

ABSTRACT

Title of dissertation: VARIATION AND LEARNABILITY
 IN CONSTRAINTS ON A-BAR MOVEMENT

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A classic problem in linguistics is explaining how learners come to know so much about their native languages, despite receiving limited and noisy input. This learning problem becomes especially acute when the linguistic properties in question are obscure and show subtle variation across languages. Cross-linguistic variation means that learners must identify the appropriate points of variation for their language, even though the direct evidence that they need is often hard to detect or even non-existent.

This dissertation presents two case studies on constraints in A-bar movement. Because constraints are by nature abstract and difficult to observe directly, a classic solution to the learning problem posed by constraints claims that knowledge of these abstract or negative linguistic properties is innate. However, a number of these constraints show cross-linguistic variation, raising questions about how they are represented and how linguistic experience might (or might not) shape linguistic knowledge.

The first case study, discussed in chapters 2 and 3, involves cross-linguistic variation in the constraint that governs A-bar movement from relative clauses: some, but not all, languages allow A-bar movement from relative clauses under exceptional circumstances. I argue that these “porous” relative clauses that permit A-bar movement can be distinguished by a property that I call “tense dependence,” and discuss how this tense property might be formally related to A-bar movement. I show that this particular kind of variation presents a learning problem: in languages like English and Mandarin Chinese, learners have little direct positive evidence that such A-bar movement is possible. Using tense dependence, I propose that learners might circumvent this absence of direct evidence by relying on A-bar movement from a superficially unrelated structure: non-finite purposive clauses.

The second case study, discussed in chapter 4, involves bridge verbs: within a given language, some verbs allow A-bar movement and others do not; in addition, the set of verbs that allow A-bar movement varies across languages. I present an acceptability judgment experiment that is aimed at clarifying existing generalizations about bridge verbs in English. With more secure generalizations in hand, I discuss the extent to which bridge effects have a pragmatic origin, bringing in data from an informal survey of English and Dutch native speakers that looks at the effect of context on long-distance A-bar movement. Echoing existing work, the survey shows what appears to be a case of cross-linguistic variation between English and some Dutch varieties for cognitive factive verbs. To account for this instance of cross-linguistic variation, I suggest that English learners might have limited access to direct evidence, and discuss what learning mechanisms a learner might need to

draw the language-appropriate conclusions based on sparse evidence.

Chapter 5 discusses the consequences these case studies have for our formal accounts of these constraints. I evaluate existing proposals and argue that the range of variation observed requires more flexibility than what many existing proposals can offer.

Chapter 6 concludes.

VARIATION AND LEARNABILITY
IN CONSTRAINTS ON A-BAR MOVEMENT

by

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Dedication

To my parents and grandparents.

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Chapter 1: Introduction

1.1 Constraints in linguistic theory

A major achievement of modern linguistics is demonstrating the depth of knowledge individuals have about their native languages in domains such as phonology, morphology, syntax, semantics, and pragmatics. This knowledge, often modeled in the form of rules and constraints on linguistic representations, enables them to comprehend and produce novel utterances, and to avoid producing certain kinds of sentences or phrases.

But the discovery of rules and constraints also raises questions about how learners come to acquire them. These rules and constraints are highly abstract and specific. They are also often not explicitly taught to learners. To illustrate the problem, consider the following fact, to be discussed in greater detail in this dissertation: English appears to have a constraint that has the effect of blocking A-bar movement (in this case, movement of a *wh*-phrase) from relative clauses. By positing this constraint, we can straightforwardly explain why native speakers of English find a sentence like (1) unacceptable.

- (1) *Who did you read a book [_{RC} that was about]? (cf. *Who did you read a book about?*)

But there seems to be no easy way for a child to learn explicitly that such a sentence is unacceptable in English, and more importantly, no way for the child to learn that there is a constraint in English that rules out this sentence and other structurally similar ones. From a learner’s perspective, there might not be easily-observed direct (positive) cues that speakers cannot produce such sentences, or that speakers have trouble parsing them. Further, other speakers (parents, older siblings, other caregivers, and teachers) do not tell children to avoid these kinds of sentences; direct negative evidence is thus also absent. Supposing that these older speakers had the desire to do so, the abstractness of the constraint — involving notions such as “A-bar/*wh*-movement” and “relative clauses” — makes it difficult for them to describe the constraint or the consequences of violating it. And even if these older speakers had the linguistic training to provide a description, it is difficult to imagine that learners always have the ability to understand what is being conveyed or observe the prohibition faithfully.

Because of their negative nature and widespread distribution cross-linguistically, it is unsurprising that these constraints have played a central role in linguistic theorizing. A classic solution to the learning problem they pose is to posit innate domain-specific knowledge: learners are born knowing these constraints (or more abstract principles that derive these constraints), so the absence of direct evidence is not a concern. In addition to eliminating the learning problem, this solution is also attractive as it explains the cross-linguistic distribution of these constraints.

For example, the earliest discussion of examples like (1), as far as I can tell, is in Chomsky, 1964, where the low acceptability was accounted for using what is now

called the A-over-A principle (2). Chomsky suggests that this principle “might ... be proposed as a hypothetical linguistic universal” (p. 931). Expanding on this issue in his ground-breaking dissertation, Ross (1967, chapter 4) suggests these examples are better handled with the Complex NP Island Constraint, which essentially rules out A-bar movement from a clause embedded within a noun phrase. Like Chomsky, Ross suggests that his constraint is universal.¹

- (2) A-over-A principle: “If the phrase X of category A is embedded within a larger phrase ZXW which is also of category A, then no rule applying to the category A applies to X (but only to ZXW).” (Chomsky, 1964, p. 931)

This kind of innate knowledge proposal constitutes a strong claim about the human language faculty. This point does not necessarily only refer to the proposal that learners are born with the knowledge that certain dependencies are subject to specific constraints, such as the Complex NP Constraint. Depending on how the constraint in question is stated, it can also entail that learners are born with knowledge of certain linguistic categories or properties. For example, Ross’ Complex NP Island Constraint is stated in terms of clauses and NPs, and therefore presupposes knowledge of these syntactic categories. Further, as mentioned, they predict that languages should behave alike with respect to certain phenomena, since the speakers of these languages are all born with the same knowledge.

Subsequent research following up on Ross’s work has proposed a variety of abstract principles, such as subjacency (in terms of bounding nodes or barriers) (Chomsky, 1973, 1977, 1986; Lasnik and Saito, 1992; Rizzi, 1982), the Empty Cat-

¹Strictly speaking, this characterization of Ross’s proposal is inaccurate: these constraints do not actually prevent the movement of a constituent per se; they block the application of a “chopping” rule that blocks the moved element from being pronounced in its original position.

egory Principle (Chomsky, 1981), relativized minimality (Rizzi, 1990), the Phase Impenetrability Condition (Chomsky, 2000, 2001; Grano and Lasnik, 2018; Huang, 2018a), the Condition on Extraction Domain (Huang, 1982), restrictions on syntactic derivations (Hunter, 2015; Stepanov, 2007; Uriagereka, 1999), discourse-based concepts like dominance (Erteschik-Shir, 1973) and backgroundedness (Goldberg, 2006), as well as event structure principles (Truswell, 2007, 2011). However, like Ross’s and Chomsky’s proposals, these proposals come with the (implicit) assumption that the principles are part of one’s innate knowledge of language; the principles are too abstract to be taught or deduced from one’s linguistic experience.

Another logically coherent response is to deny the above learning problem. There are two mutually exclusive ways of doing so. The first is to claim that these constraints are actually not grammatical in nature. Instead, the low acceptability that has led linguists to propose constraints is merely an artifact of sentence processing (e.g. Deane, 1991; Hofmeister, 2007; Hofmeister and Sag, 2010; Kluender and Kutas, 1993). For example, many constraints on A-bar movement are effectively bans on A-bar movement from syntactically complex structures, such as various kinds of embedded clauses. One could argue that the low acceptability associated with A-bar movement from these structures simply reflects the processing challenges that arise from simultaneously processing a *wh*-dependency and a structurally complex sentence. Or it might reflect a failure to imagine an appropriate context in which a native speaker might produce such a sentence. Of course, for such an argument to be credible, one will need to provide an independently-motivated theory of sentence processing. While this is no easy task, a successful account would

be theoretically welcome, as it would eliminate the need to posit grammatical constraints, and therefore eliminate the need to explain how learners come to possess knowledge of them.

Although this processing-based approach is conceptually starkly different from the classic innate knowledge solution, it is similar in that it also predicts cross-linguistic uniformity. This prediction stems from the fact that these constraints are explained as processing artifacts, reflecting factors such as memory limitations and the way we process sentences using our knowledge of grammar, context, etc. It is hard to see how such effects might vary across languages, barring effects that are ultimately attributable to differences in grammar (e.g. *wh*-questions are obviously processed differently in *wh*-in-situ languages and overt *wh*-movement languages). Consequently, we expect to observe the same processing artifacts across languages.

