Freezing: A Conspiracy
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Abstract
The idea that there are syntactic domains that are ‘islands’ to extraction is a venerable one, going back to the early days of generative grammar. The classical view is that island phenomena are a matter of grammar: particular syntactic configurations disallow the construction of extraction chains, either because of constraints on movement, or constraints on configurations. A more recent trend has sought to account for island phenomena not in terms of strictly syntactic constraints, but in terms of the processing mechanisms that map particular syntactic configurations into semantic and discourse representations.

We argue that the classical freezing cases (e.g. Wexler and Culicover 1980) are due to processing failures encountered in the construction of A′ chains. We argue that the pattern of freezing and ‘melting’ in the case of German scrambling as described by Müller (2010) is due to prosodic garden paths, which arise from default prosody in the absence of context and lead to prosody-information structure conflicts. And we argue that certain apparent islands discussed by Ross (1967) involving extraction from extraposed PPs in English are due to garden paths that result from the misalignment of prosodic phrasing and syntactic structure. We show in each case that the judgments of ill-formedness are gradient, and can be manipulated by proper contextualization and prosodic assignment. Moreover, the effects that we identify can be found in cases where a freezing account is not feasible.

Our study suggests that there is no grammatical phenomenon of freezing. Our results reinforce the importance of ensuring, to the extent possible, that the data used to support the formulation of grammatical theories in fact have to do with grammar, and are not the product of extra-grammatical factors.

1. Introduction
The idea that there are syntactic domains that are ‘islands’ to extraction is a venerable one, going back to the early days of generative grammar (Chomsky, 1964; Ross, 1967). The classical view is that island phenomena is a matter of grammar: particular syntactic configurations disallow the construction of extraction chains, either because of constraints on movement (Chomsky, 1973; Chomsky, 1986; Ross, 1967) or constraints on configurations (Koster, 1978).

A more recent trend has sought to account for island phenomena not in terms of strictly syntactic constraints, but in terms of the processing mechanisms that map particular syntactic configurations into semantic and discourse representations. For diverse approaches along these lines, see for example, Arnon et al., 2006; Hawkins, 1994; 2004; Hofmeister, 2007; Hofmeister et al., 2007; Hofmeister and Sag, 2010; Kluender, 1992; 1998; 2004; Kluender and Kutas, 1993; Sag et al., 2008.

1 We are grateful to Sam Featherston, Michael Rochemont, Jutta Hartmann and Marga Reis for valuable comments and suggestions. Any errors are our responsibility.
The idea of ‘freezing’ in syntactic theory is that the reordering of syntactic material may under certain circumstances render parts of a structure closed to extraction. It too has a venerable history, going back to Ross, 1967, 1974; see Corver, 2006 for a review. Ross proposed the Immediate Self-Domination Principle (ISP), which said that in a structure of the form \([A A B]\), nothing can be extracted from B. In the Standard Theory of the time, such structures arose through movement and adjunction; hence the consequence of the ISP is that nothing can be extracted from a derived adjoined constituent.²

Subsequently, Wexler and Culicover, 1980 proposed the Freezing Principle, based on considerations of language learnability. The basic idea was that a structure that is created transformationally that is not compatible with the base phrase structure rules of a language is frozen. Such a derivation is ‘non-structure-preserving’, in the sense of Emonds, 1970, 1976.

We give a simple illustration. In cases such as (1), the heavy NP *a picture of who* has arguably moved from the position adjacent to the verb to the end of the VP. Since the configuration \([VP V PP NP]\) is not a base configuration in English, it is frozen. Hence it should not be possible to extract from any constituent of the VP, according to the Wexler-Culicover Freezing Principle. The judgments in (1) appear to confirm this prediction. (‘__’ indicates the gap corresponding to the canonical position of the direct object.)³

(1) a. *Who did you give __ to Robin [a picture of ti]?*  
   b. *Who did you give __ to ti [a picture of Sandy]?

A point to note here is that the task of finding the gaps in such constructions is a complex one. There is one gap immediately after the verb, and another in the VP-final DP. Especially when the sentence is read silently and there is no context given, there is nothing to tell the processor to look for the trace of who in the VP-final DP. We return to this point at length in our discussion below of these cases.

Contemporary syntactic theories, whether they are derivational or monostratal, do not permit formulations such as those developed by Ross and Wexler and Culicover. Nonetheless, the idea of freezing as a grammatical phenomenon has persisted, even up to the present day. For example, Rizzi, 2006 (see also Rizzi and Shlonsky, 2005) has proposed a notion of ‘criterial freezing’, which freezes any constituent that moves in order to satisfy the formal requirements (i.e. criterion) of a head. Ruys, 2008 proposes that reordering of PPs in the Dutch VP has the consequence of freezing them against

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² Ross also considered the Frozen Structure Constraint in order to block extraction from extraposed relative clauses.

THE FROZEN STRUCTURE CONSTRAINT (FSC): If a constituent C, where C is a clause or a prepositional phrase, has been extraposed from a noun phrase whose head noun is lexical, this noun phrase may not be moved, nor may any element of C be moved out of C (pp. 160, 165).

This constraint covers the cases of extraposition of PPs, but otherwise essentially replicates the Complex NP Constraint (see Huck and Na, 1990:63-64).

³ For this illustration, we use examples with *give*, based on those that originally motivated the Freezing Principle. Since *give* also licenses double objects, it might be suspected that the dual subcategorization of this verb could be responsible for the judgments in (3). Examples given in (11) below show that the phenomenon is quite general and does not depend on dual subcategorization.
subsequent extraction. The literature is in fact rich with proposals that a particular operation ‘freezes’ a constituent with respect to subsequent operations.

Most recently, Müller, 2010 proposes a contemporary version of the Wexler-Culicover Freezing Principle to explain the fact that extraction is not possible in German from a specifier, if it is last-merged in its projection (e.g. subjects). However, it is possible when some other phrase scrambles over the last merged specifier and becomes itself the last-merged specifier within the same phrase, which he refers to as ‘melting’. For instance, he observes that (2b) is ungrammatical, but that (2a), where the freezing configuration has been removed, is grammatical.

(2) a. Was_1 haben [DP_2 den Fritz] [DP_3 für Bücher] beeindruckt?
   what have the Fritz_{acc} for books_{nom} impressed

b. *Was_1 haben [DP_2 für Bücher] [DP_3 den Fritz] beeindruckt?
   what have for books_{nom} the Fritz_{acc} impressed

   ‘What kind of books impressed Fritz?’

[Müller 2010: 61]

On Müller’s account, was für Bücher in (2b) is frozen, because it is last-merged in the specifier-position of vP. However, it is not frozen in (2a), because the movement of den Fritz over it by scrambling removes the offending configuration that froze it – this is ‘melting’.

A strong alternative hypothesis about freezing effects is that they are all the result of processing and information structure in some sense. We test the plausibility of this hypothesis by looking at a number of the well-known cases of putative freezing from the literature, including those of cited above. We argue at the notion that reordering renders a constituent impervious to subsequent extraction is an illusion, at least for the cases that we consider here. Owing to space limitations, we leave discussion of a broader set of candidates for future work.

Our aim is to show that in each case of putative freezing, the observed ill-formedness is more plausibly the consequence of a failure of processing. Because the phenomena are very diverse, syntactically, there is no single processing explanation that covers all of the cases. But there is a common thread that holds them together. For instance, for the Wexler-Culicover cases, we suggest that the ill-formedness is due to a processing failure in which the processor posits a gap after give, following a so-called ‘active filler strategy’ to form a chain with the A’ constituent (Crain and Fodor, 1985, Frazier, 1987, Hofmeister and Sag, 2010). When the postposed NP with the actual gap is processed, the initial hypothesis has to be revised and the chain has to be reconstructed, which produces the effect. In other cases, such as those cited by Müller, we argue that

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4 An even stronger hypothesis, which is beyond the scope of this article, is that all island effects are due to processing

5 Bornkessel et al., 2004 argue, on the basis of cases that are very different from the ones that we consider here, that garden path effects can vary in strength for a number of reasons, depending on the particular reanalysis steps that the processor has to go through in order to resolve the garden path. Fodor and Inoue, 1994 argue that the strength of a garden path is measured by the difficult of repair, which “is attributable not to the cost of effecting the structural alterations but to the cost of deducing which alterations are needed.” We use terms such as ‘strong’ and ‘mild’ here as an informal reflection of our subjective judgments as to the severity of the violation, without making any theoretical claims.
the ill-formedness is due to ‘prosodic garden paths’, in the sense of Fodor, 2002a and Fodor, 2002b. In these cases, the information-structure interpretation of the default prosody conflicts with that corresponding to the syntactic form.

The paper is organized as follows. In §2 we look more closely at the original Wexler-Culicover freezing cases, and develop the processing analysis in more detail. We refer to these cases as ‘chain garden paths’. We show how the analysis extends naturally to other cases that are configurationally similar, but cannot plausibly be explained in terms of freezing. This is a general strategy that we pursue throughout the article – to show that a processing account covers both the cases where freezing might be considered to be an explanation, and those where it is not applicable.

In §3 we look at the evidence in support of a freezing and melting analysis for German scrambling and its interaction with extractions. In this case we demonstrate that the judgments are not categorical: for exactly those configurations that ostensibly produce freezing effects, it is possible to eliminate these effects by properly contextualizing the examples and managing the prosody, so that the examples conform to the intended information structure. We develop the processing alternative in more detail in this section, in order to explain both why the scrambling examples are judged to be ungrammatical, and why it is possible to ameliorate them.

In §4 we look at English examples of PP extraposition from NP where a freezing analysis along the lines of Ross’ original proposal is plausible. Again, we show that the judgments are sensitive to manipulation of context and prosody. The ill-formedness in these cases is due to a different type of processing effect, where the default prosody leads the processor to misphrase and thereby misparse the sentence.

We conclude the paper in §6 with a summary, a brief survey of a number of other instances of ‘freezing’ that are promising candidates for processing accounts, and some general methodological observations about the importance of taking processing, prosody and information structure into account in the formulation of syntactic theory. We conclude that the identification of several types of processing effects, i.e. chain garden paths, prosodic garden paths, and misphrasing, suggests a general framework in which it is possible to evaluate a broader range of putative freezing and island effects, and ultimately to determine to what extent there are genuine grammatical factors at play.

Regarding methodology, our view, which coincides with that of Fodor, 2002a,b, is that without careful consideration of the status of the judgments that constitute the raw data that goes into linguistic theorizing, the status of the theories that are constructed on the basis of that data is problematic, at best. For a grammatical theory to have some explanatory force, it must be about grammatical phenomena, not about phenomena that are the consequence of extra-grammatical processes.

