradation, often called an ISLAND EFFECT. As illustrated in the right panel of Figure 1, an island effect can be recognized by the superadditive degradation associated with long extraction out of an island structure (as in (12d)).

While the source of island effects has not yet been settled (e.g. memory constraints: Kluender & Kutas 1993; grammatical constraints: Sprouse et al. 2012), it is clear that they are a characteristic property of filler–gap dependencies (Sprouse et al. 2011, 2012, 2016, among many others) and that they appear not be found with other types of long-distance dependencies (see, e.g. Kazanina et al. (2007); Yoshida, Kazanina, et al. (2014); although see Keshev & Meltzer-Asscher (2019); Liu et al. (2022) for cautionary notes). If the remnant–correlate dependency in backward sprouting is similarly constrained by islands, we should observe a comparable superadditive degradation using the same design. If not, we should get the two

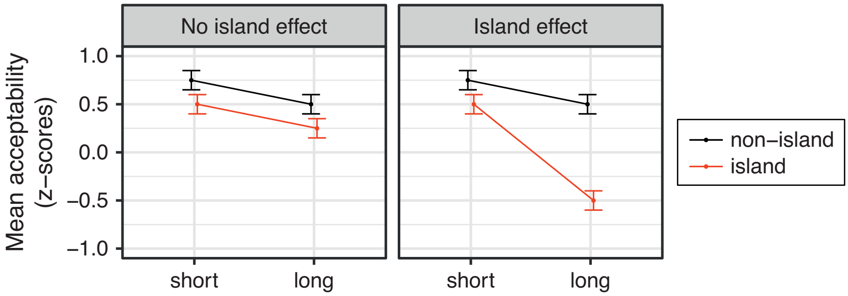

Figure 1
(Colour online) Island effects as a superadditive degradation (based on Sprouse et al. 2012: 86).

parallel lines as in the left panel of Figure 1, indicating that the degradation in backward sprouting in island environments reflects only the sum of the two individual effects, the long-distance dependency and the structural complexity of the island structure.

3. Nature of ellipsis & remnant–correlate dependency in backward sprouting

Our main goal in this paper is to compare filler–gap dependencies as in (13a) and remnant–correlate dependencies as in (13b), to see if there are significant similarities between these two types of dependencies.

(13) (a) It's unclear **with what money** Jill bought a ferry _.
(b) Although it's unclear **with what money**, Jill bought a ferry _.

We do this by examining two properties that are known to be true of filler–gap dependencies, sensitivity to clause boundaries (distance) and sensitivity to islands, and asking whether they are also true of remnant–correlate dependencies. As already alluded to in Section 1, whether we expect filler–gap dependencies and remnant–correlate dependencies to be similar in these respects depend both on our assumptions about ellipsis (and specifically sprouting) and on our assumptions about the source of island effects, so we turn to a fuller discussion of those issues now.

With regard to ellipsis, we saw two main approaches to the representation of sprouting sentences. In the first, the STRUCTURAL VIEW OF ELLIPSIS, the ellipsis site (immediately after *what* in (13b)) contains a full representation of the subsequent clause (*Jill bought a ferry* in (13b)), from which the *wh*-phrase is extracted (Ross 1969; Chung et al. 1995; J.-S. Kim 1997; Romero 1998; Merchant 2001, among many others). Under this view, we might expect some amount of sensitivity to distance, but perhaps not the same amount as in filler–gap dependencies. The reason is that in filler–gap dependencies the decline in acceptability associated with distance is usually thought to stem from the strain of maintaining the dependency while other material is being processed until the time when the verb is encountered and the dependency can be resolved. Within the ellipsis site, however, there is of course no overt material, so it is not clear if these processing considerations apply despite the instance of *wh*-extraction that is assumed in this analysis. Nevertheless, increasing the length of the elided clause, especially in a way that increases the amount of material before the dependency is resolved, could conceivably increase the amount of processing effort required, which could then plausibly decrease acceptability. To see this, consider the processing model of backward sluicing presented in Yoshida et al. (2012) and Yoshida, Ackerman, et al. (2014) (unlike backward sprouting, backward sluicing contains an overt correlate of the *wh*-remnant such as *something*). Adopting Chung, Ladusaw & McCloskey's (1995, 2011) LF-copy/reuse analysis, Yoshida et al. (2012) and Yoshida, Ackerman, et al.