In contrast, the second option takes seriously the notion that these constraints are grammatical in nature. Instead, it challenges the assumption that learners have no access to evidence about them. In this view, learners *do* get access to evidence; it is just that the evidence they use happens to be superficially unrelated to the constraints (or whatever linguistic properties that derive the constraints) that are to be acquired (see, among many others, Chacón, 2015; Chomsky, 1981; Pearl and Sprouse, 2013a,b; Pearl and Mis, 2016; Perfors et al., 2010; Real and Christiansen, 2005; Snyder, 2001; Viau and Lidz, 2011). It is important to note that such learning accounts do not necessarily mean that learners are blank slates or that the learning task is straightforward. For one, for these accounts to work, they must assume that learners have prior knowledge of hypotheses about the kind of grammars their

language might have. In fact, these hypotheses must be stated in fairly abstract terms, since, by definition, the evidence that supports one hypothesis (or one set of hypotheses) over another is superficially unrelated.²

As an example, consider one particular account: using indirect negative evidence to learn that a certain construction is ungrammatical (Chomsky, 1981; a variant of this approach that has received much attention is “statistical preemption,” see Boyd and Goldberg, 2011; Pinker, 1989; Wexler and Culicover, 1980, etc.). In such an account, learners begin with at least two distinct competing hypotheses: (i) the construction is grammatical, vs. (ii) the construction is not. All else being equal, these hypotheses make divergent predictions about how frequently the construction should appear: the first hypothesis predicts non-zero observations, while the second predicts no observations. Supposing further that they can track how frequently a given structure occurs in the input, learners then compare these predictions with actual observations. If the construction fails to appear, learners use its absence to conclude in favor of the second hypothesis.

It is also important to note that the availability of a strategy like the use of indirect negative evidence does not eliminate the need for other prior domain-specific knowledge in the language acquisition process. In the context of indirect negative evidence, for every utterance, there are many other grammatically perfect utterances that could have been produced in the same context but were not. Learners presumably somehow know which hypotheses a particular utterance bears on and

²It is also logically possible that learners might formulate these constraints from scratch, but it is difficult to see how this scenario might explain convergence across speakers. In such a scenario, it is quite likely that learners might end up formulating wildly different constraints.

which ones it does not (a point made by Pinker (1989) and Yang (2017)).

1.2 Exceptions and cross-linguistic variation

It should be clear from the above discussion that these constraints have important implications for our theories of the language faculty. It is thus not surprising that they have been the object of intense study. For illustration, consider the claim that these constraints are innately specified. To the extent that the goal of linguistics is to uncover insights about our knowledge of language, adopting this claim about innate knowledge of A-bar movement constraints obliges syntacticians to provide a detailed description of these constraints, as they might be instantiated in the mind. Alternatively, if one wishes to pursue a reductionist claim, one would need to start with similarly detailed descriptions of these constraints and show that the effects associated with them can plausibly be derived as processing artifacts.

However, as a survey of the literature since Ross's dissertation shows, developing a precise and comprehensive statement of these constraints has proven to be a challenging task. Two related but distinct problems emerge, and I illustrate them using examples from Ross's work and subsequent research.

The first problem is within-language exceptions: for almost every constraint proposed in the literature, exceptions have been pointed out for that same language, as though falsifying the constraint. Strictly speaking, this is only a technical issue, in that we can resolve it by refining our generalizations and formal descriptions, although perhaps at some theoretical cost. Examples of this kind of problem were

observed as early as Ross, 1967. The starting point of Ross’s dissertation is the observation that Chomsky’s A-over-A principle (Chomsky, 1964) is too strong for a language like English. Ross then proposes to replace it with a set of more specific island constraints. We may see this move as complicating a general theory of grammar. Another example occurs later in Ross’s dissertation, with his own Complex NP Island Constraint. Ross observes that the constraint predicts that a sentence like (3) should be unacceptable, contrary to what speakers report. He does not provide a solution to this problem, but tentatively suggests that the acceptable sentences are actually syntactically different, in a deep sense (“derive from quite different sources,” p. 140), from unacceptable sentences.

- (3) The money which₁ I have [_{NP} hopes [_S that the company will squander t₁] amounts to \$400,000]]. (Ross, 1967, p. 140, ex. 4.45a, reporting judgments by him and other speakers)
 (cf. *The money which₁ I read [_{NP} reports [_S that the company will squander t₁] amounts to \$400,000]].)

In more recent work, Truswell (2007, 2011) looks at exceptions (1) to the claim that adjuncts are islands (for specific proposals, see Cattell, 1976; Chomsky, 1986; Huang, 1982; Hunter, 2015; Stepanov, 2007; Uriagereka, 1999).

- (4) [What song]₁ did John walk in [_{adjunct} whistling t₁]?

Truswell argues that the prior generalization about adjunct islands is a composite of at least two constraints: a constraint that rules out A-bar movement from adjuncts that adjoin to a relatively high position in a clause, and another constraint that makes reference to event structures (his Single Event Grouping Condition). Again, a simple but perhaps too powerful constraint is replaced with a more nuanced

analysis that refers to notions that are relatively novel in the literature, in this case, event structure. To the extent that the event structure condition is semantic and does not have a syntactic correlate, this proposal also implies that extra-syntactic factors can interfere with the grammaticality of A-bar movement, which one might take as a violation of the autonomy of syntax hypothesis, thus pointing to a more complicated theory of syntax (I return to Truswell's proposal at several points in this dissertation.)

The second problem is cross-linguistic variation: a constraint might hold in one language but not another, often in ways that are hard to observe or characterize. This is a much more vexing problem, as cross-linguistic variation seems inconsistent with the innate knowledge claim: if constraints were so hard to learn that knowledge of them (or the knowledge of more abstract principles that give rise to constraints) were best modeled as innate, why would they vary across languages? This kind of variation is also apparently inconsistent with an approach that treats these constraints as processing artifacts: it is much harder to see how cross-linguistic variation can be derived from a processing angle. Instead, it fits naturally with the self-evident fact that grammars vary.

Returning to the issue of A-bar movement from relative clauses as an example: recall that early descriptions by Chomsky and Ross claimed that a universal constraint blocks the derivation of these sentences. However, as early as Erteschik-Shir, 1973, this claim was found to be problematic, based on examples of A-bar movement from relative clauses in Danish (39).

- (5) Is kender jeg mange der kan lide.
ice cream know I many who like
'I know many who like ice cream.' (Danish, Erteschik-Shir, 1973, p. 48, ex. 48)

Erteschik-Shir also observes that equivalent examples in English are also relatively acceptable, an observation that is also made in subsequent research (Chung and Ladusaw, 2003; den Dikken, 2007; McCawley, 1981, 1998).

- (6) This is a paper₁ that we really need to find someone [who understands t₁].
(from Chung and McCloskey, 1983)

Although similar exceptions are found in a variety of languages, these exceptions are by no means universal; Cinque (2010) reports that a number of languages lack them.

Logically, there are two mutually exclusive responses, both implicating non-trivial learning problems. The first response is to claim that the language faculty does not impose the constraint in question on all grammars, therefore the constraint is not expected to apply to all languages. Instead, the choice of the constraint (assuming that learners are selecting the most appropriate constraint out of a pre-defined set) can be influenced by one's linguistic experience. Alternatively, one could imagine a scenario where learners formulate a language-appropriate constraint from scratch, using their linguistic experience. While this scenario might be less plausible, the broader point about drawing abstract generalizations using one's linguistic experience, still stands.

The second response is to claim that the cross-linguistic difference is illusory: the structures involved are actually different. An example of this reasoning is found

in work by Kush and colleagues (Kush and Lindahl, 2011; Kush et al., 2013) for Swedish, which, like Danish, also allows A-bar movement from relative clauses. In these accounts, thanks to an idiosyncratic property of Swedish, the Swedish equivalent of *mange der kan lide* in (39) can receive either a relative clause and a small clause analysis. A-bar movement only takes place when such a string receives a small clause analysis (but see Christensen and Nyvad, 2014; Müller, 2015a for arguments against this proposal). The upshot of this analysis is that Swedish (and possibly other Scandinavian languages) have the same constraint against A-bar movement from relative clauses as other languages. The challenge here, for Swedish learners, is that they must somehow determine using their linguistic experience that certain strings are structurally ambiguous between these two analyses, even though this distinction might not be salient or occur frequently.

1.3 Case studies: constraints on A-bar movement from two types of embedded clauses

1.3.1 Goals and approach

An investigation of both kinds of variation can thus improve our understanding of the syntax of A-bar movement, while simultaneously addressing related issues regarding cross-linguistic variation and language acquisition, specifically, how learners come to determine the appropriate points of variation in their language for difficult-to-observe phenomena, such as A-bar movement constraints. In this dissertation, I adopt the following approach:

First, I study both types of variation, taking as case studies constraints on A-bar movement from two types of embedded finite clauses: relative clauses and complement clauses of verbs. (I explain my choice of case studies in the next section.) The goal here is to identify the dimensions along which we observe variation. Taking relative clauses as an example, the goal is to understand the circumstances in which A-bar movement from relative clauses becomes more acceptable, whether within languages or across languages. I do so by drawing together existing descriptions and analyses in the literature, supplementing them with my own data collection.

Next, I consider the kind of linguistic experience learners might reasonably have. The goal here is to determine what kind of evidence learners have about the constraints in their language; of particular interest is the extent to which learners get direct evidence for the relevant constraints in their language. For example, in a language that allows A-bar movement from relative clauses under exceptional circumstances (e.g. Danish), do learners actually get to observe A-bar movement from relative clauses in naturalistic environments? If learners do, the learning task becomes a little clearer for them: they get direct evidence that their grammar is one that generates A-bar movement from relative clauses, although the evidence obviously does not necessarily tell them exactly *which* grammar that is.