2. Chain garden paths

2.1. English double object contexts

In this section we argue that the apparent freezing effect observed with extraction from heavy NP shift in English is a consequence of processing that leads to garden paths, which is a more general phenomenon. First, we review the Jackendoff-Culicover argument that garden paths occur in the processing of the double object construction in English, where the actual gap is not immediately identified due to the surrounding
context. Hence a chain cannot be constructed without repair, and there is a corresponding judgment of ill-formedness. Second, we argue that in the case of extraction from a shifted heavy NP, the processor actually finds a gap in the position vacated by the heavy NP, but forms a chain with this gap and the wh-antecedent. When the gap inside of the heavy NP is subsequently encountered, a chain that includes this gap cannot be constructed without repair, and again, there is a corresponding judgment of ill-formedness. The crucial observation is that in both cases there is a garden path effect due to failure of chain construction, but there is no possibility of implicating freezing for both case.

As noted in the introduction, among the earliest data cited in support of freezing as a grammatical principle were cases such as the following from Wexler and Culicover, 1980. As before, ‘__’ indicates the gap corresponding to the canonical position of the direct object. ‘*’ indicates ill-formedness without any presumption of relative strength or cause.

(3) a. *Who did you give __ to Robin [a picture of i]?
   b. *Who_i did you give __ to t_i [a picture of Sandy]?

According to the Freezing Principle of Wexler and Culicover, 1980, everything in the VP is frozen when the direct object adjoins to the right of the PP, since the resulting configuration is non-structure-preserving. Contemporary views of syntax do not in general permit non-structure-preserving adjunctions. It might be possible to preserve the idea that the heavy NP is frozen because of movement – for example, one could imagine an analysis in which the heavy NP moves to the left to a specifier position, and then the rest of the VP moves to the left of it (Larson, 1988; but see Jackendoff, 1990). We might speculate that there is a general principle that specifiers are frozen (Müller, 2010; Rizzi and Shlonsky, 2005). But it is not clear under such a derivation why only heavy NPs can undergo this movement to specifier. And it is not clear on this view how the freezing effect can be extended to the PP.

Rather than try to adjust the grammatical account to capture these facts, we explore an alternative that relies on real time processing of the linear string leading to a type of garden path. The existence of garden paths was first documented by Bever, 1970, in connection with the (now famous) example The horse raced past the barn fell. The garden path phenomenon is characterized by (i) a local ambiguity, (ii) choice or ranking of the incorrect analysis over the correct analysis by the processor, (iii) a symptom that indicates that the wrong analysis was chosen, and (iv) repair or revision of the error.

We suggest that in some cases, such as (3), properties (i)-(iii) hold, but the repair or revision may not remove the judgment of ill-formedness. The local ambiguity in this case has to do with the location of the gap in the course of constructing a chain headed by the A' constituent (who in (3)). The processor hypothesizes a gap in the position immediately after the verb, and thus assigns a thematic role to the chain. The symptom of the error is the shifted NP, and the repair involves reconstructing the chain so that it contains the A' constituent and the true gap, and assignment of the object thematic role to the postposed heavy NP. We refer to this type of garden path as a ‘chain’ garden path.

Since our goal here is simply to show that some of the phenomena associated with freezing can be understood as garden path phenomena, we leave aside questions about the precise architecture of the processor that gives rise to these effects. For discussion of the
relative merits of choice versus ranking in the face of local ambiguity, see Gibson et al., 1994, and for discussion of the relative merits of repair versus revision, see Fodor and Inoue, 1994; 2000.

One of the debates in the literature on garden paths is whether the processor seeks to construct an A′ chain at the earliest possible point in the input string by positing a gap (‘filler-driven’ parsing), or alternatively waits for strong evidence that there is a gap before constructing a chain (‘active gap’ parsing); see Aoshima et al., 2004 for discussion and references.

We adopt the conclusion of Aoshima et al. (2004), who argue that “that the processing of filler-gap dependencies is driven by the need to satisfy thematic role requirements of the fronted phrase, rather than by the need to create a gap as soon as possible.” To see how this works, consider the analysis of English datives proposed by Jackendoff and Culicover, 1972. This paper argued for a garden path account of sentences such as (4b-d).

(4) a. Sandy gave Robin the money.
   b. *Who did Sandy give __ the money?
   c. *the person who Sandy gave __ the money
   d. *Sandy is not a lot of fun to give __ money.

We suggest that the ill-formedness of the examples in (3) is due to the same general mechanism that produces ill-formedness in (4), which effectively precludes a freezing account.

According to Jackendoff and Culicover (1972), the processor does not anticipate that the trace of the A′ constituent, e.g. who, is in the position between give and the direct object, marked in (4) as ‘__’. Rather, the processor anticipates a PP following the direct object with a trace, e.g.,

(5) Who did Sandy give the money to t?

In the course of processing Who did Sandy give, the processor encounters the money and seizes upon it as the right-adjacent sister of the verb. This error is possible because of the dual subcategorization frame of the double object verb give, and the absence of overt evidence for a gap immediately after give. So, when the end of the sentence is reached, the A′ constituent has not been connected to a trace in order to get an interpretation. A garden path occurs. This is an ‘active-gap’ scenario, that is, a processing account in which the gap is not constructed until and unless there is overt evidence in the string for its existence. On the alternative, the ‘filler-driven’ scenario, there would be no garden path because the A′ constituent would force a gap to be hypothesized in the first available position, immediately after the verb.6

We propose that the examples in (3) show similar effect due to ‘active-gap’ processing. In (3a), the processor identifies a gap between the verb and the PP. This gap

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6 Additional evidence for the active-gap scenario comes from processing and information structure. Clifton and Frazier, 2004:888) observed that in double object constructions, "V NP NP" with an indefinite final NP is preferred. This observation suggests that extractability is preferred from the second NP, which constitutes the focus domain (cf. Erteschik-Shir, 2006a, Fanselow, 2006).
is the result of the heavy NP being shifted to the end of the VP. The processor posits a trace in this position and forms an A’ chain, as shown in (6).

(6)  \text{Who}_i \text{ did you give } t_i \text{ to Robin \ldots}

When the heavy NP is reached, it is not possible to form a chain with the actual gap, again notated as __.

(7)  \text{Who}_i \text{ did you give } t_i \text{ to Robin [a picture of __]}

Thus there is a chain garden path. The repair involves dissolving the first A’ chain, constructing a second chain between the A’ constituent who and the trace in the NP, and interpreting the entire VP-final NP as the direct object of the verb.

In (3b) there is also a chain garden path. Again, the processor posits a gap between the V and the PP, and the chain is constructed, as in (8).

(8)  \text{Who}_i \text{ did you give } t_i \ldots

The symptom of the garden path is the PP [to __] followed by the heavy shifted NP. Thematic roles can be assigned to all of the arguments if the shifted NP is taken to be the complement of P, but then the semantic interpretation fails to make sense – the person ‘who’ was given to the picture.

When there is a syntactic cue that there must be a trace immediately after the preposition, the repair of this garden path seems to be more straightforward and produces a much weaker effect. In the well-formed (9) the VP-final S cannot be the complement of the preposition.

(9)  \text{Who}_i \text{ did Sandy mention (__ to } t_i \text{ [s that this bill was not paid]?}

Example (9) is preferred to (10), unless there is intonation at the preposition in (10) that marks the postposed NP. (Capitalization signals a pitch accent, the double slash ("//") signals an intonational break.)

(10)  \text{?Who did Sandy mention TO // [the fact that this bill was not paid].}

We suggest, then, that a garden path account explains the ill-formedness of the examples in (3) without appealing to a grammatical freezing principle.

Returning to the analysis (3), while the Jackendoff-Culicover garden path effects of (4) are specific to double object verbs with alternative subcategorization frames, the effect exemplified in (3) is not specific to any class of verbs. The processor in this case is not failing to process the unacceptable examples because there are more promising subcategorization frames, but because of the syntactic configuration. Shifting of the direct object past the PP and extraction from the direct object produces this effect regardless of what the verb is. E.g.,

(11) a.  *What did Sandy load __ onto the truck [NP a huge pile of t]?
Without shifting the NP, these extractions are far more natural.

(12) a. What did Sandy load [NP a huge pile of t] onto the truck?
a’. Which truck did Sandy load a huge pile of bricks onto?
b. How many chairs did Sandy determine [NP the cost of t] with this calculator?
b’. Which calculator did Sandy determine the cost of the chairs with?
c. Which committee did Sandy introduce [NP the head of t] to the membership?
c’. Which members did Sandy introduce the head of the committee to?

It is also noteworthy that this garden path effect can be manipulated by context and intonation, as suggested already in (10). In the dialogue in (13), we set things up so that a picture of X is a contrastive focus.\(^7\)

(13) A: I found some pictures of the students, so I decided to give them out to the class. I gave to SUSan a picture of ALbert, I gave to Marla a picture of OTto, and ...

B: Ok ... but who did you give to RObin a picture of?

The fact that this manipulation is possible is additional evidence that what we are dealing with here is not a syntactic freezing effect, contrary to the original proposal, but a matter of processing, in particular, identifying the gap. It is plausible that the prior use of the Heavy NP Shift construction in this example primes the processor to at least accept the possibility that there is a gap after give corresponding to a shifted NP.

2.2. **English ECM/control contexts**

One would expect there to be other environments where the surface string tricks the processor into not recognizing a gap in a particular position. In such a case the processor waits for a trace later in the sentence, only to find that there is no such trace. There are several other contexts in English in which a local parsing ambiguity is possible, and these also produce garden path effects. Crucially, these cases do not lend themselves to a freezing account.

Postal, 1974:406 suggests that heavy NP shift of an ECM subject in English produces a garden path effect, citing examples such as (14) (see also Bošković, 1997).

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\(^7\) Thanks to Sam Featherston for suggesting this example.
(14) *I want __ to leave now [NP all the men who are tracking mud on my carpet].

The problem here is that want to leave can be interpreted as subject control, hence the Agent role of leave is assigned to I. A reanalysis is required when the shifted NP is encountered.

Fodor, 1988 reviews experimental evidence that the type of local ambiguity around want __ to produces a garden path effect. Although the precise cause of this effect is at issue, a case can be made that it is in part due to the fact that the subcategorization requirements of the verb can be satisfied without positing a trace, that is, by taking want to be a subject control verb (Boland et al., 1990). This interpretation of the phenomena is a corollary of ‘active gap’ parsing, and is consistent with our account of the putative freezing cases of (3) in §2.1. There is no plausible derivation that would produce a freezing configuration in (14), however, so there is no explanation in terms of freezing.