(2014) claim that the ellipsis site in backward sluicing is restored in real time when each word after the *wh*-remnant is processed, as illustrated in (14).

(14) Although it's not clear **how**, Jill bought a ferry somehow.
  (a) … how <$_{\text{Ellipsis}}$ … >, …
  (b) … how <$_{\text{Ellipsis}}$ Jill … >, [Jill …]
  (c) … how <$_{\text{Ellipsis}}$ Jill bought … >, [Jill bought …]
  (d) … how <$_{\text{Ellipsis}}$ Jill bought a ferry … >, [Jill bought a ferry …]
  (e) … how <$_{\text{Ellipsis}}$ Jill bought a ferry somehow>, [Jill bought a ferry somehow]

In this model, after the *wh*-remnant is encountered, as in (14a), each subsequent word from the antecedent clause is then copied into the ellipsis site, as in (14b–e). In backward sprouting, one could assume that the process would be the same, the only difference being the lack of an overt correlate (e.g. *somehow* in (14)) in the sprouting case. It would be reasonable to expect that as the amount of material to be restored into the ellipsis site increases, processing difficulty would also increase. This should be particularly true as the length of the dependency increases, which we would expect to be reflected in declining acceptability. The type of distance effect seen with filler–gap dependencies might then also be found in backward sprouting, although for different reasons and perhaps to a different extent.

This sketch of how the ellipsis site is restored also allows us to see what this approach predicts for island effects in backward sprouting. In the analysis in Chung et al. (1995, 2011), the *wh*-remnant is licensed by a movement-like dependency with the null correlate, as in (15) (cf. (14e)).

(15) … **how** <$_{\text{Ellipsis}}$ Jill bought a ferry _ >, [Jill bought a ferry _]

In effect, this establishes a filler–gap dependency within the ellipsis site, so given the known island-sensitivity of filler–gap dependencies, an island effect is predicted in backward sprouting as well.

The structural view of ellipsis thus predicts both a distance effect (although perhaps not of the same magnitude as with filler–gap dependencies) and an island effect in backward sprouting. Let us now turn to the non-structural view of ellipsis. Under this approach, there is no internal structure to the ellipsis site, which is interpreted through inferential processes such as anaphora (Barker 2013; Poppels 2020) or direct interpretation (Ginzburg & Sag 2000; Culicover & Jackendoff 2005; Sag & Nykiel 2011; J.-B. Kim 2015, among others). As with the structural view, we would expect some degree of sensitivity to distance under this view, given that more processing resources would presumably be required as the distance between the *wh*-remnant and the part of the antecedent clause that licenses it increases, but it is difficult to say whether this sensitivity would be predicted to be larger or smaller than that seen with filler–gap dependencies. For islands, however, the predictions of the non-structural view of ellipsis seem very clear.

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There is no covert filler–gap dependency under this analysis, so no reason to expect sensitivity to island structures.

The two views of ellipsis that we have considered thus make similar predictions regarding distance effects (they are likely), but very different predictions regarding islands. The structural view predicts that there will be island effects with backward sprouting, while the non-structural view predicts that there will not be.