Within generative syntax, it is usually assumed that such direct evidence is non-existent. In the context of these constraints, this assumption is not an unreasonable one, since the constraints are of a negative nature and most utterances that learners observe are syntactically simple in the sense that they do not involve embedded clauses (see, e.g. Chomsky, 1971, for similar comments about subject-auxiliary

inversion in English).

However, in this dissertation, I look at both child-directed and adult-directed corpora, following in particular Pearl and Sprouse, 2013a,b, in order to get a more realistic picture of the sparsity (or richness) of linguistic experience at different stages of the language acquisition process (for other research that take a similar empirical, corpus-based perspective on linguistic experience, see, among many others, Dudley et al., 2017; Huang et al., 2018; Hyams, 1986; Legate and Yang, 2007, 2002; Pullum and Scholz, 2002; Valian, 1990, 1991; White et al., 2018; Yang, 2002, 2016).

With characterizations of what adult native speakers know and what kind of linguistic experience they might have, I identify the gaps between both components. To what extent is direct evidence missing? If direct evidence is not available or very sparse, what else might help learners identify the relevant constraints for their languages? To address this question, I consider the role of “indirect” evidence — evidence that is superficially distinct from the relevant phenomenon — by looking at cross-linguistic correlations and corpus data (Chomsky, 1981; Pearl and Sprouse, 2013a,b; Pearl and Mis, 2016; Perfors et al., 2010; Real and Christiansen, 2005). I put quotes around “indirect,” because strictly speaking, whether a piece of evidence counts as “direct” depends on what hypotheses learners entertain about their grammar. For example, suppose that learners can conclude that construction A is grammatical, by observing tokens of a superficially distinct construction, construction B. In a descriptive sense, we might label construction B as indirect evidence for construction A, as I did above. However, if both constructions are licensed by some abstract syntactic property P, then it is probably more accurate to say that

the observation of construction B is direct evidence for property P, which in turn guarantees that construction A is grammatical.

A discussion about linguistic evidence therefore inevitably implicates questions about hypothesis spaces and inference mechanisms (see, among many others, Chomsky, 1957, 1965, 1981; Gibson and Wexler, 1994; Pearl and Sprouse, 2013a,b; Pearl and Mis, 2016; Perfors et al., 2010; Viau and Lidz, 2011; Yang, 2016). By considering the kind of evidence that learners might be using, I also seek to spell out more concretely the kind of hypotheses that learners consider about their grammars and/or how they use the evidence they observe to identify the appropriate grammar; for example, which aspect(s) of the evidence they use to draw the right conclusion about their grammars. In this regard, this study is part of a long line of inquiry connecting cross-linguistic syntactic variation with learning concerns (among many others, Chomsky, 1981; Dunbar, 2013; Hyams, 1986; Legate and Yang, 2007; Rizzi, 1982; Snyder, 2001; Valian, 1991; Viau and Lidz, 2011; Yang, 2002).

1.3.2 Why these clauses?

I next address my choice of case studies. As a first approximation, relative clauses and complement clauses are held to impose very different restrictions on (overt) A-bar movement, and have been central to the literature on A-bar movement constraints (see work by Huang (1982) and others on restrictions on covert A-bar movement). Consequently, there has been much work done on these two types of clauses and the circumstances under which (overt) A-bar movement from them is

possible. Since this dissertation is concerned with cross-linguistic variation, the richness of this literature is valuable, as it means that there are relatively many prior descriptions and analyses to draw from.

More specifically, within the generative syntax literature, relative clauses are standardly held to be incompatible with A-bar movement. There are two well-regarded independent analyses for why relative clauses are islands. First, they are clauses embedded inside a nominal projection; A-bar movement from them thus violates the Complex NP Island Constraint and its formal descendants, such as subjacency or even the Phase Impenetrability Condition (assuming that clauses and nominal projections are phases) (e.g. Chomsky, 1973, 2000, 2001; Ross, 1967). Alternatively, relative clauses are adjuncts, and some principle of the grammar rules out A-bar movement from adjuncts (Cattell, 1976; Chomsky, 1986; Huang, 1982; Hunter, 2015; Stepanov, 2007; Uriagereka, 1999).

That said, there are languages for which A-bar movement from relative clauses is acceptable under very specific circumstances, challenging the above generalization. In addition to Danish, Swedish, English, as mentioned previously, similar observations have been made for Hebrew (Sichel, 2018) and Mandarin Chinese (Xu and Langendoen, 1985; Zhang, 2002).

Complement clauses of verbs, on the other hand, are canonically depicted as compatible with A-bar movement, starting from Ross, 1967. The claim that A-bar movement is unbounded (although subject to negative constraints) is almost always illustrated with A-bar movement from these complement clauses. The notion that A-bar movement from complement clauses (or complements in general) is always well-

Marcus et al., 1999).³

Pearl and Sprouse found that the proportion of tokens with A-bar movement from an embedded finite clause relative to the total number of utterances ranged between 0.10% to 0.32%; all these tokens involve A-bar movement from complement clauses of verbs, and not of any other kind of complement clauses (see their Appendix B); they did not report finding tokens involving A-bar movement from other kinds of embedded finite clauses. It is in this sense that we may consider the direct evidence to be sparse, since it seems unlikely that learners can reliably observe A-bar movement from certain kinds of relative clauses. One might also wonder why, given the evidence, learners do not conclude that A-bar movement from complement clauses of all verbs is equally acceptable.

(8) Selected statistics on A-bar movement from Pearl and Sprouse, 2013b⁴

| | Child- directed speech | Adult- directed speech | Adult- directed texts |
|--|------------------------------|------------------------------|-----------------------------|
| Total utterances | 101,838 | 74,576 | 24,243 |
| Total <i>wh</i> -dependencies | 20,923 | 8,508 | 4,230 |
| Total <i>wh</i> -dependencies involving embedded finite clauses | 324 | 104 | 24 |

We can convert these proportions to annualized figures, using estimates for number of utterances reported by Hart and Risley (2003, 1995). More specifically, they report that low socioeconomic status (what they label as “welfare”) children hear about 176 utterances an hour; assuming these children observe about 5,200

³As far as I can tell, it appears that they were specifically interested in A-bar movement of *wh*-phrases.

⁴Figures on embedded finite clauses are calculated with data reported in Pearl and Sprouse, 2013b, Appendix B, for any dependency that is analyzed as crossing a CP headed by a null complementizer and *that*. This criterion picks out finite clauses but not non-finite ones. In Pearl and Sprouse’s analysis, control verbs take IP complements, not CP complements.

hours of speech a year, this works out to about 915,000 tokens a year. Using this estimate to calculate annualized figures, one concludes that in a single year, English learners might get to observe up to 900–2,900 *wh*-dependencies that cross a clause boundary, of which an absolute majority, if not all, involve movement from complement clauses of verbs. (Of course, just because they are exposed to 900–2,900 tokens a year does not guarantee that they use all of them for drawing the right inferences: it is possible that they fail to observe some of them, or misparse others.)

1.4 Contributions of this thesis

One of the deliverables of this thesis is a review of the circumstances in which A-bar movement from relative clauses and complement clauses of verbs become more acceptable, by drawing together existing work in the literature; the hope is that this review can serve as a summary of the state of the art on both phenomena. As mentioned, I also supplement this review with my own data collection, where feasible: I report acceptability judgment experiments on A-bar movement from both types of clauses as well as informal surveys of native speakers. Doing so is important, especially in the case of complement clauses, where there are dozens, if not hundreds, of verbs that take complement clauses (Anand et al., to appear; White and Rawlins, 2016, 2018). However, most existing datapoints and hypotheses in the literature are based on a small number of verbs; the most thorough investigation I am aware of is Liu et al., 2019, which looks at 48 English verbs.

Better empirical generalizations allow me to identify the linguistic dimen-

sion(s) that affect the acceptability of A-bar movement from these two types of embedded clauses. Doing so is important for two reasons.

First, better characterizations of the dimensions that matter in A-bar movement and the range of cross-linguistic variation are clearly necessary for formal accounts of these constraints, which in turn bear on more general, architectural issues in syntax. For instance, consider the case of A-bar movement from relative clauses. As mentioned previously, it is rather common to come across the generalization that A-bar movement from relative clauses is uniformly unacceptable; this generalization is taken to be evidence for certain claims about the nature of syntactic derivations. For instance, Uriagereka (1999) posits that linearization requires that adjuncts (presumably including relative clauses) be Spelled Out before they are merged, which derives the fact that adjuncts are incompatible with A-bar movement. Likewise, Stepanov (2001) proposes that adjuncts are obligatorily merged “late” (after A-bar movement), which also derives the incompatibility of A-bar movement from relative clauses. As elegant as these proposals may be, the fact that A-bar movement from relative clauses can be acceptable poses a challenge for them, thus weakening the overall argument for these proposals (see Truswell, 2011 for similar remarks).⁵

Second, better generalizations of cross-linguistic variation can inform our theories of learning. Ideally, one should do more than just point out that certain constraints vary cross-linguistically and thus speakers need to somehow learn what the relevant constraints are in their language. To the extent that the goal of linguis-

⁵Sichel (2018) proposes to resolve this issue by positing that these exceptional relative clauses are actually complements, not adjuncts. However, this particular treatment does not accommodate cross-linguistic variation easily

tic theory is to understand the language faculty, and to the extent that our language faculty contains a component that makes learning possible, we should seek to also provide plausible learning accounts. In principle, a full account should consist of answers to the following questions:

- (9)
 - a. What is the learner’s initial knowledge state?
 - b. How does the learner’s knowledge state change?
 - (i) What evidence does the learner encounter?
 - (ii) What inferences does the learner make?
 - (iii) What mechanisms and knowledge does the learner use to draw these inferences?
 - c. What evidence is there for this learning account?
 - (i) Is the hypothesized linguistic evidence present in the input?
 - (ii) If it is present, can learners detect it?
 - (iii) If learners can detect it, can they draw the hypothesized inference?