3. Prosodic garden paths

We have argued that some of the classical cases of freezing do not, upon closer examination, require a freezing analysis. Rather, a garden path explanation appears to be a plausible alternative. Since garden path effects are independently known to produce ill-formedness judgments, we are led to prefer the latter account on the grounds of relative simplicity, other things being equal.

We turn now to Müller’s (2010) analysis of German data that involves a freezing explanation. In §3.1 we look at the core cases of freezing and ‘melting’ in German reported in the literature, all of which involve scrambling. Our general claim is that these freezing configurations are marked as unacceptable due to prosodic garden paths. We show that non-default prosody and context can repair these constructions. Melting is the consequence of restoring the default intonation pattern by moving discourse-given elements out of the focus domain.

As in the case of more familiar garden paths, a prosodic garden path can be repaired via reanalysis. We claim that extraction from was-für extraction, long extraction, and remnant topicalization cause prosodic garden paths which can be repaired by non-default prosody and active context enrichment.

3.1. Scrambling and was-für Split

We repeat in (15) the representative examples of Müller (2010:61(36)).

(15) a. Was$_1$ haben [DP$_2$ den Fritz] [DP$_3$ t$_1$ für Bücher] t$_2$ beeindruckt?

   what have the Fritz$_{acc}$ for books$_{nom}$ impressed.

   “What kind of books impressed Fritz?

b. *Was$_1$ haben [DP$_3$ t$_1$ für Bücher] [DP$_2$ den Fritz] beeindruckt?

   what have for books$_{nom}$ the Fritz$_{acc}$ impressed

   “What kind of books impressed Fritz?

[Müller 2010:61 (36)]
Müller (2010:56) updates the Wexler-Culicover freezing principle (Wexler and Culicover 1980:119) by formulating a constraint in terms of configuration, rather than extraction. Müller’s constraint is given in (16).

(16) Freezing Generalization
A trace t may not be included in a moved XP (i.e., an XP that binds a trace) if the antecedent of t c-commands XP.

Müller’s formal analysis is very complex and we don’t have space to reproduce the details here. We are not in fact concerned with whether it is technically feasible, but whether it correctly characterizes the violation in examples like (15b). We claim that (15b) is marginal not because of a freezing configuration, but because of a violation of general information structural requirements on was- für extraction. These requirements are construction specific. We argue that the ill-formness of these extractions in decontextualized written material results from prosodic garden paths. The judgments for the example pair in (15) reflect the assignment of default prosody, as predicted by the Implicit Prosody Hypothesis (IPH) (Fodor, 2002a,b; Kitagawa and Fodor, 2006).

The IPH is formulated as follows: “In silent reading, a default prosodic contour is projected onto the stimulus. Other things being equal, the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction.” (Fodor, 2002a). Most generally, a prosodic garden path sentence is a sentence which is temporarily ambiguous with respect to pitch accent assignment. We assume that the human parsing mechanism selects the default prosodic pattern of sentences for examples with unspecified contexts. Crucially, if presented without prosodic cues, the parser assigns the default intonational contour of the construction in a default context.

Default intonation in English and German canonical word order is determined by the nuclear stress rule (NSR) (e.g. Chomsky and Halle, 1968:17, Chomsky, 1972, Jackendoff, 1972, Culicover and Rochemont, 1983, Zubizarreta, 1998, Féry, 1993, Höhle, 1982, Jacobs, 1988, Lenerz, 2002, Uhmann, 1991). In English, default prosody is characterized by the nuclear accent on the postverbal DP, as in (17a) and in German by the sentence accent on the preverbal DP as in (17b). Accent is signalled here by capitalization.

(17) a. [Jesus] [preached [to the people [of JuDEA]]]
   b. daß Jesus [ [ [zu dem Volke [von JuDEA]] predigte]]
   [Halle and Vergnaud, 1987:265]

Default prosody typically occurs in a sentence with canonical word order in an unmarked context, such as an answer to a wide focus inducing what-happened question, as in (18).

A2: Ich glaube, dass wahrscheinlich eine Katze einem Vogel die FEDERN ausgerupft hat.
   [catNom a birdDat the feathersAcc out plucked has]
'I think that a cat probably plucked out a bird's feathers'

The question that is central to an explanation of the judgments in (15) is: What happens in reading decontextualized linguistic examples that involve scrambling and *was-für* extraction? Let us first consider scrambling. Musan, 2002 carried out a rating study using written material. She obtained the most positive judgments (“1”) for examples like (19a) and the least positive (“5”) for examples like (19b) on a scale from “1 to 5” (sentence adverb inserted). Both types of scrambling examples occurred in the identical exclamative context which mentioned the DP *der Vogel* ‘the bird’, thus marking it as contextually given in the scrambled continuations.

(19) Guck mal, wie der Vogel aussieht! (‘Look how the bird looks!’)
   a. Ich glaube, dass dem Vogel (wahrscheinlich) eine Katze die Federn
      I think [DP the bird (probably) a cat the feathers
      out-plucked has
      'I think that a cat probably plucked out the bird's feathers'
      (1 – most positive)
   b. Ich glaube, dass die Federn (wahrscheinlich) eine Katze dem Vogel
      I think [DP the feathers (probably) a cat the bird
      out-plucked has
      (5 – least positive)

Note that these examples show only scrambling, and no extraction.

Word order variation alone might not account for the extreme differences in judgments seen here. However, if we assume, following the IPH, that subjects project a default prosody onto (19a) and (19b) alike, the judgment differences find an explanation. A schematic representation of the default intonational pattern in the canonical example in (18) is given in (20). The preverbal DP is assigned the nuclear accent and is interpreted as the unmarked information focus (F). Typically, F is associated with a H*L accent, also referred to informally as ‘fall’. More details will be filled in as we proceed:

(20) Default intonational Pattern (German SOV)
    
    [CP ... pref ... [TP ... <left middle field>... [vP ... <right middle field>...] Vfin]]

    DP:  F
    H*L

Let us turn to the scrambled examples in (19). Scrambling refers to the reordering of argument DPs in the German middle field (Featherston, 2001; Grewendorf and Sternefeld, 1990; Haider and Rosengren, 2003; Haider, 1993; 2010; Sternefeld and Müller, 1993 among many others). Scrambling serves two functions. First, it removes given DPs out of the right middle field (vP) usually considered the focus domain. Second, it ideally leaves behind only those DPs (in the right middle field) which are discourse
new; the verb-adjacent DP carries the default pitch accent (Haider and Rosengren 1998, 2003, Lenerz, 2002, Hinterhölzl, 2006). These two functions interact and bring about the effect that the frequently observed intonational pattern in scrambling mimics the default intonation.

Sentence adverbials and certain particles (like *ja doch, denn*) mark the vP-border in German, as observed by many authors (e.g. Webelhuth, 1989, Diesing, 1992). In the schematic representation scrambling structure in (21) the adverbial separates the left middle field from the right middle field of the German clause.

(21) Default intonational Pattern for German scrambling

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[CP ![TP ![<left middle field> ![vP ![SAdv ![vP ![<right middle field> ![V ![fin]]]]]]]]
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The observation is that DPs can either precede or follow the particle or adverbial. Those that precede the adverbial are generally interpreted as given (G) and are typically unaccented. Those that follow it are interpreted as discourse new or contrastive (CF), and receive a pitch accent. If there is more then one DP in the right middle field, both receive an accent, but the DP which is a sister to the head is assigned the nuclear accent. The declarative example ends with a low boundary tone (L%) realized on the verb.

On the basis of the IPH we propose that the default prosody provided in (21) is projected onto the scrambled examples in (19a,b) as shown in (22a,b). The information status of the DPs in the grid depends on the context utterance. We detail the prosody/IS match in (22a) in (22a') and the mismatch of (22b) in (22b').

(22) Guck mal, wie der Vogel aussieht! (‘Look how the bird looks!’) Ich glaube,

a. dass dem Vogel (wahrscheinlich) eine Katze die FEDernausgerupft hat that the bird probably a cat the feathers plucked.out has

<table>
<thead>
<tr>
<th>scrambled</th>
<th>subject</th>
<th>Preverb</th>
<th>obj</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>dem Vogel</em></td>
<td><em>eine Katze</em></td>
<td><em>die FEDern</em></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>Given</td>
<td>New</td>
<td>Given</td>
</tr>
<tr>
<td>Prosody</td>
<td>unaccented</td>
<td>accented</td>
<td>Nuclear</td>
</tr>
<tr>
<td>Match?</td>
<td>Match</td>
<td>Match</td>
<td>Match</td>
</tr>
</tbody>
</table>

b. dass die Federn (wahrscheinlich) eine Katze dem VO Gel ausgerupft hat that the feathers (probably) a cat the bird plucked.out has

<table>
<thead>
<tr>
<th>scrambled</th>
<th>subject</th>
<th>Preverb</th>
<th>obj</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>die Federn</em></td>
<td><em>eine Katze</em></td>
<td><em>dem VOGel</em></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>new</td>
<td>New</td>
<td>Given</td>
</tr>
</tbody>
</table>
Prosody | more than one possibility | accented | Nuclear accent (H*L) \\
---|---|---|---
Match? | Mismatch (bridging) | Match | Mismatch

In (22a), the dative object with topic (given) status *dem Vogel* is scrambled to the left of the SAdv. The reader selects default prosody and assigns a pitch accent to the preverbal DP *die Federn*. We propose that the reader projects a similar default contour onto (22b). In this case, the DP *die Federn* is scrambled despite the fact that the feathers haven't been mentioned before. A mismatch occurs, but can be accommodated by deaccenting *die Federn* and bridging: birds have feathers and the context exclamation states that the bird looks funny. The default nuclear accent is then assigned to the preverbal DP *dem Vogel*. This causes a prosodic garden path and a semantic mismatch. The preverbal DP *dem Vogel* is discourse-given (it is an aboutness topic) by virtue of being mentioned in the context exclamation. Assigning the nuclear accent to this DP marks it as discourse new. This is a prosodic garden path that gives the impression of ungrammaticality. It can only be resolved by reanalysis (see (23)).

There is a local ambiguity in this case, as there is in a syntactic garden path. Here it is connected to the discourse appropriate prosodic realization of the preverbal DP. The parser can either project a pitch accent onto the preverbal DP and thereby mark it (and possibly the other DPs in VP) as discourse new, or it can project a flat intonation as in deaccentuation contexts and thereby mark it as discourse given. Under the IPH, the parser projects the default contour.