Beyond the analysis that one adopts for ellipsis, though, the relationship between the remnant *wh*-phrase and the null correlate could also generate predictions about distance and island effects. This relationship is the remnant–correlate dependency that we discussed earlier and, as we saw in Section 1, it would seem to require processing mechanisms very similar to those assumed for the filler–gap dependency: the *wh*-phrase must be held in memory until the correlate site is reached, at which point it must be retrieved and integrated into the linguistic representation in progress. If we assume that these mechanisms in and of themselves are the source of island-sensitivity, and that the syntactic nature of the dependencies is not relevant, we then predict that filler–gap dependencies and remnant–correlate dependencies will behave the same with regard to distance and island effects. As discussed in Section 1, filler–gap dependencies and remnant–correlate dependencies appear to have very different syntactic representations (resulting from external merger or SLASH values for filler–gap dependencies versus something else for remnant–correlate dependencies), but if we assume that the processor is oblivious to these distinctions, then the two dependency types could be processed in the same way and the same sensitivity to distance and islands could arise.

4. Experiment

4.1 *Methods*

4.1.1 *Participants*

Eighty-nine people, all undergraduate students at the University of California, San Diego, participated in this experiment for course credit. The experiment was approved by the Institutional Review Board of the university (#182111XX) and all participants gave their informed consent. The experiment was performed in a laboratory setting.

The responses from two groups of participants were excluded from analysis. The first group included those who reported either that English was not their native language or that they were born outside of the United States and moved to the United States after age 5. This eliminated six participants. The second group were those who did not appear to be paying attention to the task, based on their responses on 20 GOLD STANDARD filler items, the 10 filler items with the highest score and the 10 filler items with the lowest score in a pilot study, following the procedure in Sprouse, Messick & Bobaljik (2022). For each gold standard filler, we calculated the difference between each participant's response and its expected value from the pilot. Then, each of the differences was squared and summed for each participant,

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which gave us the SUM-OF-THE-SQUARED-DIFFERENCES value for each participant. We excluded any participants whose sum-of-the-squared-differences value was greater than two standard deviations away from the mean. Three participants were excluded by this procedure, leaving 80 in total. The mean age of the participants was 20 (SD = 1.99), with a range of 18–28.

4.1.2 *Stimuli and method*

Experimental items were constructed using a 2 × 2 × 2 design, crossing dependency DISTANCE (*short* vs. *long*), STRUCTURE of the embedded clause (*that-clause* non-island vs. *complex NP* island), and DEPENDENCY type (*filler–gap* dependency in *wh*-questions vs. *remnant–correlate* dependency in backward sprouting), as exemplified in (16).

(16) (a) **[short | *that*-clause | filler–gap (*wh*-question)]**
It is unclear on what basis Eli believes _ that Jill bought a ferry.
(b) **[long | *that*-clause | filler–gap]**
It is unclear with what money Eli believes that Jill bought a ferry _.
(c) **[short | *complex NP* | filler–gap]**
It is unclear on what basis Eli believes _ the rumor that Jill bought a ferry.
(d) **[long | *complex NP* | filler–gap]**
It is unclear with what money Eli believes the rumor that Jill bought a ferry _.
(e) **[short | *that*-clause | remnant–correlate (backward sprouting)]**
While it is unclear on what basis, Eli believes _ that Jill bought a ferry.
(f) **[long | *that*-clause | remnant–correlate]**
While it is unclear with what money, Eli believes that Jill bought a ferry _.
(g) **[short | *complex NP* | remnant–correlate]**
While it is unclear on what basis, Eli believes _ the rumor that Jill bought a ferry.
(h) **[long | *complex NP* | remnant–correlate]**
While it is unclear with what money, Eli believes the rumor that Jill bought a ferry _.