For scope reasons, this dissertation will only address questions (9a), (9b), and (9c-i). In particular, I take a quantitative approach toward questions about evidence, in particular the question of indirect evidence. Conventionally, such accounts are substantiated using covariation evidence: showing that in a sample of languages, the phenomenon to be learned and the phenomenon that serves as indirect evidence are either both well-formed or both ill-formed. This dissertation presents a proof of concept, using covariation data to point out what kind of evidence learners might be using, and providing corpus data to show that the evidence is actually present in the input and hence in principle accessible for learners.

To the extent that the proposals here are successful, they set the stage for experimental inquiry, i.e. answering questions (9c-ii) and (9c-iii). We can then ask how these proposals are similar to or different from proposals about how learners

acquire other aspects of language, e.g. phonology or semantics, or even how these proposals compare with learning problems in other domains of cognition. These questions are important, since they bear on debates about domain specificity and knowledge: to what extent are the learning mechanisms unique to language? How much domain-specific knowledge do we need to assume for these learning accounts to work?

1.5 Roadmap

To sum up, constraints on A-bar movement have been taken to provide a powerful argument for innate knowledge of language. Systematic variation in these constraints, however, poses potentially serious problems: it is not always easy to see how learners might acquire the points of variation appropriate for their language, nor is it always easy for linguists to accommodate variation in their theories of syntax.

In Chapter 2, I present the first case study, on variation in the constraint that governs A-bar movement from relative clauses: some languages, like Polish, Bulgarian, and German, impose a ban on A-bar movement from relative clauses, while others, like Hebrew, English, Mandarin Chinese, allow it under exceptional circumstances. I show that learners of the second set of languages do not always have reliable direct positive evidence that their language allows A-bar movement from relative clauses. With cross-linguistic evidence, I argue that learners instead make use of indirect evidence: A-bar movement from purposive clauses. Chapter 3 elaborates on the argument, presenting corpus evidence to show the feasibility of

this indirect learning account, and considers the kind of biases a learner might need for this account to work.

In Chapter 4, I discuss the second case study, on bridge verbs: within a language, certain verbs allow A-bar movement from their complement clauses while others do not. I review existing claims about the nature of bridge verbs, and present an acceptability judgment experiment that is aimed at clarifying existing generalizations about bridge verbs in English. I also evaluate how context might influence the acceptability of long-distance A-bar movement, through an informal survey of English and Dutch. I also find some evidence showing that there are cross-linguistic differences between these two languages, at least in the domain of cognitive factive verbs, in a way that corroborates existing descriptions of Dutch (Broekhuis and Corver, 2016). I discuss how these cross-linguistic differences might be derived from direct evidence, looking at the distribution of long-distance A-bar movement and cognitive factive verbs in English as a case study.

In Chapter 5, I review existing proposals regarding these phenomena and discuss consequences cross-linguistic variation has for our formal descriptions and theories of A-bar movement constraints. For example, I argue that the variation we observe suggests A-bar movement from relative clauses and complement clauses does not have a unified analysis. I also use the case of A-bar movement from relative clauses to argue against proposals that seek to derive adjunct islandhood from more basic syntactic principles, following Truswell (2011).

Chapter 6 concludes.

Chapter 2: Variation in A-bar movement from relative clauses

2.1 To what extent do relative clauses block A-bar movement?

Relative clauses, which often bear finite and/or indicative morphology, are typically thought to be strong islands that block all types of A-bar movement from within (1) (Chomsky, 1977; Ross, 1967). Perhaps less appreciated is the fact that there are relative clauses that seem to allow overt A-bar movement of what is typically an object, as illustrated in (2) with relativization.

For ease of reference, I will use “porous” as a label for these relative clauses and their environments (2); these include a relative clause that is part of a complex NP that is either c-commanded by an intensional predicate (2a) or the predicate of a copular sentence (2b).

(1) “Regular” relative clauses

- a. *This is the problem₁ that Mary hired the programmer [who solved t₁].
[Relativization]
- b. *Which problem₁ that Mary hired the programmer [who solved t₁]? [*Wh*-question]
- c. *This problem₁, Mary hired the programmer [who solved t₁]. [Topicalization]
- d. *Mary solved more problems₁ than Smith hired the programmer [who could solve t₁].
[Comparative deletion]

(2) “Porous” relative clauses (adapted from examples in Chung and McCloskey,

1983)

- a. This is the problem₁ that Mary wants to hire a programmer [who can solve t₁].
- b. This is the problem₁ that Mary is the only programmer [who can solve t₁].
- c. This is the problem₁ that there is only one programmer [who can solve t₁].
- d. This is the problem₁ that I know a programmer [who can solve t₁].

2.1.1 Porous relative clauses cross-linguistically

Porous relative clauses are not unique to English. Some of the earliest discussion on A-bar movement from porous relative clauses in the literature is centered on examples in Scandinavian languages like Swedish (3), Danish, and Norwegian (e.g. Allwood, 1982; Engdahl, 1980; Erteschik-Shir, 1973; Taraldsen, 1982; see Engdahl, 1997; Lindahl, 2017 for reviews). Other languages where they have been observed include Hebrew (4) (Rubovitz-Mann, 2000; Sichel, 2018), Mandarin Chinese (Xu and Langendoen, 1985; Zhang, 2002), and Spanish (Cinque, 2010). Brazilian Portuguese appears to be another such language (Gesol Mendes and Kayron Beviláqua, p.c.). These examples resemble their English counterparts in (2), occurring in similar syntactic and semantic contexts.

(3) Swedish¹ (Engdahl, 1997)

- a. Här är [en fråga]₁ som jag inte känner någon [som kan svara på
here is a question that I not know anybody that can answer
t₁].

‘Here is a question that I don’t know anybody who can answer.’ (ibid.)

¹Abbreviations used in glosses: ACC: accusative; CL: classifier; COMP: complementizer; DAT: dative; DEF: definite marker; EXP: experiential aspect; IND: indicative mood; INF: infinitive; MOD: modifier; NOM: nominative case; PRF: perfective aspect; REL.PRN: relative pronoun; SBJ: subjunctive mood; 1/2/3: 1st/2nd/3rd person; sg/pl: singular/plural

ex. 15a)

- b. Garagedörren₁ är det bara Kalle [som kan öppna t₁].
garage door.DEF is it only Kalle who can open
'The garage door, it is only Kalle who can open.' (ibid. ex. 36)
- c. [De blommorna]₁ känner jag en man [som säljer t₁].
those flowers know I a man that sells
'These flowers, I know a man that sells.' (Allwood, 1976 ex. 48)

(4) Hebrew (Sichel, 2018)

- a. [al lexem faxor]₁ yef rak gvina axat [fe-kedai limro'ax t₁].
on bread black be only cheese one that-worth to.spread
'On black bread there is only one cheese that's worth spreading.' (ibid. ex. 46a)
- b. [al ha-haxlata hazot]₂ Yair Lapid haya ha-axaron [fe-yada t₂].
about the-decision this Yair Lapid was the-last that-knew
'About this decision, Yair Lapid was the last to know.' (ibid. ex. 47a)
- c. [me-ha-sifria hazot]₂, od lo macati sefer exad₁ [fe-kedai
from-the-library this yet not found book one that-worth
lehaf'il t₁ t₂].
to.borrow
'From this library, I haven't yet found a single book that's worth borrowing.' (ibid. ex. 49a)

(5) Mandarin Chinese

- a. [Zhe-ben shu]₁ wo renwei [du-guo t₁ de] ren bu duo.
this-CL book I think read-EXP MOD person not many
'This book, I think there are not many people who have read it.' (Xu and Langendoen, 1985 p. 14 ex. 61a)
- b. [Zheme wanpi de haizi]₁, wo zhao-bu-dao [yuanyi shouyang t₁
so naughty MOD child I can't-find willing adopt
de] ren.
MOD person
'Such a naughty child, I cannot find someone who is willing to adopt him/her.' (Zhang, 2002 ex. 5c)

(6) Brazilian Portuguese (sentences provided by Gesoel Mendes, judgments from Mendes and Kayron Beviláqua)

- a. (?) [Esse é o projeto de lei]₁ que o presidente quer encontrar o
this is the project of law that the president wants to.find a
senador [que suporte t₁].
senator who supports.SBJ

- ‘This is the bill that the president wants to find a senator who supports.’
 b. Violência₁ é uma coisa que tem muitas pessoas [que perdoam t₁].
 violence is one thing that there.is many people who forgive
 ‘Violence is something that there are many people who condone.’