The prosodic garden path account sketched here explains the judgments of the participants in Musan's study. Upon projecting a default contour on (19b), the participants experience a severe prosody-information structure mismatch. As in syntactic garden paths, reanalysis is possible. The parser must backtrack and reanalyze the scrambling sentence and chose a context related non-default prosodic pattern. The prosodic parser projects the default accent to the indefinite DP *eine Katze* and leaves the dative object prosodically unmarked.8 This particular contour is a non-default prosodic contour in German, which can repair (22b) in the appropriate context, as in (23):

(23) Guck mal, wie der Vogel aussieht! Ihm fehlen ja alle Federn!
('Look at the bird! The feathers are all gone!') Ich glaube,
dass die Federn (wahrscheinlich) [*eine KATZE* *dem Vogel ausgerupft hat*].

L H*L L L%

*scrambled subject Preverb obj*

| die Federn | *eine KATZE* | *dem Vogel* | 3.1.1.

---

8 Féry et al., 2009 and Weskott et al., 2006 provide empirical evidence for the hypothesis that an early nuclear fall (H*L) allows the human processor to anticipate a discourse given entity. Their perception experiments on canonical word order in German support the hypothesis forwarded here that the non-default contour with an early nuclear fall is available in specific contexts, and moreover allows the human processor to anticipate the discourse- given status of the remaining referent.
The discourse old DP *die Federn* is scrambled to the left of the SAdv *wahrscheinlich*. The indefinite DP *eine Katze* is assigned a pitch accent, and the definite dative DP *dem Vogel* is prosodically integrated into the prosodic domain of the verb. This particular contour is possible, although marked. The fact that a topical element can remain in the right middle field has been independently argued for by Fanselow (2006).

Next, let us consider *was-für* extraction, which seems to be responsible for the freezing effect in (15b). The *was-für* split in German is an extraction operation that can only apply to discourse new constituents and not to topic-like or discourse-given constituents (e.g. Erteschik, 1973; Erteschik-Shir, 2006a; 2006b; 2007, Diesing, 1992, Bayer, 2004, Fanselow, 2006, but see Frey, 2004). The processor projects the default prosodic contour onto (15a,b). As in declarative sentences, in the default contour the nuclear accent (H* L) is assigned to the preverbal DP, as illustrated in (24a,b).

(24) a. *Was haben [DP2 den Fritzacc][DP3 t1 für BÜCHERnom] t2 beeindruckt?*

   \[ L \quad H* L \quad H\%

   b. *Was haben [DP3 t1für Büchernom] [DP2den FRITZacc] beeindruckt?*

   \[ L \quad H* L \quad H\%

In (24a), default prosody assigns a pitch accent to the preverbal DP *für Bücher*. We propose that the reader projects a similar default contour onto (24b) and thereby assigns the sentence accent to the discourse given DP *den Fritz* in preverbal position. This produces a prosodic garden path effect.

The processor encounters two conflicting information structural mismatches upon parsing (24b), as follows. First, *was-für* extraction in (24b) applies to the topic constituent *für Bücher*, which violates the requirement that *was-für* extraction is preferred from a focus constituent. Generally, topic constituents are prosodically unmarked. Assuming, default prosody, then the nominative constituent *für Bücher* remains prosodically unmarked. Second, the processor projects a nuclear pitch accent onto the DP *den Fritz* in preverbal position, which violates the default implicit prosody that definite DPs tend to be discourse given and typically remain unaccented.

The observed prosody-information structure conflict can be characterized in the following way: the default focus position of the sentence is occupied by the discourse given unfocused DP *den Fritz* and the target constituent of extraction *für Bücher*, which needs to be focus, is an aboutness topic.

Note, however, that this prosodic garden path effect can be repaired through reanalysis. The processor must create an appropriate context and adjust the prosody accordingly, as in (25).

(25) (Two teachers talking about their student Fritz and his scholarly interests.)

A: Ich habe beobachtet, dass viele Dinge den Fritz doch beeindrucken.
I have observed that many things the Fritz PART impress
B: Ja? Was haben (denn) [DP₃ t₁ für BÜCHER] [DP₂ den Fritz] beeindruckt?
Yes? What have PART for books the Fritz impressed

The DP BÜCHER is assigned a H*L-pitch accent signalling contrastive focus (in the sense of Jacobs, 1988, and Rooth, 1992). The contextually given DP den Fritz remains unaccented and in situ, a valid option that is explicitly noted by Fanselow (2006:11(19)). The definite DP is prosodically integrated into the verb phrase. Thus, a non-default prosodic contour can repair the prosodic garden path of (15b).

We have shown that default assignment of prosody in reading, when combined with the information structure requirements of constructions such as was-für split and scrambling, produces the appearance of freezing. Proper contextualization ameliorates the effect, as does proper matching of the IS requirements of the construction with the prosody. We summarize in (26) and (27) the two hypotheses that form the core of our analysis.

(26) Prosodic Garden Path Hypothesis (PGH):
When parsing decontextualized linguistic examples, the processor projects the default prosodic pattern of the particular language and construction onto the target sentence. In freezing configurations, the default intonational pattern leads to a prosodic garden path defined as a prosody-information structure conflict. Reanalysis triggers the search for a context-dependent non-default prosodic pattern.

(27) Information Structure Hypothesis (ISH): Freezing effects which result from extraction out of noncanonical constructions can be repaired by discourse appropriate non-default prosody.

3.2. Scrambling and long extraction (from subject vs. object)
Another case for which it can be argued that a prosodic garden path account is plausible is discussed by Bayer, 2004. He observes freezing and melting effects that are related to the cases discussed in the preceding section. These are given in (28).

(28) a. Was₁ glaubst du, daß die Anitaₙom [t₁ für Leuten₅dat] vertrauen würde?
   What believe you that the Anitaₙom [t₁ for people₅dat] trust would
   ‘What kind of people do you think Anita would trust?’

b. ?*Was₁ glaubst du, daß [t₁ für Leuteₙom] der Anita₅dat vertrauen würden?
   What believe you that [t₁ for peopleₕnom] the Anita₅dat trust would
   ‘What kind of people do you think would trust Anita?’

c. Was₁ glaubst du, daß der Anita₅dat [t₁ für Leuteₙom] vertrauen würden?
   What believe you that the Anita₅dat [t₁ for peopleₕnom] trust would
   ‘What kind of people do you think would trust Anita?’

---

9 There is an alternative pattern.

(i) Two teachers talking about which books impressed which of their students most.
A: Bücher über ReptTILIEN haben SANDY beeindruckt.
   Books about reptiles impress Sandy.
B: Was haben (denn) [DP₃ t₁ für /BÜCHERₙom] [DP₂ den FRITZ₅acc] beeindruckt?
Bayer investigates subject/object asymmetries with respect to long extractions and observes that the opposition is not actually one of grammatical function (subject vs. object), but different information-structural states. He distinguishes the topic domain and the focus domain. He proposes that the topic, which is defined in terms of the aboutness topic (Reinhart, 1981), coincides with the left middle field and focus with the right middle field, or VP domain. He offers the generalization in (29), and argues on the basis of the examples in (28) that elements cannot be extracted from the topic domain (cf. Bayer 2005: 238).

(29) In einer Topic/Fokus Struktur \([\text{TOP } X | \text{FOC } Y]\) darf die A′-Bewegung X nicht affizieren.

(‘In a topic/focus structure \([\text{TOP } X | \text{FOC } Y]\), A′-movement is not allowed to affect X.’)

More specifically, he proposes that the ungrammaticality of (28b,d) is due to the topic status of the extraction site für Leute in each case.

Although we believe that Bayer’s information-structural account is on the right track, we go beyond his explanation and argue that the markedness effects arise from a prosodic garden path, as characterized in (26). As before, the freezing effects in Bayer's (28b,d) can be ameliorated with the appropriate prosody. After experiencing the prosodic garden path, the processor must reanalyze the sentence and assign it a non-default intonational contour. The relevant contextualization for examples like (28) is given in (30), where a hospital scenario is chosen. The utterance A2 is to be understood as a second thought, after the speaker has uttered A1. To improve plausibility, we replace Bayer’s Leute ‘people’ with Ärzte ‘doctors’.

(30) A1: Ich weiss, dass hier kaum jemand mehr der Anita vertrauen wird.

I know that here hardly anyone (any)more the Anita trust will

‘I know that hardly anyone here will trust Anita any more.’

A2: Oder? Was glaubst du, dass \(t_1\) für Ärzte der Anita dat (noch)

or? what believe you that for doctors the Anita

trust would

‘Or? What kind of doctors do you think would trust Anita?’

(30A1) makes a general statement that hardly anyone trusts Anita around here anymore. A2 is a question to the hearer about what he thinks. The effect is that Ärzte carries a pitch accent which is interpreted as contrastive. The DP Anita is given in the discourse question and remains unaccented.

A similar contrastive context can be constructed for (28d), as in (31).

---

10 We are grateful to Judith Tonhauser for pointing out this interpretation.
The prosodic garden path approach presented here shows that examples like (30) and (31) are highly complex. In reanalysis, the processor must contextualize the sentence and assign a non-default prosodic contour to it that makes it more felicitous than the example to which a default contour was assigned. The reanalysis is complex: in (30), the parser must create a context which allows a pitch accent on the A-moved subject DP was für Ärzte which has topic status. In (31), the DP was für Ärzten is scrambled. Extraction from a topic or a scrambled position is highly marked. However, these configurations can be saved by contrastive contexts, in which the DPs with topic status are assigned a contrastive accent.\footnote{Alternative prosodic realizations of the examples in the text are conceivable. It is possible to construct a context in which the target sentence contains a pairwise contrastive reading.}

3.3. The position of the subject and judgment disagreements

An additional argument that shows that the extraction data cannot be accounted for in configurational terms is provided by disagreements in the literature on the position of the subject. The fact that some linguists find examples acceptable that are essentially identical to the supposedly ungrammatical cases suggests that what is at play is not in fact a grammatical principle, but processing and interpretation, along the lines that we have been arguing.