All *wh*-phrases were adjuncts, in accord with the characteristics of sprouting, where the *wh*-remnant is limited to being an adjunct or an optional argument (Chung et al. 1995). Adjuncts were used rather than optional arguments because adjuncts may be associated with either the matrix clause or the embedded clause. With optional arguments, constructing plausible stimuli with this property would be much more difficult. Using adjuncts for the *wh*-remnants thus allowed us to create stimuli that varied by dependency DISTANCE (*short* vs. *long*). The short-dependency conditions had *wh*-adjuncts that were most plausibly associated with the matrix predicates, which were always closer to the filler/remnant than the embedded predicate; in the long-dependency conditions, the *wh*-adjuncts were naturally associated with the embedded predicates and dissonant with the matrix predicates. This may be seen in the contrast between (16a) and (16b), for example. In (16a), the *wh*-remnant *on what basis* is most naturally associated with the matrix predicate (*believe*), while in (16b), the *wh*-remnant *with what money* is very difficult to associate with that predicate, instead being most naturally associated with the embedded predicate (*bought*). If this manipulation was successful, we should see a significant effect for DISTANCE in the [filler–gap] conditions, because filler–gap dependencies that cross a clause-boundary (as is our intent in (16b)) reliably lead to a substantial decline in acceptability. If we do not see this effect with filler–gap dependencies, this would suggest that our attempt to construct appropriate stimuli was not successful.

With regard to STRUCTURE, the non-island structure in our stimuli was always a complement *that*-clause, and the island structure was a complex NP headed by a definite singular NP. Complex NPs are well known to induce island effects (Ross 1967). As for DEPENDENCY, the filler–gap dependencies were formed with embedded *wh*-questions, and the remnant–correlate dependencies were established using backward sprouting constructions.

Thirty-two lexically matched sets of the eight conditions were prepared and distributed into eight counter-balanced lists using a Latin-square design. Each list contained four tokens of each condition together with 70 filler items (experimental : filler ratio ≈ 1 : 2). As mentioned earlier, the filler items included 20 GOLD STANDARD items, 10 with the highest acceptability and another 10 with the lowest acceptability. In total, each survey contained 102 experimental and filler items. The complete list of stimuli can be found at https://osf.io/jw3ds.

The stimuli were presented on a computer screen using Ibex 0.3.9 (Drummond, 2007). In each experiment, a set of six filler items (the same for all participants) with varying degrees of acceptability was given at the beginning, and the remaining 96 experimental and filler items were automatically pseudorandomized for each participant using the Ibex interface, so that every experimental item was separated by two filler items. Participants were instructed to rate each sentence on a scale from 1 'very bad' to 7 'very good', based on how it sounded to them as a native speaker of English. The numbers were presented horizontally below the stimuli and were evenly spaced in increasing order from left to right and only the two extremes were labeled (Goodall 2021). They indicated their response by left-clicking on the appropriate number. They were asked to report their first reaction to the sentence, without trying to analyze it, and were told that no sentence had a correct answer.

4.2 *Results*

Figure 2 shows the mean acceptability of each of the eight experimental conditions with the raw ratings from the 80 participants (10 per each of the eight Latin-square lists).

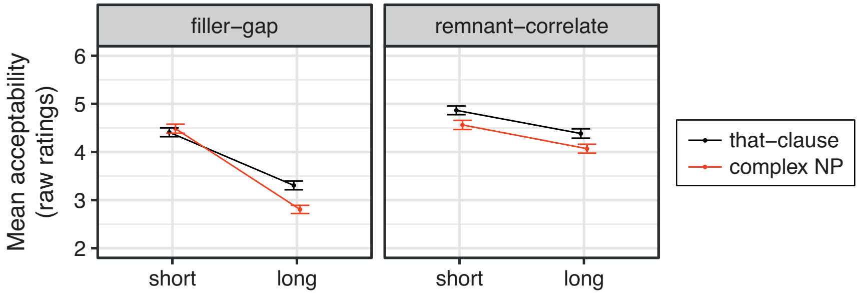

Figure 2
(Colour online) Mean acceptability of the experimental conditions (raw ratings; error bars = SE).

Prior to analysis, to eliminate potential scale bias in Likert-scale responses (see Schütze & Sprouse 2013), we normalized the raw ratings into *z*-scores by the following procedure. For each participant, we calculated the mean and the standard deviation of all the raw ratings from that participant. Then we calculated how many standard deviations each of that participant's raw ratings was above or below the mean, which returns its *z*-score. Figure 3 present the mean *z*-score acceptability of each of the eight experimental conditions.