Since relative clauses can block A-bar movement in these languages, one cannot explain the acceptability of the above porous relative clause examples by claiming that these languages lack a Complex NP constraint or an adjunct island condition. Rather, what is more likely is that these languages exceptionally allow A-bar movement from porous relative clauses.

- (7) *[De blommorna]₁ kysste jag en man [som salde t₁].
 those flowers.DEF kissed I a man who sold
 ‘Those flowers I kissed a man who sold.’ (Christensen and Nyvad, 2014 p. 31, ex. 5, citing Kush and Lindahl, 2011) [Swedish]
- (8) *[Me-ha-sifria hazot]₂, od lo macati [et ha-sefer₁ [fe-kedai
 from-the-library this yet not found ACC the-book that-worth
 lehaf’il t₁ t₂]] fe-Dina mac’a.
 to.borrow that-Dina found
 ‘From this library, I haven’t yet found the book that’s worth borrowing that Dina found.’ (Sichel, 2018, ex. 67a) [Hebrew]
- (9) *[Zheme wanpi de haizi]₁, wo zhaodao-le [shouyang t₁ de] ren.
 so naughty MOD child I find-PRF adopt MOD person
 ‘Such a naughty child, I found the person who adopted him/her.’ (Zhang, 2002 ex. 5c) [Mandarin]
- (10) *Esse é [o problema]₁ que a Maria contratou o programador [que
 this is the problem that the Mary hired the programmer that
 resolveu t₁].
 solved
 ‘This is the problem that Mary hired the programmer who solved it.’ (sentences provided by Gesoel Mendes, judgments from Mendes and Kayron Beviláqua) [Brazilian Portuguese]

In an short but important paper, Cinque (2010) reports cross-linguistic vari-

ation in A-bar movement from porous contexts. Looking also at relativization and topicalization, he observes that equivalent structures in German and Bulgarian are unacceptable. The Bulgarian data are striking, as they contain resumptive pronouns/clitics (12), whose presence is traditionally held to ameliorate island violations (Ross, 1967) but fails to do so here.² As further evidence of cross-linguistic variation, I give examples from Polish (Marta Ruda, p.c.) and French (Valentine Hacquard, Anouk Dieuleveut, p.c.). These languages appear to block A-bar movement of objects from relative clauses.³

(11) German (Cinque, 2010, ex. 8)

- a. *Diese Schrift gibt es niemand, der gelesen hat.
 this writing there be nobody who read has
 ‘This writing there is nobody who has read.’
- b. *Dies habe ich nie jemand getroffen, der getan hat.
 this have I never anyone met who done has
 ‘This, I have never met anyone who has done.’

(12) Bulgarian (Cinque, 2010, ex. 9)

- a. *Ivan, na kojto njama nikoj, {kojto/deto} može da
 Ivan, to whom there-isn’t nobody who/that can to
 mu kaže novinata.
 him.clitic.DAT tell news.DEF

²That said, recent experimental work on resumptive pronouns, sparked off by papers like Alexopoulou and Keller, 2007, has found that they do not improve (but nor further degrade) the acceptability of island violations.

³My classification of French together with German runs counter to that by Cinque (2010), who claims that French patterns like English, based on examples like (i). However, the acceptable examples all contain sentential negation, and they are the only instances of A-bar movement of objects from relative clauses that were perceived to be more acceptable by the French native speakers I consulted with. Other examples, explicitly modeled on acceptable non-negated sentences in English (Scandinavian, Hebrew, Mandarin Chinese), were judged to be unacceptable. It is clear that French is significantly more conservative than English (Scandinavian, etc.) is, although I do not yet fully understand the role of negation, nor why German and French might diverge in the acceptability of sentences like (i).

i. Jean, à qui il n’y a personne qui puisse s’opposer.
 Jean, whom there not is nobody who can.SBJ self to.oppose
 ‘Jean, whom there is nobody that could oppose, ...’ (Cinque, 2010, p. 84, ex. 5a)

- ‘Ivan, who there isn’t anybody who can tell him the news ...’
- b. *Ivan, na kojto njama nito edin prijatel, {kojto/deto} iska da
 Ivan, to whom there-isn’t not one friend who/that wants to
 mu pomaga.
 him.clitic.DAT help
 ‘Ivan, who there isn’t anybody who wants to help ...’
- (13) *To jest ten problem, który Jan chce znaleźć programistę, który
 this is the problem which Jan wants find.INF programmer who
 będzie potrafił rozwiązać.
 will be.able solve.INF
 ‘This is the problem that Jan wants to find a programmer who can solve.’
 [Polish (Marta Ruda, p.c.)]
- (14) *C’ est le problème que Jean veut trouver un programmeur qui
 this is the problem that Jean wants find a programmer who
 puisse résoudre.
 can.SBJ to.solve
 ‘This is the problem that Jean wants to find a programmer who can solve.’
 [French (Valentine Hacquard, Anouk Dieuleveut, p.c.)]

2.1.2 How porous are porous relative clauses?

Acceptable instances of A-bar movement from relative clauses reported in the literature — whether for English or for other languages — typically feature relativization or topicalization from a porous relative clause. It is less common for an example to feature other types of A-bar movement, such as the movement of a *wh*-phrase or *tough* movement. As far as I can tell, there is no explicit discussion of why certain constructions are omitted. The literature seems to implicitly suggest that the omission is just out of convenience, but it is also possible that this issue has not been studied in detail. At least in English, the compatibility of different A-bar movement constructions with porous relative clauses seems to vary (15), but

I will leave a more precise characterization for future work. Nevertheless, I take the relativization and topicalization facts to show that there are certain constructions in some (but not all) languages like English or Hebrew that are inconsistent with standard generalizations about relative clauses.

- (15) a. [(?)Which problem/?*What]₁ does Mary want to find a programmer
[who can solve t₁]? [Wh-question]
b. *John can solve more problems₁ than Mary wants to find a programmer
[who can solve t₁]. [Comparative deletion]
c. ?This problem₁ is hard to find someone [who can solve t₁]. [Tough-
movement]

That said, there are also restrictions on what kind of syntactic object can relativize or topicalize from porous relative clauses. The examples above show that NP objects of verbs can do so. There is also evidence from English and Swedish that NP objects of prepositions may extract (16). It is less clear to me whether non-NP arguments can extract; they can topicalize (in at least some contexts) in Hebrew and in Brazilian Portuguese (17).⁴

- (16) a. That's one trick₁ that I've known a lot of people who've been taken in
[by t₁]. (Chung and McCloskey, 1983, p. 708, ex. 9a)
b. Der₁ vet jag många [som har fastnat i t₁].
that know I many that have gotten.stuck in
I know many people who have gotten stuck on that. (Swedish, naturally
occurring conversation cited in Lindahl, 2017, p. 90, ex. 84)

⁴It is harder to say whether PP arguments may move from porous relative clauses in English (i); A-bar movement of argument PPs is at best stilted, even in syntactically simple contexts (ii).

i. a. ??That's the diplomat [to whom]₁ they need to find an ambassador [who can give the
award t₁]
b. ??That is the small town [in which] the mining company wants to find someone [who is
willing to live t₁].

ii. a. ?[To whom]₁ will the ambassador give the award t₁?
b. ?[In what town]₁ is Mary living t₁?

- (17) a. Be-yerufalayim₁ hem hayu hayexidim [fe-hiskimu lagur t₁].
 in-Jerusalem they were the.only.ones that-agreed to.live
 Intended: ‘They were the only ones who agreed to live in Jerusalem.’
 (Sichel, 2018, p. 345 ex. 19a)
- b. [Nessa cidade]₁, a Maria é a única pessoa [que está disposta a
 in.this city the Maria is the only person who is willing to
 viver t₁].
 live
 ‘Maria is the only person who is willing to live in this city.’ (transla-
 tion by Gesoel Mendes, judgments due to Gesoel Mendes and Ana N.
 Mendes)
- c. ??[Nessa cidade]₁, eles querer encontrar alguém [que esteja disposto
 in.this city, they want to.find someone who is willing
 a viver t₁].
 to live
 ‘They want to find someone who is willing to live in this city.’ (ibid.)

The precise extent to which A-bar movement of adjuncts from porous relative clauses is possible, both within a language and across languages, is not entirely clear. There is not a lot of discussion of this issue in the literature, and it seems to me that this perhaps reflects the diversity of adjuncts (one could distinguish between adjuncts that describe manner, time, location, and so on). To summarize some general patterns reported in the literature: in a number of languages, porous relative clauses do not seem to allow overt A-bar movement of at least some adjuncts, including temporal or locative PPs (18) or *wh*-adjuncts like “how” and “why” (19).⁵

- (18) Movement of PP adjunct degraded
- a. *[In the next session of congress], the president wants to find a senator
 [who will support the law t₁].
- b. *[Na semana que vem]₁ o presidente quer encontrar um senador
 in.the week that comes the president wants find a senator
 [que suporte a lei t₁].
 who supports.SBJ the law

⁵Since there is no obvious gap in the relative clause in these examples, the acceptability of these examples is derived by asking native speakers whether the examples can have the same meaning as an example where the adjunct is found in its intended position. To the extent that they cannot, the A-bar movement examples are unacceptable.