Müller (2010, 66 (46)) assumes that subject-DPs always occupy the same position in German and constitute barriers for extraction, since they are last merged in vP. He illustrates this point with example (32). He argues that the ungrammaticality of (32a) is due to the fact that subjects cannot participate in VP-topicalization, and so must be outside of the embedded VP.

\begin{itemize}
\item \textbf{(31) A1:} Ich habe gehört, dass Anita kaum jemandem mehr vertraut.
  Ich have heard that Anita hardly anyone\textsubscript{dat} (any)more trusts
\item \textbf{A2:} Oder? Was glaubst du, daß \(t_1\) für ÄRZTEN\textsubscript{DAT} die Anita\textsubscript{nom} noch vertrauen würde.
  Or? What believe you that for doctors the Anita trust would
  ‘Or? What kind of doctors do you think would Anita trust?’
\end{itemize}

\begin{itemize}
\item \textbf{[VP2 [DP3 Ein Buch]t\textsubscript{1} beeindruckt]} hat ihn\textsubscript{1} nicht t\textsubscript{2}.
  a book impressed has him not
  ‘A book didn’t impress him./No book impressed him.’
\item \textbf{[VP2 [DP3 Ein Buch gelesen] hat er\textsubscript{1} nicht t\textsubscript{2}.}
  a book read has he not
  ‘He didn’t read a book.’
\end{itemize}

\[\text{[Müller 2010, 66 (46)]}\]

\begin{itemize}
\item \textbf{(32) a.} *[VP2 [DP3 Ein Buch]t\textsubscript{1} beeindruckt]} hat ihn\textsubscript{1} nicht t\textsubscript{2}.
  a book impressed has him not
  ‘A book didn’t impress him./No book impressed him.’
\item \textbf{b.} [VP2 [DP3 Ein Buch gelesen] hat er\textsubscript{1} nicht t\textsubscript{2}.}
  a book read has he not
  ‘He didn’t read a book.’
\end{itemize}

\[\text{[Müller 2010, 66 (46)]}\]
In (32a) the vP containing the subject is topicalized, while in (32b) the VP containing the object is topicalized. According to Müller's analysis, the accusative object ihn ('him') was scrambled out of vP before topicalization.

However, it is possible to improve (32a). Müller’s judgment of ill-formedness illustrates the fact that the default prosody of VP also applies to topicalized VPs. While (32b) is well-formed if we assign an H*L accent to the preverbal DP ein Buch ('a book'), similar intonation produces a severe prosodic garden path effect in (32a). But the processor can avoid the garden path in this case by backgrounding the subject DP and assigning a contrastive accent to the verb, as is illustrated in (33): \(^{12}\)

(33)  Context: Auf der Frankfurter Buchmesse hat er sich so manches Buch angesehen. (‘He looked at lots of books at the Frankfurt book fair.’)
      Aber [ein Buch /BEEINDRUCKT] hat ihn \Nicht.
      but a book impressed has him not
      L LH* H% H*L
      ‘But no book impressed him.’

Strikingly, Haider (1993: 132 (24)) also observes that subjects can be part of VP topicalization, as shown by example (34), contrary to Müller’s general claim.

(34)  Ein Fehler unterlaufen ist dabei fastjedem Spieler.
      a mistake avoided is though almost every player
      ‘Almost every player avoided a mistake, though.’

Müller (2010:67) argues explicitly against the possibility that the subject DPs in (32) occur in Spec,TP in the ill-formed case and in Spec,vP in the well-formed case, as proposed, for example by Diesing (1992). His major argument is based on his observation that sentence adverbials which are claimed to occur at the boundary of vP (cf. Webellhuth, 1992, Diesing 1992, Haider, 1993) do not alter the grammaticality judgments in (35). According to his judgment, was-für extraction from subject DP in Spec,vP as in (35a) is ungrammatical, in contrast to (35b) and (35c), where local scrambling applies.

(35)  a. \[^{*}\text{Was haben denn [DP3}_1\text{für Bücher }] [DP2}\text{den Fritz }\]_2\text{beeindruckt?}\\
      what have PRT for books\text{nom} the Fritz\text{acc} impressed

  b. \[^{*}\text{Was}_1\text{haben denn [DP2}\text{den Fritz }][DP3}_1\text{für Bücher }\]_2\text{beeindruckt?}\\
      what have PRT the Fritz\text{acc} for books\text{nom} impressed

  c. \[^{*}\text{Was}_1\text{haben [DP2}\text{den Fritz }]\text{denn [DP3}_1\text{für Bücher }\]_2\text{beeindruckt?}\\
      what have the Fritz\text{acc} PRT for books\text{nom} impressed

[Müller 2010: 67 (48)]

\(^{12}\) Other example types are possible (following the Haider pattern)
(i)  Context: Was gibt es Neues von der der Frankfurter Buchmesse?
      Ein Buch /BEEINDRUCKT hat dort fast \JEDEF Besucher.


But Diesing (1991: 32) reports different judgments. She proposes that there is a difference between extraction from VP-internal and VP-external subjects. One argument for this claim comes from *was-*für extraction. For her, *was-*für extraction from a subject within the verbal projection is well-formed, as in (36b), whereas extractions from subjects outside the verbal projection (Spec, TP) are not well-formed, as in (36c).

(36)  
a.  Was für Ameisen haben denn einen Postbeamten gebissen?   
     what for ants have PART a postman bitten
b.  *[CP What haben [TP denn [VP für Ameisen einen Postbeamten gebissen]]]?  
c.  *[CP Was haben [TP für Ameisen denn [VP einen Postbeamten gebissen]]]?  
[Diesing 1991: 32]

Diesing's judgments contradict Müller's with respect to (36b)/(35a). However, their judgments coincide with respect to the configuration in (36c)(cf. Müller's (2010: 69 (49a)). Both judge these structures as ill-formed.

And note that for Frey (2004), extraction out of a DP above the sentence adverbial (a so-called ‘medial topic position’) is possible. In the appropriate context, extraction is possible from either the medial topic position, as in (37a) outside or adjoined to VP (to the left of an SAdv), or from the scrambled position in (37b).

(37)  
a.  Was_{1} hat Hans [t_{1} für Leute] dummerweise angerufen?   
     what has H. for people annoyingly called
     'What kind of people has Hans annoyingly called?'
     b.  Was_{1} hat dummerweise [t_{1} für Leute] ein Kollege gestern angerufen?   
     what has annoyingly for people a colleague yesterday called
     [Frey 2004: 32 (65)]

Frey judges both instances as grammatical, in contrast to Müller (2010:68f) who judges both as ill-formed.

Cases like those in (35) to (37) are perfect candidates to show that freezing effects are not caused by configurational relations, but are sensitive to context, intonation and information structure. The fact that for some authors they are judged to be well-formed, while for others they are not, is precisely what we would expect if what is relevant here is not grammaticality *per se*, but the application of the IPH and interpretation out of context. The ill-formedness judgments on the decontextualized written material are caused by garden path effects due to default prosodic assignment. Acceptability judgments occur when the author is able to construct and interpret a plausible non-default prosodic assignment.

### 3.4. Remnant Topicalization

Another potential source of freezing effects is remnant topicalization in German. In remnant topicalization, illustrated in (38) from Müller (2010:57), a constituent is scrambled to the left (e.g., *das Buch* in (38)), and then the VP constituent from which it was scrambled is itself topicalized (e.g., *[t zu lesen] to Spec,CP in (38)).

(38)  
*[VP_{2} t_{1} Zu lesen] hat das Buch_{1} keiner t_{2} versucht
to read has the book no-one tried
‘No-one tried to read the book.’

Remnant topicalization of an infinitival VP to a middle-field external position is possible, as in (38). However, movement of the same remnant VP constituent to a position below the complementizer is not well-formed as in (39b), according to Müller’s judgments.

(39)  

a. \[ \text{daß }_{vP2} \text{ zu lesen }_t \text{ es }_1 \text{ keiner }_t \text{ versucht hat } \]

that to read it no-one tried has

‘that no-one tried to read it’

b. \[ \text{*daß }_{vP2} \text{ zu lesen }_t \text{ das Buch }_1 \text{ keiner }_t \text{ versucht hat } \]

that to read the book no-one tried has

‘that no-one tried to read the book.’

[Müller (2001: 23), (37)]

Remnant scrambling in embedded clauses is possible, according to Müller, 2001), if the initial movement is not also a scrambling operation, but another movement, such as weak pronoun fronting as in (39a). This constitutes another ‘melting’ effect which is explained on the basis of purely configurational considerations.

However, if we consider the minimal pairs, (39a) differs from (39b) only by the type of nominal expression which is moved from vP2. In (39a) the processor must immediately recognize the focus scrambling construction and project a topicalization contour (non-default) onto the example. This so-called ‘hat’ contour is characterized by a rise on the remnant VP, a deaccented pronominal, and a fall on the negative non-referential indefinite DP _keiner_.

Although the difference between (39a) and (39b) is minimal (in (39a) the pronoun is by default weak) the processor experiences a prosodic mismatch in (39b). The difference is caused by the scrambled definite DP _das Buch_, which is followed by the non-referential negative indefinite. Note, that underlingly, the DP _das Buch_ was merged in preverbal position. We hypothesize that by default a pitch accent is assigned to the DP _das Buch_, which causes a conflict with the following indefinite _keiner_. In particular, the hat-contour is disrupted.

Default intonation of (39b) is given in (40), which shows a prosody-information structure conflict. If, however, a similar hat contour is projected onto (39b) as it is in (39a), where the DP _das Buch_ is integrated into the hat countour, the example is grammatical, as shown in (41).

(40)  

Default Prosody:

\[ \text{*dass } \text{ zu LESEN } \text{ das BUCH } \text{ keiner versucht hat } \]

that to read the book no-one tried has

LH* H* ? L%

<table>
<thead>
<tr>
<th>Topicalized VP</th>
<th>object scrambled</th>
<th>Preverbal indefinite subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>zu lesen</td>
<td>das Buch</td>
<td>keiner</td>
</tr>
<tr>
<td>IS</td>
<td>contrastive</td>
<td>given</td>
</tr>
<tr>
<td>Prosody</td>
<td>accented-rise</td>
<td>Default accent</td>
</tr>
</tbody>
</table>

unaccented
In summary, we claim that the remnant topicalization examples in (39a,b) do not constitute a case of freezing and melting. Rather the difference in acceptability arises from a prosodic conflict. More precisely, it results from the fact that the processor assigns the full definite DP in (39b) a default accent, because there is no other accentable DP in the example. This yields a prosodic garden path which results in the perception of ungrammaticality. However, if reanalyzed properly, with the appropriate prosodic topic contour as in (41), the status improves.

3.5. Conclusion

The evidence reviewed in this section shows that freezing and melting effects cannot be captured in purely configurational terms, contrary to what Müller (2001, 2010) suggests. We propose that the freezing effect must be explained on the basis of interacting factors which complicate processing. In particular, the complexity of identifying the different types of traces and their derivational history in freezing configurations and simultaneously assigning a matching context-dependent prosody and meaning results in ill-formedness judgments that can be confused with ungrammaticality.

4. Extraction from A'

A case of freezing discussed by Müller (2010) that is very different from the scrambling cases in §3 involves extraction from an apparent embedded topic in German. Müller (2010:55) classifies (42c) as an “entirely uncontroversial freezing effect” in German.