All analyses were done using R 3.5.3 (R Core Team 2020). We constructed a linear mixed-effects regression (LMER) model for each DEPENDENCY, using the *lmer* function in the *lmer4* package for R (Bates et al. 2015), with *z*-scored responses as the dependent variable and DISTANCE and STRUCTURE as well as their interaction as the fixed factors. The model employed the largest random-effects structure that converged, including random intercepts for participant and item, a by-participant random slope for the main effect of each of the two factors. All *p*-values were estimated with Satterthwaite's method using the *lmerTest* package for R (Kuznetsova, Brockhoff & Christensen 2017). With the [FILLER–GAP] (*WH*-QUESTION) CONDITIONS, there was a significant main effect of DISTANCE (β = −0.545, SE β = 0.076, t = −7.129, p < 0.001) and no main effect of STRUCTURE (β = 0.038,

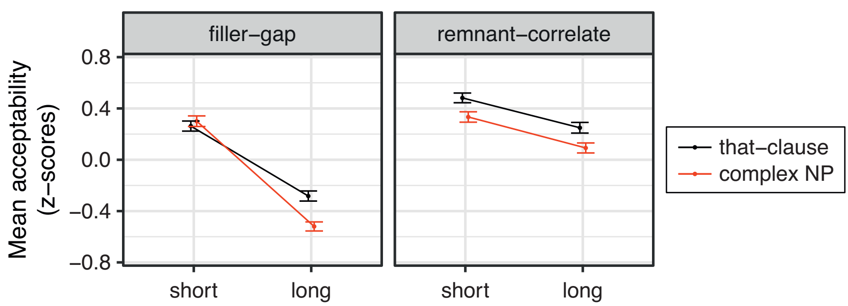

Figure 3
(Colour online) Mean acceptability of the experimental conditions (z-scores; error bars = SE).

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SE $\beta = 0.064$, $t = 0.592$, $p = 0.555$). The two-way interaction DISTANCE × STRUCTURE, which is the standard definition of the superadditive island effect, was significant ($\beta = -0.276$, SE $\beta = 0.091$, $t = -3.034$, $p = 0.003$). With the [REMNANT–CORRELATE] (BACKWARD SPROUTING) CONDITIONS, the main effect of DISTANCE was significant ($\beta = -0.233$, SE $\beta = 0.081$, $t = -2.862$, $p = 0.005$), while that of STRUCTURE was only marginal ($\beta = -0.149$, SE $\beta = 0.081$, $t = -1.842$, $p = 0.068$). Crucially, the two-way interaction DISTANCE × STRUCTURE was not significant ($\beta = -0.009$, SE $\beta = 0.113$, $t = -0.077$, $p = 0.939$). In summary, the results suggest that while the filler–gap dependencies in *wh*-questions showed clear sensitivity to the complex NP island, as expected, the corresponding remnant–correlate dependencies in backward sprouting did not, at least not to the same degree.

We then constructed an LMER model for the three-way interaction DISTANCE × STRUCTURE × DEPENDENCY, which tests whether the amount of the superadditive degradation due to the complex NP island (i.e. the island effect) was different between the [filler–gap] conditions and the [remnant–correlate] conditions. The results indicated that the three-way interaction does not reach the conventional threshold of statistical significance ($\beta = 0.267$, SE $\beta = 0.147$, $t = 1.814$, $p = 0.071$), but nonetheless suggests that the two dependencies do show some differential sensitivity to complex NP islands. Moving forward, we will tentatively assume that the two dependency types do in fact differ in their sensitivity to islands.