- Intended: ‘The president wants to find a senator who will support the law next week.’ (Brazilian Portuguese; Geseel Mendes, p.c.)
- c. *Be-yerufalayim₁ hem hayu hayexidim [ʃe-hiskimu le'exol t₁].
 in-Jerusalem they were the.only.ones that-agreed to.eat
 Intended: ‘They were the only ones who agreed to eat in Jerusalem.’
 (Hebrew; Sichel, 2018, p. 345 ex. 19b)

(19) Movement of *wh*-adjuncts degraded

- a. *How₁/[How quickly]₁ does Mary want to find a programmer [who can solve this problem t₁]?
 b. *Porque₁ o presidente quer encontrar um senador que apoie
 why the president want find a senator who support.SBJ
 a lei t₁]?
 the law
 Intended: ‘What is the reason such that the president wants to find a senator who supports the law for that reason?’ (Brazilian Portuguese; sentence and judgement from Geseel Mendes, p.c.)
 c. *Varför₁ känner du många [som har skrivit böcker t₁]?
 why know you many that have written books
 Intended: ‘What is the reason do you know many who have written books for that reason?’ (Swedish; adapted from Lindahl, 2017, p. 199 ex. 53)

That said, Engdahl (1997) gives an example of acceptable A-bar movement of a manner adjunct from a porous relative clause in Swedish; Lindahl (2017) further points out that similar structures occur naturally. She also provides preliminary data (her chapter 6) showing that under the right circumstances, a variety of adjuncts, such as manner, time, reason, amount adjuncts, can be fronted as topics from porous relative clauses. This contrasts with the analogous English examples (21), which seem degraded. Likewise, in Sichel’s description of Hebrew, A-bar movement of adjuncts in general is reported to be not possible. If these contrasts are robust, they point to even deeper cross-linguistic differences, but more careful work is necessary to determine whether that is the case.

- (20) Acceptable A-bar movement of adjuncts in *Swedish*
- a. Så₁ känner jag ingen [som kan måla t₁]
 like.that know I no.one who can paint
 ‘I don’t know anybody who can paint like that.’ (Engdahl, 1997, p. 57)
 - b. ... [genom Per]₁ är det många [som fått jobb t₁].
 through Per are there many that got job
 ‘... there are many who have gotten jobs through Per.’ (naturally occurring example from Radio Sweden, cited by Lindahl, 2017, p. 175, ex. 15, my translation)
- (21) a. *In that style, I don’t know anyone [who can paint t₁].
 b. ??[Through Per]₁, there are many [who have gotten jobs t₁].

Given the lack of clear generalizations about A-bar movement of adjuncts cross-linguistically, I will not have much to say about the argument/adjunct split for porous relative clauses. For ease of presentation, for the rest of the discussion, I will restrict my discussion and examples to A-bar movement of arguments (specifically, of objects), abstracting away from the argument/adjunct subtleties.⁶

I note that when the porous relative clause in question is one where a non-subject (e.g. object) is relativized, its subject cannot undergo A-bar movement (22). This might receive an independent explanation, as Sichel (2018) also observes.

Assuming a bottom-up syntactic derivation, when such a porous relative clause is formed, there are two phrases that eventually undergo A-bar movement: the subject

⁶I would like to also point out that at least within English, there appear to be more general restrictions on how easily *wh*-adjuncts can move. Cattell (1978), for example, observes that *wh*-adjuncts can move from embedded finite clauses that are complements of a class of attitude verbs which he calls “volunteer stance,” such as *think*, *believe*, *say* and so on. Movement of *wh*-adjuncts from the complement clauses of non-volunteer stance verbs like *deny* or *regret* is more degraded. For scope reasons, I will not discuss Cattell’s proposal (or subsequent proposals, like Hegarty, 1992, Szabolcsi and Zwarts, 1993, or Abrusán, 2014, to give a few examples), but in light of these restrictions on A-bar movement of adjuncts from complement clauses, the fact that porous relative clauses impose restrictions on A-bar movement of adjuncts is thus in a way the rule rather than the exception.

and the non-subject (22c); the subject is structurally higher of the two, but it is the non-subject that first undergoes A-bar movement (to form the relative clause). Movement of the non-subject before the subject is taken to violate a general syntactic principle like the Path Containment Constraint, Relativized Minimality or Shortest Move (Chomsky, 1995; Pesetsky, 1982; Preminger, 2010; Rizzi, 1990).

- (22) a. *This is the criminal₁ who I know some people₂ [t₁ cheated t₂].
 b. *Anaʕim ka-ele₁, ra'iti [maʕehu₂ [ʕe-t₁ moxrim t₂].
 people like-that, saw.I something that sell
 'I saw something that people like that sell.' (Hebrew; Rubovitz-Mann (2000), fn. 2, ex. ib, cited in Sichel, 2018, p. 347, ex. 28b)
 c. [_{RC} ... subject ... non-subject ...]

2.1.3 Characteristics that distinguish porous relative clauses

In this section, I turn my attention to the question of what features distinguish these relative clauses. I start with an overview of examples found in the literature, summarizing existing descriptions about porous relative clauses from various languages. I also point out that the relative clauses have distinctive tense and temporal interpretation properties, an observation that I believe has not been discussed in detail before in the literature. With these descriptive generalizations in hand, I discuss how to characterize these relative clauses, discussing several alternatives.

2.1.3.1 Are porous relative clauses always subject relative clauses?

One often comes across claims that porous relative clauses are necessarily subject relative clauses (Chomsky, 1986; den Dikken, 2007; Engdahl, 1980; Erteschik-Shir, 1973; Kush et al., 2013; Taraldsen, 1982), supported by judgments for non-

subject relative clause examples such as (23).

- (23) *This is a paper₂ that we really need to find someone₁ [that we can intimidate t₁ with t₂]. (judgment by Chung and McCloskey (1983))

However, recent work on Hebrew and Swedish has reported acceptable A-bar movement from non-subject relative clauses. These examples can be sorted into two categories based on the finiteness of the relative clauses. It is not clear to me that the non-finite examples genuinely counter-exemplify the point about subject relative clauses (*pace* Sichel), since classic island effects involving relative clauses (and the lack thereof) are based on examples with finite relative clauses, not non-finite ones. The examples that pose a bigger problem for the claim that porous relative clauses are subject relative clauses are those in (24b), which involve finite relative clauses. Overall, I agree with Lindahl (2017) and Sichel (2018) that porous relative clauses do not always have to be subject relative clauses, although, again, more work is necessary to determine the circumstances in which A-bar movement from non-subject relative clauses becomes acceptable.⁷

- (24) a. Non-finite relative clauses
 (i) [im ha-balfan ha-ze]₂, od lo macati be'aya₁ [PRO ledaber
 with the-linguist the-this yet not found.I problem to.talk
 t₂ aleya₁].
 about.it
 'With this linguist, I haven't yet found a problem to talk about.'
 (Sichel, 2018, p. 347, ex. 29a)

⁷That said, we may draw some preliminary generalizations based on the acceptable Hebrew and Swedish examples: in the non-finite cases (24a) and (24b-i), the subject of the relative clause appears to be bound by the matrix subject, recalling Grano and Lasnik's observations that locality restrictions can be lifted when the subject of a locality domain is a bound pronoun. In (24b-ii), however, the subject is an indefinite pronoun *man*. I have yet to come across an example where the subject of a porous relative clause is a R-expression referring to an individual. As for (23), its low acceptability might partly reflect the fact that it describes an odd scenario: the speakers are describing their obligation to look for someone who is for some reason afraid of a paper.

- (ii) Det₂ har jag inte haft någonting₁ PRO att göra t₁ med t₂.
that have I had not anything to do with
‘That, I have not had anything to do with.’ (adapted from Engdahl, 1997, p. 57, ex. 16a)
- b. Finite relative clauses
 - (i) ... det₂ har jag inte hittat någon ryggsäck₁ [jag inte blir
that have I not found some backpack I not become
t₁ av t₂].
of
‘... I have not found any backpack that I don’t become that [=sweaty] from.’ (Forum thread cited by Lindahl, 2017, p. 96 ex. 95)
 - (ii) [just den här delen av matten]₂ kommer ni inte hitta
precisely the here part of math.DEF will you not find
nått jobb₁ [där₂ man behöver t₂ t₁].
some job where one needs
‘You won’t find any job where you need THIS part of math.’
(Converation cited in ibid. ex. 97)

2.1.3.2 What environments do porous relative clauses appear in?

A closer survey of examples of porous relative clauses shows that four types of constructions make up the bulk of examples. I enumerate and label these constructions below, illustrating them with examples from English.

- (25) a. Non de re
 - (i) The president wants to find a senator [who supports this bill].
 - (ii) That is the bill₁ that the president want to find a senator [who supports t₁].
- b. Predicational
 - (i) Stevie is the only person [who wanted to record the song].
 - (ii) That is the song₁ is Stevie the only person [who wanted to record t₁].
- c. Existential
 - (i) There are many people [who condone violence] in this town.
 - (ii) Violence is something₁ that there are many people [who condone t₁] in this town.
- d. “Evidential existential” (Rubovitz-Mann, 2000)
 - (i) I’ve known a lot of people [who’ve been taken in by this trick].
 - (ii) That’s the trick₁ that I’ve known a lot of people [who’ve been

taken in by t_1].