(42) a. Ich denke [CP [VP2 das Buch gelesen] hat keiner t2].
   I think the book read has no one
   ‘I think no one read the book’.

b. [DP1 Was] denkst du [CP t1 hat keiner [VP2 t1 gelesen]]?
   what think you has no one read
   ‘What do you think no one read?’

c. *[DP1 Was] denkst du [CP [VP2 t1 gelesen] hat keiner t2 ]
   what think you read has no one
   ‘What do you think no one read?’
The empirical facts are straightforward: wh-extraction from a topicalized VP in an embedded V2 complement clause is ruled out. In (42c), the wh-element was ‘what’ has ostensibly been extracted from a topicalized VP in the lower V2-clause into the higher V2-clause.

At first sight, this case appears to us to be one of genuine ungrammaticality; it seems not to be possible to improve (42c) easily. It may well be that there is a fatal garden path effect in processing the string *Was denkst du gelesen hat…*, which blocks identification of the gap. At second sight, however, it seems possible to improve the sentence with context and prosody. The following dialogue renders the target question of speaker B only slightly degraded.\(^\text{13}\)

\[(43) \quad \begin{align*}
\text{A: } & \text{ Ich denke // Bücher von Chomsky /GEKAUFT // hat fast } \text{JEDER.} \\
& \text{I think books by Chomsky bought has almost everyone} \\
& \text{L H* H*L L\%} \\
\text{B: } & \text{ Aber was // denkst du /GELESEN hat (vermutlich) } \text{KEINER?} \\
& \text{but what think you read has probably no one} \\
& \text{H* L H* H*L H\%}
\end{align*}\]

Note that the example is constructed in such a way that the typical topicalization contour (the ‘hat’ contour) is realized in the statement of speaker A with a contrastive rise on gekauft (‘bought’) and a contrastive fall on jeder (everyone). Speaker B uses the same hat pattern with a contrastive rise on gelesen (‘read’) and a fall on keiner (‘no one’) repeated in the question of B. It is crucial that denkst du be intonationally set off and pronounced flatly, almost without suprasegmental features. (i.e. deaccented). Moreover, there is an accent on the question word was (‘what’).

In (44), we apply the same context to was-für extraction in different positions.

\[(44) \quad \begin{align*}
\text{A: } & \text{ Ich denke // frühe Bücher von Chomsky /GEKAUFT // hat fast } \text{JEDER.} \\
& \text{I think early books by Chomsky bought has almost everyone} \\
& \text{L H* H*L L\%} \\
\text{B: } & \text{ Aber was (für Bücher) // denkst du // GELESEN / hat (vermutlich) } \text{KEINER?} \\
& \text{but what (for books) think you read has probably no one} \\
& \text{H* LH* H*L H\%} \\
\text{B': } & \text{ Aber was // denkst du // (für Bücher) GELESEN hat } \text{KEINER?} \\
& \text{but what think you (for books) read has no one} \\
& \text{H* L H* H*L H\%}
\end{align*}\]

\(^{13}\) A preferred alternative to (43B) is given in (i) or (ii)

i. \text{ Aber was denkst Du dass vermutlich gelesen keiner hat?} \\
\text{but what think you that probably read no one has}

ii. \text{ Aber was denkst Du was vermutlich gelesen keiner hat?} \\
\text{but what think you what probably read no one has}

Note that example (i) and (ii) are not extraction from the topic in an embedded V2 clause, but extraction from the scrambled vP initial constituent in an embedded V-final clause. The fact that it is better than (43) provides additional evidence that the problem in (43) is not that there is extraction from an A’ constituent, although such extraction does introduce complexity. The more significant problem with (43) is that with default intonation, *Was denkst Du gelesen hat* appears to violate basic constraints of German word order. In processing this sequence left-to-right, there is no plausible syntactic structure that the processor can build in anticipation of what is to follow, unless, of course, the intonation and context signal that this a special case. In contrast, there is no apparent violation in *Was denkst Du, dass/was vermutlich gelesen keiner hat.*
The parallel intonational pattern and the semantic interpretation of (44A) appears to be necessary to identify the position of the VP-trace. Speaker A is interpreted as Fast jeder hat Bücher von Chomsky gekauft (‘Almost everyone bought books by Chomsky’). The question by B starts with aber (‘but’) and thus establishes a pairwise contrast between gekauft and gelesen and jeder (‘everyone’) and keiner (‘no one’).

Similarly, we find that it is possible under certain circumstances to extract from A’ constituents in English. While examples (45b,c) are unacceptable, putting emphasis on the preposition by increasing its phonological weight improves matters considerably, as shown in (46).

(45)  
a. Sandy said that on the table, Robin had put a tarantula.  
b. *This table, Sandy said that [on t], Robin had put a tarantula.  
c. *Which table did Sandy say that [on t], Robin had put a tarantula?

(46)  
a. This is the table that Sandy said that [immediately under t], Robin had put a tarantula.  
b. This table would be very difficult for Sandy to prove that [directly on top of t], Robin had put a tarantula.

The fact that the examples in (46) are better than they should be if freezing is operative suggests that topicalization per se does not cause freezing, contrary to Müller’s general proposal. It also suggests that an account other than freezing should be sought for the cases that Müller cites in support of the freezing analysis.

An interesting counterpart to the German case is provided by English VP topicalization. As (47) shows, VP topicalization is possible when the VP is given with respect to the prior discourse, and what is left behind in AUX and possibly following AUX is in focus.

(47)  
They said that Terry would look at Dali’s painting of Lincoln, and [VP look at Dali’s painting of Lincoln] Terry did.

It might be supposed that it would be impossible to extract from a VP-topic in English, just as it is impossible in German.

It is in fact impossible to extract from the topicalized VP alone, if only because the VP is in one conjunct of a conjoined structure, and thus runs afoul of the Coordinate Structure Constraint (Ross 1967). But, strikingly, it is possible to do across-the-board (ATB) extraction from the two VPs.

(48)  
a. What did they say that Terry would look at, and then [actually look at t], Terry did?  
b. Dali’s painting of Lincoln is the painting that they said that Terry would look at t, and then [actually look at t], Terry did.

c. It was Dali’s painting of Lincoln that they said that Terry would look at t, and then [actually look at t], Terry did.
5. Misphrasing

In this section we consider the third case of apparent freezing noted in the introduction. This is the apparent impossibility of stranding a preposition in an extraposed PP in English, noted by Ross (1967: 305). We show that the freezing effect is an illusion. It arises from a type of prosodic garden path effect based on default prosodic phrasing, so that the preposition is not given its own intonational domain. The result is a misparsing of the preposition and failure to properly identify the extraction site.

Following the strategy pursued in previous sections, we demonstrate first that the effect occurs even when there is no configurational basis for a freezing account. Then we demonstrate that the effect can be mitigated by the judicious use of intonation and context, which facilitates the assignment of non-default prosodic phrasing and aligns the preposition with its own intonational phrase (Truckenbrodt, 1995, Selkirk, 2000, Göbbel, 2007; 2010; to appear).

5.1. Apparent freezing

(49) illustrates extraposition from a direct object.

(49) a. I showed a picture [of that actor] to Martha.
    b. I showed a picture ___ to Martha [of that actor].
    c. I saw a picture [of that actor] yesterday.
    d. I saw a picture ___ yesterday [of that actor].

(50b,c) show that under normal circumstances (i.e. as an answer to an unmarked question such as “What happened?”) it is unacceptable to extract from a PP that has been extraposed from an object NP. Baltin, 1984:160 cites the following examples, referring to such extraposed PPs as ‘islands’.

(50) a. Who did you show a picture ___ to Martha?
    b. Who did you see a picture ___ yesterday?
    c. *Who did you show a picture ___ to Martha of ___?
    d. *Who did you see a picture ___ yesterday of ___?

Examples with canonical word order are assigned default intonation in the sense of §3. The nuclear accent is realized on the most deeply embedded postverbal DP. In extraposition constructions an additional accent is assigned to the extraposed phrase (cf. Culicover and Rochemont, 1983; Rochemont, 1986).

Extraposition from subject produces similar results (Huck and Na, 1990). While extraction from the non-extraposed PP in subject position is slightly degraded (52a), extraction from the extraposed PP is much worse (52b-d).14

14 It is possible in principle to position an PP that is extraposed from a subject in various positions in a VP that has multiple constituents, with potentially varying degrees of acceptability. E.g., along with (51) we have the examples in (i).

(i) a. A picture was for sale of that actor at the market yesterday.
    b. A picture was for sale at the market of that actor yesterday.
Extraposition of PP does not predict freezing on the classical notion of freezing, since the position of the extraposed PP is an otherwise possible position of PP in the VP. One might look for an alternative configurational account, perhaps an update of Ross’s (1967, 1974) proposal. One might suppose, for example, that the extraposed constituent is frozen because it moves from a position where it is the complement of a head N to a position where it is a complement of V. Hence the PP is not governed by the head of the phrase of which it is a constituent. On earlier versions of syntactic theory in which government plays a central role, e.g. Chomsky, 1986, it is conceivable that the extraposed PP could constitute a barrier to government, so that extraposition would create a violation of ECP.

Most importantly, however, there is substantial evidence that the extraposed PP is not actually frozen, hence not a barrier to extraction in any sense. We show in §5.2 that the stranding of a preposition in cases such as extraposition is facilitated by context and the judicious placement of accent. In §5.3 we offer an account of why things work this way. And in §5.4 we show how the account extends to cases that behave the same way with respect to context and accent, but where there is no plausible account in terms of extraposition and freezing.

5.2. Facilitating stranding

It is clear that in some cases, stranding a preposition is problematic even when the PP is in situ. Some of the clearest cases are those where the preposition follows a complex constituent in VP. (We use ‘??’ to indicate that the examples are less than perfect without attempting to make any finer discriminations.)

(51)  a. A picture [of that actor] was for sale at the market yesterday.
      b. A picture __ was for sale at the market yesterday [of that actor]

(52)  a. Which actor do you suppose that a picture [of it] was for sale at the market yesterday?
      b. *Which actor do you suppose that a picture __ was for sale at the market yesterday [of it]?

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(53)  the person who, Terry gave that painting to ti

(54)  a. ??the person who, Terry gave that painting that Robin bought at the art fair
     [to ti]
     [cf. a person who Terry gave that painting to]

     b. ??the music that, Terry entertained some of Robin’s biggest and most
     enthusiastic fans from Chicago [with ti]
     [cf. the music that Terry entertained Robin with]

Our initial intuition is that extraction from these positions is marginally more acceptable than extraction from a VP-final PP, as in (52b). However, the judgments are difficult to distinguish, and an accurate measure of any differences between them would require a systematic empirical investigation.