Apart from the main concerns of this paper, the finding of an island effect in the [filler–gap] conditions is noteworthy in itself, because, to our knowledge, this is the first time that such an effect has been demonstrated experimentally with a filler–gap dependency involving an adjunct filler. The effect itself is not in doubt (adjunct extraction has long been known to be sensitive to islands), but demonstrating it experimentally in an acceptability study is difficult, as discussed above, because it is hard to ensure that participants associate certain *wh*-adjunct fillers with the intended (i.e. matrix vs. embedded) predicates, unlike *wh*-argument fillers whose gap positions are generally very clear.[8] We constructed the stimuli in such a way that the intended (short- vs. long-dependency) reading is strongly favored, and the fact that there was a clear DISTANCE effect in the [*that*-clause] (i.e. non-island) conditions with filler–gap dependencies (LMER: $\beta = -0.545$, SE $\beta = 0.070$, $t = -7.836$, $p < 0.001$), as in Figure 4, suggests that we were successful.

Figure 4 shows the *z*-score results for only the non-island conditions in each DEPENDENCY, comparing the effect of DISTANCE free from any influence of an island

[8] A useful way to compare the effect size of island effects, although potentially problematic when done across experiments, is to compare the differences-in-differences (DD) scores: {([short | island] − [long | island]) − ([short | non-island] − [long | non-island])}. The DD-score in the *wh*-adjunct filler–gap dependencies was 0.275, which is slightly smaller than DD-scores reported for argument extraction from complex NPs, which range from 0.5 to 1.7 (Sprouse & Villata 2021). We suspect that the smaller effect seen here with adjunct extraction might be due to plausibility being a weaker cue to the location of the gap than subcategorization. Subcategorization is what is standardly used to cue gap location in experiments on argument extraction and it typically makes the gap location unambiguous.

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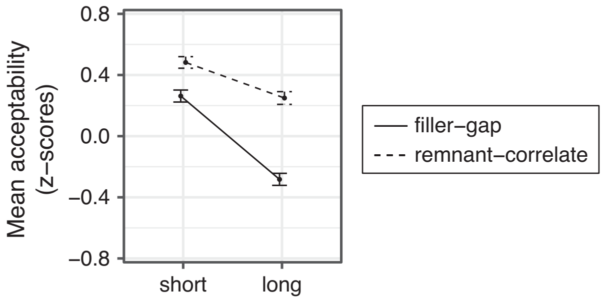

Figure 4
DISTANCE effects in the NON-ISLAND [that-clause] conditions (z-scores; error bars = SE).

structure. *Wh*-argument filler–gap dependencies are known to show significant degradation in cross-clausal, long-distance dependencies compared with within-clausal, short-distance dependencies (Cowart 1997; Alexopoulou & Keller 2007; Fanselow 2021). Thus, the clear degradation (the DISTANCE effect) in the *wh*-questions indicates that participants successfully distinguished between short and long dependencies with adjunct fillers, as we intended.

Similarly, the remnant–correlate dependency showed a significant degradation in the [long] conditions (LMER: $\beta = -0.234$, SE $\beta = 0.084$, $t = -2.802$, $p = 0.007$). However, an LMER model with the result for only the non-island conditions indicated that the DISTANCE effect was significantly weaker in the [remnant–correlate] conditions than the [filler–gap] conditions (DISTANCE × DEPENDENCY: $\beta = 0.312$, SE $\beta = 0.114$, $t = 2.733$, $p = 0.007$).