On a side note, these examples also involve A-bar movement from within a noun phrase; work looking at A-bar movement from PP complements of noun phrases have shown that the definiteness of the noun phrase affects acceptability (Chomsky, 1973; Davies and Dubinsky, 2003; Huang, 2018a; Simonenko, 2015). However, (25) shows that A-bar movement in these cases is not dependent on whether the complex NP is morphosyntactically definite or not; the predicational example shows that definite complex NPs allow A-bar movement.

The labels should be fairly self-explanatory, except for “non de re” and “evidential existential.” I will start with “evidential existential,” which is easier to describe: this construction asserts the existence of individuals described by the complex NP, although it does so indirectly through a verb of perception (“see”) or acquaintance (“know”) (cf. Sichel, 2018).

As for “non de re,” this refers to the fact that NPs in such a setting can in principle receive three readings (Fodor, 1970). I illustrate this ambiguity with (26).

- (26) Mary needs to find [_{NP} a professor who can teach Vata].
- a. De re (specific, transparent to speaker), reporting a situation where Mary said, “I need to find Joe.” The speaker knows that Joe is a professor and Joe can teach Vata.
 - b. De dicto (non-specific, opaque to speaker), reporting a situation where Mary said, “I need to find a professor who can teach Vata — I don’t care who it is.”
 - c. “Third reading” (non-specific, transparent to speaker), reporting a situation where Mary said, “I need to find a professor who can teach a non-European adposition stranding language — I don’t care who it is or what language it is.” Mary actually doesn’t know of any non-European language with this property, nor has any express desire to find a Vata teacher. However, the speaker knows that Vata meets Mary’s criteria,

and reports Mary’s statement as (26).

As mentioned above, Sichel (2018) observes that A-bar movement from a relative clause is blocked if the complex NP receives a *de re* reading (i.e. “presuppositional,” in Sichel’s terms), even if the context makes clear the intended reading. In (27), the NP denotes an actual individual, Joe.

- (27) Context: Jack and Jill overhear Mary speaking on the phone: “I need to find Joe.” Jill says to Jack: “Sounds like Mary needs to find a professor who can teach Vanuatu for the fieldwork class.” Jack knows that Jill has made a mistake; Joe specializes in Vata, not Vanuatu. Jack corrects her: “*It’s not Vanuatu, but VATA₁, that Mary needs to find a professor who can teach t₁].”

A-bar movement becomes acceptable when the speaker (or Mary) does not have any actual professor in mind, e.g. when the NP gets a *de dicto* interpretation.

In fact, this is also the case for the third reading, although to the best of my knowledge, this point has not been explicitly made in the literature. In Schwager, 2009, Kaufman observes that a complex NP that receives the third reading can refer to an individual that does not exist in the actual world. She does so using an example like (28), which is judged to be acceptable even though the indefinite NP *a building with at least 192 floors* is extensionally empty.

- (28) Context: Mary is looking at the Burj Dubai, which has 191 floors and is currently the highest building in the world. Also, no other building has more floors. Mary doesn’t know this. She also doesn’t know how many floors Burj Dubai has. She exclaims, “Wow, I want to buy a building that’s even one floor higher!” John overhears Mary, and reports Mary’s statement as, “Mary wants to buy a building with at least 192 floors.” (adapted from Schwager, 2009, pp. 399–400 exx. 11, 12)

When the complex NP has the third reading, it also allows A-bar movement

from the relative clause. A scenario that facilitates this reading is given in (29), and A-bar movement takes place in (29b).

- (29) Context: Jack and Jill overhear Mary speaking on the phone: “I need to find a professor who can teach a non-European adposition-stranding language, if such a language even exists.” Both Jack and Jill know that such languages exist, although they don’t know of anyone who can teach them.
- a. Jill mistakenly thinks that Vanuatu is such a language, and says to Jack, “Sounds like Mary needs to find a professor [who can teach Vanuatu].”
 - b. Jack corrects her: “It is not Vanuatu, but VATA₁, that Mary needs to find a professor [who can teach t₁].”

2.1.3.3 The semantics of the complex NP?

An interesting idea that has been difficult to pin down concretely is the idea that porous relative clauses or the NPs they modify have a distinctive reading, perhaps best captured by the term “non-presuppositional” (Sichel, 2018); other labels found in the literature include “prominent,” “presentational,” “non-backgrounded” (Erteschik-Shir, 1973; Goldberg, 2006; Lindahl, 2017; Rubovitz-Mann, 2000).

For instance, in the non *de re* and predicational environments, the complex NP itself does not refer to a particular individual, as if the interpretation of the NP does not involve the presupposition of a discourse referent. Likewise, in the predicational environment (25b), *the only person who wanted to record the song* is a description of Stevie but not an expression that refers to Stevie. If it were the latter, then the sentences should be tautological, with a reading like “Stevie is Stevie.”

These two environments alone suggest that the complex NP in question might be distinguished by its semantics: in these cases, it is extensionally empty or non-

referring. However, attractive as this generalization might be, it runs into problems with the existential environments (or even the evidential existential construction, to the extent that these two constructions have similar existential semantics). Although there are proposals that claim that in existential constructions, the post-copular NP (the “pivot”) is semantically not an individual (Keshet, 2008; McNally, 1997; Schwarz, 2012), the fact remains that in affirmative frames, these complex NPs are ultimately associated with some discourse referent.

Setting aside the technical challenges for now, I note that this kind of analysis has a precedent in the literature on subject contact clauses. Following McCawley (1998), Doherty (2000) observes that the environments that permit porous relative clauses also permit what is called “subject contact clauses” (SCCs) in certain non-standard dialects of English. SCCs are bare VP-like constituents that appear immediately on the right of the noun they modify, without a complementizer *that* or a relative pronoun like *who* or *which*. McNally (2009) summarizes very succinctly the distribution of SCCs in “liberal”/“permissive” dialects like Appalachian English and Hiberno-English: they are “licensed in certain modal contexts . . . ; as complements to intensional verbs such as *seek*, where they have a strong or exclusive preference for *de dicto* readings . . . ; in a slightly wider variety of copular sentences . . . , and in the restriction of universally quantified DPs” (p. 175). The SCC examples in (30), taken from Doherty, 2000, bear a strong resemblance to the porous relative clause examples discussed above.⁸

⁸The *it*-cleft case (30f) is interesting because these sentences are compatible with subject contact clauses but are incompatible with A-bar movement from the relative clause 8, at least not for English. However, Engdahl (1997) notes that relativization from cleft structures is acceptable in Swedish.

(30) Subject contact clauses

- a. We want someone [_{SCC} knows John]. (Doherty, 2000, p. 91, ex. 112b, noting that de dicto reading “strongly preferred if not obligatory”)
- b. John is the only one [_{SCC} can do it]. (ibid., p. 91, ex. 110a)
- c. There’s something [_{SCC} keeps upsetting him]. (ibid., p. 72, ex. 40a)
- d. I knew a man [_{SCC} owned twenty restaurants]. (ibid., p. 92, ex. 114)
- e. Everybody [_{SCC} lives in the mountain] has an accent. (ibid., p. 92, ex. 113a)
- f. It was John [_{SCC} actually did it]. (ibid. p. 100, note 37)

Notably, in these dialects, SCCs cannot appear in what Doherty and McNally call “extensional contexts,” where noun associated with the SCC receives an extensional reading (31).

(31) Unacceptable SCC examples

- a. *A man [_{SCC} speaks Irish] walked into the bar. (Doherty, 2000, p. 91, ex. 111a)
- b. ??I gave a lift to this man [_{SCC} knows Mary]. (ibid., ex. 111b)
- c. {??A / *The} man [_{SCC} speaks Irish] was at the party. (ibid., p. 93, ex. 117)

In other words, there is a good case to be made that SCCs in “liberal” dialects and porous relative clauses have the same distribution. Analyzing SCCs as relative clauses, Doherty (1993) suggests that the condition licensing SCCs is semantic: the noun that a SCC modifies is non-referential, “in the pretheoretical sense that it fails to denote an individual in the real world (an extensional individual)” (as cited in Doherty, 2000, p. 91). Echoing this intuition, and adopting the analysis of existential constructions in McNally, 1997, McNally (2009) suggests that SCCs are

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- i. a. *Which crime₁ was it John who committed t₁?
 - b. *That’s the crime₁ that it was John who committed t₁.

I do not have a full explanation of the oddness of these examples, although I suspect that they can be reasonably blamed on information structure of *it*-clefts in English. For example, (29b) might be unacceptable because the sentence tries to focus two elements: *the crime* and *John*.

licensed in nominals that do not “introduce persistent discourse referents into the discourse model” (p. 176, ex. 33).⁹

2.1.3.4 Tense and temporal interpretation in porous relative clauses

It is also possible to look at porous relative clauses through the lens of tense and temporal interpretation, to the extent that tense is dissociable from the referentiality/intensionality facts discussed above. In this section, I present novel facts about English porous relative clauses that distinguish them from regular relative clauses; some of these facts have been observed in the literature on tense (Abusch, 1988; Ogihara, 1996), but the connection to porous relative clauses has not been made explicit. The generalization that emerges is that tense in porous relative clauses is dependent; more specifically, it is always evaluated with respect to the tense in the main clause. This dependence sets porous relative clauses apart from regular relative clauses, and mean that some of them pattern more like complement clauses. I will discuss English facts, as the idiosyncrasies of tense in English are relatively well-studied.