15 In order to develop this line of reasoning, one would of course have to be concerned with whether the PP forms a chain with a trace in the NP, and how this chain interacts with government. Since the example is purely speculative, we do not go further into technical matters.
c. ??the listeners who, Terry mentioned in his weather forecast that it was going to rain [to \( t_i \)]
   [cf. the listeners who Terry mentioned it to]

d. ??the table, that Terry put the paint that Robin bought [on \( t_i \)]
   [cf. the table that Terry put the paint on]

Such examples can be improved somewhat by adding more lexical material to the stranded prepositional phrase. As a consequence, the PP becomes heavier and forms its own intonational phrase. The accent is realized on the added material. The preposition itself remains unaccented in these cases.

(55) a. the person who, Terry gave that painting that Robin bought [BACK to \( t_i \)]
    b. the music that, Terry entertained some of Robin’s biggest and most enthusiastic fans from Chicago [with several VERsions of \( t_i \)]
    c. the listeners who, Terry mentioned in his weather forecast that it was going to rain [to some good FRIENDS of \( t_i \)]
    d. the table, that Terry put the paint that Robin bought [on TOP of \( t_i \)]

Reordering complement PPs within the VP produces similar stranding effects, which can be ameliorated by adjusting phrasal weights. Consider the following examples. In (56a), the PP to Robin is to the left of the sentential adverb (SAdv), in its canonical position. It can appear to the right of the SAdv, as shown in (56b). When the PP is in its canonical position, extraction is not problematic, as shown in (56c). But when the PP is to the right of the SAdv, as in (56d), extraction is somewhat degraded.

(56) a. Sandy talked to Robin yesterday.
    b. Sandy talked yesterday to Robin.
    c. a person who, Sandy talked [to \( t_i \)] yesterday
    d. ?a person who, Sandy talked yesterday [to \( t_i \)]

Example (56d) seems slightly odd when encountered out of context. It can be improved if there is an accent on the preceding adverb, but it gets much worse as the temporal adverb is made more complex.

(57) a person who, Sandy talked

\[
\begin{align*}
\text{[to } t_i \text{]} & \\
\text{last WEEK} & \\
\text{[?the week beFORE}} & \\
\text{[?the week beFORE}} & \\
\text{[?during the MOvie}} & \\
\text{[?during the MOvie}} & \\
\text{[?during that very boring MOvie}} & \\
\text{[?during the MOvie that they were watching}} & \\
\end{align*}
\]
As in the cases already cited, these examples are not perfect, but they are not ungrammatical. They can all be improved by adding more syntactic complexity to the phrase that contains the stranded preposition.

(58) a person who, Sandy talked [last week, the week before, last week and the week before, during the movie, during that very boring movie, during the movie that they were watching] [to a very good FRIEND of t₁]

It also appears to be possible to construct examples where extraction is facilitated when the preposition is sufficiently accented.

(59) a. ?a person who, Sandy talked during the MOVIE [to t₁]
b. person who, Sandy talked during the movie [ABOUT t₁]
(60) a. ??the table, that Sandy put the tools that were required for the JOB [on t₁]
b. the table, that Sandy put the tools that were required for the job [UNDER t₁]
c. the table, that Sandy put the tools that were required for the job [in FRONT of t₁]

Huck and Na, 1990 (see also Bolinger, 1992) showed that even in cases of extraposition of PP, contrastively stressing the preposition and contextualizing the contrast conveyed by the accent facilitates stranding of the preposition.

(61) Okay, you saw a picture yesterday, but just whom did you see a picture yesterday OF?
(62) a. Here’s an article in the Tribune by Trevor, of all people; he’s someone I’d expect to read a story in the paper ABOUT.
b. I know Alger found letters in the file TO Chambers, certainly, but I’m not sure I can remember whom he found letters in the files FROM.
c. I think Bill said we saw a film yesterday by Napoleon, but of course Napoleon was the fellow whom(m) we saw a file yesterday ABOUT.
d. I heard Mary took some photographs in Peoria for the director, but one has to wonder what she could find there to take photographs for the director OF.

[Huck and Na (1990:66)]

Huck and Na also observe that a stranded preposition is marginal when there is a full sentence immediately preceding it, as in their example (56).

(63) ?Which dean did you indicate that you wanted to go on sabbatical next year to?
Thus they arrive at the conclusion that what is going on in the extraposition cases is not a matter of grammar, but of accent and focus.

Following Zwicky, 1982, Huck and Na (1990:69-70) propose that an unstressed stranded preposition is a ‘leaner’: it forms “a phonological phrase with another unit which contains the intonational peak of the phrase. Stressed prepositions are not leaners and can stand by themselves.” We elaborate on their proposal in the next section.

5.3. **Phonological phrasing**

While the impossibility of stranding a preposition in certain contexts is a candidate for a freezing analysis, the variability noted in the previous section suggests that there are other factors involved. The fact that there are heaviness effects involving both the material that precedes the preposition and the prepositional phrase itself suggests that the effects are prosodic, and linked to information structure.

The key idea of Huck and Na (1990) is that unstressed prepositions must form a phrase with preceding material, i.e. they are ‘leaners’. When the phonological phrasing conflicts with the syntactic phrasing, a violation occurs. Our hypothesis is that in this case the phrasing that is driven by prosodic structure leads to a syntactic misanalysis, and is a thus a type of prosodic garden path (Beckman, 1996; Friederici, 2001; Steinhauer and Friederici, 2001).

Our explanation draws from two interacting themes in the literature. One theme concerns the assignment of H* accents and the alignment of syntactic, phonological and intonational phrasing, along the lines proposed by Truckenbrodt, 1995. Dehé, 2005 proposes an account of the distribution of NPs and verbal particles in English and German using such a framework, and we propose to extend this approach to stranded prepositions.

At the same time, it has been shown that speakers regulate the placement of phrase boundaries in order to maximize ‘balance’ between the phrases; whether the ‘balance’ is phonetic or semantic is a matter of debate (see, for example, Breen et al., 2010; Fitzpatrick, 2001; Gee and Grosjean, 1983; Watson and Gibson, 2004).

We do not focus here on the precise mechanisms that account for the placement of phrase boundaries, particularly because the literature is far from clear in this regard. What is clear, however, is that the phrasing of a PP is dependent to some extent on its heaviness, however that is measured. For example, Fitzpatrick (2001) found that the longer a clause-final PP is, measured in terms of words, the more likely it is to have a pause before it. Her results are summarized in Table 1.

<table>
<thead>
<tr>
<th>WORDS IN PP</th>
<th>NO PAUSE PRECEDES PP</th>
<th>PAUSE PRECEDES PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Table 1.** Distribution of prosodic phrasing as a function of PP word count (Fitzpatrick 2001: 551)
Fitzpatrick writes (551):

This distribution suggests that length of the PP plays a role in determining the prosodic phrasing of clause-final PPs since, in general, the greater the number of words the more likely it is that a pause will precede the PP. However, at three words per phrase, the data are nondecisive: 21 PPs are not set off while 25 are.

Whether the three-word transition point actually has to do with the number of words, the number of syllables, the semantic content, or a combination, it appears that the complexity of a phrase is a factor in determining how the processor assigns intonational phrasing to a sentence. In particular, when a phrase is short, it is less likely to be preceded by a pause, and thus less likely to be prosodically marked as a separate phrase.

We suggest, then, that phrasing a PP that consists of an unstressed preposition and a trace, that is, \([\text{PP P } t]\), with the preceding NP inhibits the construction of the A’ chain, thereby producing a garden path effect. We illustrate using an example from Huck and Na (1990).

(64) I know Alger found letters in the file TO Chambers, certainly, but I’m not sure I can remember whom he found letters in the files FROM ti.

[Huck and Na 1990:66 (39c)]

Compare with (65), with default accent on files.

(65) a. ?I’m not sure who he found letters in the FILES from ti.
   b. I’m not sure who he found letters from ti in the FILES.

Applying the notion of balance, if the NP preceding the PP is relatively short, then it and the PP are distinct phrases. The phonological phrasing aligns with the syntactic phrasing, as proposed by Truckenbrodt and adapted by Dehé. Because the stranded preposition heads its own syntactic phrase, the trace is visible, and a chain can be formed. Hence a sentence like (65b) is relatively unproblematic. Example (66) illustrates this. We denote syntactic phrasing with square brackets [...] and intonational phrasing with parentheses (...).

(66)

| SYNTACTIC | who, he [found [NP letters]] [PP from ti]| |
| INTONATIONAL | who, he (found letters) (from) |

If the NP is longer, as in (65a), there is no intonational break before the stranded preposition. Thus P is intonationally phrased with the NP, which obscures the context required for recognition of the trace.\(^16\) Example (67) illustrates this.

\(^16\) Ruys, 2008:553 takes a very different approach to comparable cases in Dutch. On his analysis, extraposition of the PP requires that it be accented. Since the trace cannot be accented, extraction is ungrammatical. We believe that Ruys has things backwards – extraction is possible only when the preposition is accented.
Because the head that governs the trace is not in its own intonational phrase, there is no corresponding syntactic phrase that contains the trace, so it is effectively invisible. Thus there is a garden path in the construction of the chain headed by who.

In contrast, if the preposition is accented, the preposition heads an intonational phrase, as in (68).

The construction of the chain in (67) is of course not impossible. However, it requires extra computation. It is necessary to unpack the incorrect phrasing in order to identify the trace. We hypothesize that it is this extra computation that is responsible for the perception of ill-formedness in examples such as (50b,c), (56d) and (57). As is typical in garden paths, this extra computation is a repair that is triggered when no trace is found for constructing the chain.

The plausibility of this account is bolstered by the fact that putting extra weight on the preposition inhibits misphrasing and improves acceptability. There are several ways to add extra weight. One is to append something before the preposition, as in (55a). Another is to locate the preposition in a larger phrase, as in (55b,c). A third is to use a multi-word preposition, as in (55d). A fourth is to contrastively stress the preposition, as in Huck and Na’s (61)/(62). In any case, the effect is to prevent the intonational phrasing shown in (67). When the intonational phrasing corresponds to the syntactic structure, the trace is visible.

5.4. Extensions

Next, consider the verb-particle construction, illustrated in (69).

It is apparent that there is no extraction involved in this alternation. However, the same factors regulate the distribution of the particle that regulate the distribution of the stranded preposition. This fact gives further support to the claim that the constraints on extraction from extraposed PPs have nothing to do with freezing.

As in the case of P-stranding, in the V-NP-Prt pattern of (69b), the longer the NP, the more unacceptable the sentence, as shown in (70).
c. *!I threw all the important documents that I brought home from the office out.

The addition of right to the particle improves the examples somewhat. We put the judgments in parentheses to indicate that the subjective acceptability of these examples can be improved if there is an intonation break at the right edge of the NP and accentuation of right out.

(71) a. I threw the documents that I brought home right out.
    b. (?)I threw all the important documents that I brought home right out.
    c. (??)I threw all the important documents that I brought home from the office right out.