4.3 *Discussion*

Our experiment was designed to examine the effects of distance (clause boundaries) and island structures on acceptability in *wh*-questions (filler–gap dependencies) and backward sprouting (remnant–correlate dependencies). The results for *wh*-questions were entirely in line with expectations given the previous experimental literature on island effects. Extraction out of a non-island embedded clause resulted in a significant decline in acceptability relative to a matched condition with the gap in the matrix clause, and there was a significant interaction between DISTANCE and STRUCTURE, reflecting the fact that extraction out of an island produced degradation greater than the sum of that seen with long-distance extraction and that seen with the simple presence of an island structure. This type of superadditive interaction is the defining characteristic of an island effect. Despite the expected nature of these results for *wh*-questions, they are nonetheless important for two reasons. First, they demonstrate that it is possible to detect an island effect in a formal acceptability experiment using adjunct extraction. As mentioned earlier, this has not been shown before, to our knowledge, and it was not obvious that it would be possible, since with adjunct extraction one cannot rely on subcategorization to signal the location of the gap. Second, the results for *wh*-questions provide a baseline for our results with backward sprouting. We see a clear distance effect and a clear island effect with *wh*-questions, so this allows us to see whether we will detect the same effects with backward sprouting, all within the same experiment and with the same set of participants.

The results for backward sprouting were like those for *wh*-questions in the sense that there was a significant distance effect in both. A long remnant–correlate dependency in a non-island context was significantly less acceptable than a short remnant–correlate dependency in the same context. However, this distance effect was significantly greater with *wh*-questions than it was with backward sprouting, as we saw in Figure 4 and the interaction noted in the discussion there. With island effects, the difference between *wh*-questions and backward sprouting was sharper: no island effect was detected with backward sprouting, in contrast to the significant island effect seen with *wh*-questions.

Overall, then, given our experimental results with *wh*-questions and backward sprouting, it appears that both filler–gap dependencies and remnant–correlate dependencies show distance effects (although with a larger effect for filler–gap dependencies), but only filler–gap dependencies show island effects. This is the central empirical finding of our experiment and it has clear implications for our understanding of ellipsis and of islands. We turn to those implications in the next section.

5. Implications

Our goal in this paper has been to determine the degree to which remnant–correlate dependencies are similar to filler–gap dependencies with regard to two well-known properties of filler–gap dependencies: their sensitivity to clause boundaries (distance) and their sensitivity to islands. Our experiment has shown that remnant–correlate dependencies are in fact not very similar to filler–gap dependencies. Remnant–correlate dependencies are sensitive to distance, although significantly less so than filler–gap dependencies, but they do not appear to be sensitive to islands at all, unlike filler–gap dependencies. In this section, we explore the implications of these findings for analyses of ellipsis and of island phenomena.

5.1 *Implications for the nature of ellipsis*

The lack of island effects with backward sprouting which we observed in our experiment is prima facie evidence in favor of the non-structural view of ellipsis and against the structural view. That is, the non-structural view claims that there is no internal structure at the ellipsis site and no filler–gap dependency within it, so there is no reason to expect an island effect there. The relation between the *wh*-remnant and the implicit correlate position (i.e. the remnant–correlate dependency) is still

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there, but without additional assumptions (see Section 5.2), we would not predict that this relation would be island-sensitive.

The structural view of ellipsis, however, very clearly predicts an island effect in backward sprouting (unless we make additional assumptions to prevent it; see more below). If the ellipsis site contains an internal structure that is identical to the antecedent clause except that it contains a filler–gap dependency, then island-sensitivity follows directly (Ross 1969; Chung et al. 1995, 2011; J.-S. Kim 1997; Romero 1998; Lasnik 2001; Merchant 2001; Abels 2018, among many others). Our experimental results strongly suggest that such an analysis cannot be correct.

One way to reconcile the lack of island effects with a structural view of ellipsis would be to assume that the internal structure at the ellipsis site is simpler than the antecedent clause, consisting either of only the clause that immediately contains the gap or of an alternative source such as a copular construction (e.g. Merchant 2001: ch. 4; Barros, Elliott & Thoms 2014). In either case, the island structure would not be present and an island effect would not be predicted. Alternatively, one could assume that the full structure is present but that ellipsis enables the filler–gap dependency to repair the island violation, along the lines of what has been proposed for sluicing (e.g. Ross 1969; Merchant 2001). Without such additional assumptions, however, the structural view of ellipsis appears to make the wrong prediction for backward sprouting, given the results of our experiment. Thus, our finding of a clear lack of sensitivity to islands in backward sprouting is evidence against the putative distinction in the literature between SLUICING and SPROUTING in which sluicing ignores islands, but sprouting does not (Chung et al. 1995, 2011; J.-S. Kim 1997; Romero 1998; Lasnik 2001; Merchant 2001; Yoshida, Lee & Dickey 2013, among many others). Our findings thus support the relevant conclusions in Culicover & Jackendoff (2005: 248) and Kim & Kuno (2013), who provide additional evidence against the purported island-sensitivity of sprouting.