The number of syllables in the particle also appears to have an effect – an accented particle is more acceptable than an unaccented one in the same context.

(72) a. ??I carefully passed a very important document that I had written out.
    b. I carefully passed a very important document that I had written aROUND.

(73) a. ??I put the document that I brought home down.
    b. I put the document that I brought home aSIDE.

In these cases, the particle can stand as the head of its own phrase. Our proposal is that in these cases, as in the cases of preposition stranding, the particle is misphrased with the long NP. At first glance misphrasing would not appear to be problematic in the case of the particle, because there is no A′ chain to be constructed. However, as pointed out by Hawkins, 2004, there is a dependency that must be computed in the verb-particle construction, namely, the dependency between the verb and the particle. The interpretation of the V-Prt collocation cannot be arrived at until both have been identified and parsed as occupying their appropriate positions in the VP. Since the particle must be parsed separately in order to be interpreted as dependent on the verb, there is a weak garden path effect here, which is perceived as ill-formedness when the particle is not prosodically strong enough to resist being phrased with the NP. As in the case of the prosodic garden paths discussed in §3, the garden path effect is strongest when default intonation is assigned to the string. It can be avoided with judicious phrasing that, in this case, highlights the intended syntactic phrasing.

It is interesting to observe that the misparsing in this case is most confounding when there is a post-nominal modifier, such as a relative clause. A string of pronominal modifiers does not affect the prosodic pattern immediately before the particle, because the head is typically accented. This is illustrated in (74).

(74) I accidently threw a very important, very controversial and potentially very explosive DOCUMENT out.

---

17 Dehé, 2005 proposes an account of intonational phrasing in verb-particle constructions in English and German, couched in terms of OT. Her discussion covers only very simple examples, however, like those in (69).
But even a one-word post-nominal modifier causes difficulties.

(75) a. The few people alive were in serious danger.
    b. I met with the few people alive.
    c. ?I invited the few people alive in.
    d. I invited the few people alive // in.

What makes the sequence *few people alive in* acceptable in (75d) is the presence of a prosodic break between *alive* and *in*, which blocks the misphrasing. When the particle is accented, as in (76), the pause is not necessary, although it may be preferred.

(76) I sent the few people alive away.

Examples with post-nominal gerunds and past participles illustrate this phenomenon as well.

(77) a. We sent the crying child out.
    b. ??We sent the child crying out.
    c. We sent the child crying aWAY.
(78) a. I sent the crying child home.
    b. ??I sent the child crying home.
    c. I sent the child crying back home.
(79) a. They threw the implicated students out.
    b. ??They threw the students implicated out.
    c. They threw the students implicated right OUT.
(80) a. I told the available fireman off.
    b. ??I told the fireman available off.
    c. I told the fireman available right OFF.

These examples confirm that the ill-formedness of stranded prepositions and light particles in VP-final position is a matter of phrasing, not syntax.

6. Prospectus

In this paper we have argued that the ill-formedness of a range of configurations that are typically referred to as ‘frozen’ is due not to grammatical constraints, but to processing that leads to garden path effects and mismatches between default prosody and information structure. In other words, they are not islands. The cases that we have looked at are characterized by extractions from reordered constituents, which acquire their position through such operations as heavy NP shift, scrambling and extraposition.

Whether processing accounts can be justified for all apparent or proposed freezing is an open question. And, of course, another open question that is currently receiving considerable attention is whether all constraints on extraction are the consequence of processing limitations, or whether there are in fact strictly grammatical constraints on processing.

While it would take us far beyond the limits of this article to pursue these questions in detail, several additional cases of purported freezing are worth mentioning
briefly, to give some weight to the notion that processing explanations for freezing may well go beyond the cases that we focus on in this paper, and warrant further investigation.

_Clefts and pseudo-clefts._ Reeve, 2010 discusses the proposal of Pinkham and Hankamer, 1975 that the focus constituent of a cleft does not allow extraction due to freezing. Their examples are given in (81).

(81) a. ?Who was it a picture of __ that he decorated his door with?  
b. *Who was it with a picture of __ that he decorated his door?

Reeve notes, following Gundel, 1977, that such extractions are problematic but not completely ruled out.

Our own investigation confirms this. Next to the unacceptable examples in (82), we find that manipulation of the context, and the heaviness and prosody of the focus constituent can facilitate extraction, as in (83).

(82) a. It was in this fridge that Sandy put the beer.  
b. *Which fridge was it in t that Sandy put the beer.  
c. *This is the fridge that it was in t that Sandy put the beer.

(83) a. Which FRIDGE was it in t that Sandy put the beer.  
b. (?)This is the fridge that it was right NEXT to t that Sandy placed the groceries.  
c. This is the fridge that it was directly on TOP of t that Sandy placed the groceries.

Similarly,

(84) a. It is eating pizza that Sandy prefers.  
b. This is the kind of pizza that Sandy prefers eating t.  
c. *This is the kind of pizza that it is eating t that Sandy prefers.

(85) ?This is the kind of pizza that it is eating t with a pair of CHOPsticks that Sandy prefers.

Along related lines, Culicover, 1977 argued that it is not possible to extract from the focus of a pseudo-cleft because the focus is frozen. E.g.,

(86) a. What John did was [\text{VP buy an iPhone}].  
b. *What was what John did [\text{VP buy } t_i]?

In this case, we speculate that the processor is expecting something like

(87) What was // what John did // [\text{AP SIMilar to } t_i]

where _was_ signals that there is a predicate in focus position, in this case $[\text{AP } \text{sim} \text{ilar to } t_i]$. The construction is treated not as a pseudo-cleft, but as predicational, in the sense of
Higgins, 1973; *was* signals the expectation that there is a predicate, in this case \([_{AP} \text{similar to } t_i] \).

**Stylistic inversion.** Another focus construction considered in Culicover (1977) is stylistic inversion, exemplified in (88).

(88) a. \([NP \text{A picture of Terry}] \text{ was hanging on the wall.}\)
b. \(\text{On the wall was hanging } [NP \text{a picture of Terry}].\)

(89) suggests that it is not possible to extract from the focus constituent.

(89) *Who was on the wall hanging \([NP \text{a picture of } t_i]\)?

But extractions in the form of a relative clause or cleft are not quite as ill-formed as the question in (89), suggesting again that there may be non-grammatical factors at play, not a grammatical principle of freezing.

(90) a. ?Terry is the person who on the WALL was HANGing // \([NP \text{a PICTure of } t_i]\).
b. ?It was Terry that on the WALL was HANGing // \([NP \text{a PICTure of } t_i]\).

These sentences are virtually perfect if uttered with an accent on *wall* and *hanging*. They are improved more if *a picture of* is elaborated, e.g.

(91) a. Terry is the person who on the WALL was hanging \([NP \text{a very silly, and somewhat insulting, PICTure of } t_i]\).
b. It was Terry that on THIS wall was hanging \([NP \text{a very silly, and somewhat insulting, PICTure of } t_i]\) (and on THAT wall (was hanging,) \([NP \text{an extremely unflattering magaZINE article about } t_i]\)).

**Extraction from A’**. A case of freezing discussed by Müller (2010) that is very different from the scrambling cases in §3 involves extraction from an apparent embedded topic in German. Müller (2010:55) classifies (42c) as an “entirely uncontroversial freezing effect” in German.

(92) a. Ich denke [\(\text{CP[VP2 das Buch gelesen]} \text{ hat keiner } t_2\)].
   I think the book read has no one
   ‘I think no one read the book’.
b. \([\text{DP1 Was}] \text{ denkst } \text{du } [\text{CP } t_1 \text{ hat keiner } [\text{VP2 } t_1 \text{ gelesen}]]?\)
   \(\text{what think you has no one read}\)
   ‘What do you think no one read?’
c. *\([\text{DP1 Was}] \text{ denkst du } [\text{CP[VP2 } t_1 \text{ gelesen]} \text{ hat keiner } t_2 ]\)
   \(\text{what think you read has no one}\)
   ‘What do you think no one read?’
The empirical facts are straightforward: wh-extraction from a topicalized VP in an embedded V2 complement clause is ruled out. In (42c), the wh-element was ‘what’ has ostensibly been extracted from a topicalized VP in the lower V2-clause into the higher V2-clause.

This case appears to us to be one of genuine ungrammaticality; it is not possible to improve (42c) with context and prosody. Whether the topicalized VP is frozen in Müller’s sense, or whether the ungrammaticality is a consequence of other factors having to do with specific constraints of German grammar is a question that needs to be explored further. It may well be that there is a fatal garden path effect in processing the string Was denkst du gelesen…, which blocks identification of the gap.

To summarize, then, the cases focused on in this paper, along with those touched on in this section, provide some evidence in support of the hypothesis that freezing does not exist as a distinct, definable grammatical phenomenon. Rather, the evidence suggests that it is the consequence of other, essentially non-grammatical factors having to do with the processing of traces and the computation of correspondences between syntactic structure and information structure, mediated by prosody.

We envision three components of future investigation of the issues raised here. First, it is important to explore in greater detail the cases summarized in this section, as well as others cases of putative freezing that have been proposed in the literature. Does the general pattern of gradient judgments hold up, and can the judgments always be manipulated by supplying context and prosody? Second, experimental work is needed to verify that subjects in fact experience garden path effects when processing these types of examples, and that the strength of the effects correspond to the complexity of the processing. And third, there is the more general question of whether all constraints on extraction are in some way the product of constraints on processing, either because of garden paths or because of complexity factors, along the lines that have been suggested by Kluender, Hofmeister and Sag, and others (see references cited in §1).

Moreover, to the extent that it is possible to provide non-grammatical accounts of apparently grammatical phenomena, as pointed to in this article, it is possible to simplify the theory of grammar and get a better handle on the basis for linguistic judgments in general (Schütze, 1996, Fodor, 2002a, Phillips and Wagers, 2007). Crucially, in order for a grammatical theory to have explanatory force, it is important to establish as firmly as possible that the phenomena that it seeks to account for are in fact grammatical phenomena, and not the product of extra-grammatical factors.

Judgments of ill-formedness do not come labeled as to whether they are due to ungrammaticality or something else. When the words are in the wrong order – e.g. *Robin will the cake eaten have in English – there is a reasonable basis for treating the ill-formedness as a matter of grammaticality, that is, syntactic well-formedness. But when the words are in the right order, as in the vast majority of the examples considered in this paper, serious attention has to be paid to the very real possibility that the ill-formedness is not a matter of grammar. There is considerable virtue in taking this step, because it opens up the possibility of genuine simplification of the theory of grammar, as well as affording us a deeper understanding of the mechanisms that enter into language comprehension and production that go beyond grammar per se.
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