5.2 *Implications for the nature of islands*

As we have seen, filler–gap dependencies and remnant–correlate dependencies can be superficially identical, consisting of the same words in the same order. In addition, the demands that these two dependencies place on the processor would seem to be at least similar. In both cases, a *wh*-phrase must be retained in memory while other material is processed up until the moment when the relevant verb is encountered and the dependency can be resolved. Given all of this, the sharp difference in island-sensitivity between the two that we observed in our experiment is particularly striking and would argue against any attempt to reduce island effects to processing mechanisms operating on the linear string, without regard to the syntactic representation of the dependency.

Our results also lend further support to the view that island effects are a property specifically of filler–gap dependencies (or of the syntactic mechanisms that produce filler–gap dependencies, such as external merge in minimalist frameworks or SLASH

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values in HPSG frameworks). Remnant–correlate dependencies of the type seen in backward sprouting, then, despite their superficial similarity to filler–gap dependencies, are actually more like the dependency between the *wh*-remnant and the overt correlate in backward sluicing (Yoshida et al. 2012; Yoshida, Ackerman, et al. 2014), for example, as in (17a), or the dependency between a cataphoric pronoun and its antecedent (Yoshida, Kazanina, et al. 2014), as in (17b).

(17) (a) I'm not sure *what*, but she knows a man [$_{\textbf{island}}$ who bought something].
(b) Even if I hate *him*$_1$, I believe [$_{\textbf{island}}$ the report that John$_1$ will be promoted].

As the examples in (17) show, neither of these dependencies is island-sensitive. Not coincidentally, we would suggest, neither remnant–correlate dependencies in backward sprouting nor the dependencies in (17) are filler–gap dependencies or are produced by the syntactic mechanisms that create filler–gap dependencies. Whatever is responsible for the phenomenon of island-sensitivity, then, would seem to be intimately connected to the nature of filler–gap dependencies themselves.

This view of filler–gap dependencies as having special properties distinct from other types of dependencies receives further support from the differential sensitivity to distance that we observed in our experiment. As we saw, filler–gap dependencies in *wh*-questions seem to be significantly more sensitive to distance than remnant–correlate dependencies in backward sprouting (see Figure 4). It is often assumed that distance effects in filler–gap dependencies are due to processing difficulty and, if this is correct, it would suggest that remnant–correlate dependencies and other dependencies do not place the same degree of burden on the processor that filler–gap dependencies do (Kluender 1992; Kluender & Kutas 1993; Cowart 1997; Alexopoulou & Keller 2007).

6. Conclusion

The results that we have obtained in this paper replay a lesson that has been learned many times in linguistics: superficial similarity does not equal identity. In the case examined here, the superficial similarity has been very striking: filler–gap dependencies and remnant–correlate dependencies may consist of exactly the same string of words and would appear to impose almost identical processing demands. Given that, the results of our experiment are equally striking: filler–gap dependencies and remnant–correlate dependencies differ in their degree of sensitivity to clause boundaries and they differ entirely in their sensitivity to islands, with filler–gap dependencies showing very clear island effects and remnant–correlate dependencies showing none. Filler–gap dependencies and remnant–correlate dependencies thus appear to be very different types of dependencies, and as we have seen, that straightforward conclusion has interesting implications for analyses of ellipsis, especially sprouting, and for our understanding of the nature of island phenomena.

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