The temporal interpretation facts only become significant after we consider the corresponding datapoints for complement clauses and relative clauses. Conse-

⁹Doherty (2000, p. 92) points out complications for his proposed non-referentiality condition. First, he observes that in contexts like (30d), it is not clear if the complex NP object of *know* is referential, although I believe this objection can be mitigated if one adopts the analysis of evidential existential constructions of Rubovitz-Mann, 2000 (and Sichel, 2018). Second, he observes that if SCCs are licensed in all non-referential contexts, it predicts that they are licensed as long as the NP is used predicatively, which is not the case. Third, as alluded to above, this condition over-generates for more conservative dialects. In conservative dialects, SCCs are found only in existentials, “*have*-existentials” (*I have this friend lives in Dublin*, p. 72 ex. 41a), clefts, and copular sentences with deictic subjects, but not in e.g. intensional contexts.

quently, I will first give an overview of facts related to tense and temporal interpretations in these contexts, using them as baselines (Abusch, 1988; Eng, 1987; Gennari, 2003; Ogihara, 1996; von Stechow and Grønn, 2013a, among many others).

I first consider the interpretations available when a past tense in the matrix clause appears together with a past tense in a complement clause. These environments can receive a “back-shifted” reading: the time denoted by the lower past tense is in the past of the time interval denoted by the higher past tense, which is in turn in the past of the utterance time (32a). In certain circumstances, e.g. if the embedded predicate is stative, the reading obtained can also be a simultaneous one, as if the lower past tense were semantically vacuous (32b); this phenomenon is known as “sequence of tense.”

- (32) Hillary thought [that her husband was president].
- a. OK: Hillary thought at time *t*, “My husband was previously president.” (“backshifted”)
 - b. OK: Hillary thought at time *t*, “My husband is now president.” (“simultaneous”)

Importantly, the lower past tense cannot denote a time interval that is in the past of utterance time but in the future of the higher past tense (i.e. a “later than matrix” reading) (33). Importantly, in both cases, the embedded tense lacks a later-than-matrix reading.¹⁰

- (33) Hillary thought [that her husband was president].
- a. Not OK: Hillary thought in 1993, “My husband will be president in 1998.” (“later than matrix”)

¹⁰The only exception that I am aware of is reported by Klecha (2016): for a set of verbs that have a future orientation, like *hope* or *pray*, an embedded past tense c-commanded by a higher past tense can get a later-than-matrix reading.

The tense literature has observed that tense in relative clauses generally runs afoul of this generalization. The tense in a relative clause can be independent of the tense in the main clause, allowing a “later than matrix” reading. For example, in (34), the time of marriage is free to precede or follow the time of the husband becoming president.

- (34) Hillary married a man [who became president].
- a. OK: Time of marriage precedes time of becoming president. (Hillary married someone, and that person later became president.)
 - b. OK: Time of becoming president precedes time of marriage. (For example, Hillary married a former president.)

When a past tense c-commands a present tense in a complement clause, a “double access” reading becomes available. In (35), the time interval of Michelle’s husband being president must contain both the time of Michelle’s speech and the time of utterance.

- (35) Michelle said [that her husband is president].
- a. OK: One reports in 2015 that Michelle said in 2014, “My husband is president.” (Barack Obama served as US president from 2008 to 2016.) (“double access” reading)
 - b. Not OK: One reports in 2019 that Michelle said in 2014, “My husband is president.” (relative present tense)

Having discussed temporal interpretation for complement clauses and regular relative clauses, I now review temporal interpretation for porous relative clauses, contrasting them with regular relative clauses. Essentially, in contrast to regular relative clauses, the time interval denoted must be related to the time interval denoted by the main clause’s tense, in ways that recall the restrictions that apply to complement clauses.

First, when both tenses are in the past tense, there is no “later than matrix” reading available. The time described by the embedded predicate can only be simultaneous with the main clause time, if not backshifted (Abusch, 1988; Ogihara, 1996). That said, to be clear, a later than matrix reading is available for (36a) if the complex NP *a senator who voted for this bill* receives a de re reading (ibid.).

- (36) a. The president was looking for a senator [who voted for this bill].
 (When a de dicto reading is intended, this sentence cannot describe a scenario where the president was looking for any senator who would vote for the bill in the relative future.)
- b. At the start of the language courses, Stevie was the only person [who studied German].
 (Intended but impossible scenario: a group of military officers were assigned to learn various languages. Stevie was the only one assigned to learn German, most officers were assigned to learn Spanish. The commanding officer uttered the above sentence after all the officers became fluent in their assigned languages. The matrix past tense refers to a time interval coinciding with the start of the language courses, while the embedded past tense describes a later time interval that is in the past of the utterance time.)
- c. At the start of the language courses, there were many people [who studied Spanish].
 (Impossible for the scenario above)
- d. At the start of the language courses, I knew a lot of people [who studied Spanish].
 (Impossible for the scenario above)

Second, a present tense in the relative clause generally cannot co-exist with a past tense in the main clause (37). (A main clause present tense is compatible with either a present tense or a past tense in the relative clause.) The one exception that I am aware of is for the non de re environment (37a), which must get a double access reading: the president had a desire to find a senator who supported the bill at the time of search through the time of utterance (Abusch, 1988; Ogihara, 1996). In this respect, the non de re construction resembles complement clauses, possibly because

the main predicate in this construction is also a predicate with modal semantics, e.g. *want* or *look for*.

- (37) a. The president was looking for a senator [who supports this bill].
(Cannot describe a scenario where the president was looking for a senator who did not support the bill at the time of search but would support the bill later at a time that coincides with the time of utterance.)
- b. *Last Monday, Stevie was the only person (in the group) [who speaks German].
(Intended but impossible scenario: Stevie is one of several native German speakers in a group. Stevie arrived last Monday, while the other German speakers arrived only on Tuesday.)
- c. *In this school last year, there were many students [who speak Spanish].
(Intended but impossible scenario: last year, there were many native speakers of Spanish enrolled in this school. This year, after Spanish language classes were canceled, almost all these students transferred out of the school. Since these speakers are still students and still Spanish speakers, the present tense is in the relative clause arguably justified.)
- d. *Last year, I knew a lot of students [who speak Spanish].
(Impossible for the scenario above)

As for the other three constructions, the restrictions on main clause past tense and present tense in the relative clause for the constructions have a parallel in specificational copular constructions (38), where the phenomenon is known as “tense harmony” (Akmajian, 1970; Higgins, 1973; Romero, 2004, 2005; Sharvit, 2003).

- (38) Tense harmony in specificational copular constructions
- a. [What John was] was/is a fool.
- b. [What John is] *was/is a fool.

2.1.3.5 Formal approaches to tense phenomena

In this section, I review two distinct approaches for modeling tense phenomena in complement clauses and relative clauses. This review sets the stage for discussing how to model the tense facts for porous relative clauses.

I first discuss a Priorian analysis of tense, in which tenses are relative. In this analysis, a tense denotes a time interval whose interpretation is determined with respect to a higher (c-commanding) tense, if there is one. If there is no higher tense, a tense is interpreted relative to utterance time. My discussion will focus on Ogihara, 1996, an influential proposal that covers a wide range of the facts.

In this analysis, a past tense that c-commands another past tense always yields a backshifted reading. To account for the simultaneous reading, some kind of Sequence of Tense rule is necessary. Ogihara suggests that when a tense c-commands another tense of the same type, the lower tense can delete; the resulting tenseless embedded clause is then interpreted as being in the relative present of (i.e. simultaneous with) the higher tense.

This rule alone cannot explain why relative clauses allow for a later than matrix reading. Ogihara derives this reading associated with relative clauses by positing that (i) NPs move at LF from their surface position to a much higher position, e.g. for quantificational purposes (such as QR); (ii) temporal interpretations are assigned based on structural configurations at LF, after NP movement. In (39a), as a result of LF movement, neither past tense morpheme c-commands the other. Both $PAST_a$ and $PAST_b$ are interpreted with respect to utterance time, and so the time intervals they denote are in the past of utterance time, but not necessarily with respect to each other. In contrast, complement clauses are not hypothesized to move. Therefore, in (32), $PAST_b$, which is in the complement clause, is necessarily interpreted with reference to $PAST_a$.

- (39) a. LF of (34): $[[\text{a man who PAST}_a \text{ become president}]_1 [\text{Hillary PAST}_b \text{ marry } t_1]]$.
 b. LF of (32): Hillary PAST_a think [that her husband PAST_b be president].

An alternative view holds that tenses are absolute, and therefore are not interpreted relative to other tense morphemes. This analysis easily accounts for the temporal interpretations found for regular relative clause, but overgenerates for embedded tense in complement clauses. All else being equal, it incorrectly predicts, for example, that *Melania said Donald became president* (“Melania PAST say [Donald PAST become president]”) can be used to report in 2019 a later-than-matrix scenario where Melania said in 2014, “Donald will become president in 2017.” Consequently, one requires additional stipulations to derive the temporal interpretation facts for complement clauses. For example, one could imagine stipulating that tenses in complement clauses are obligatorily bound by some higher tense (for a similar obligatory binding analysis, although motivated for very different reasons, see Kusumoto, 2005).

This absolute analysis of tense is in particularly compatible with a view in which tenses are pronoun-like (e.g. Kratzer, 1998; Partee, 1974). In this analysis, a past tense can refer to a particular time interval that is prior to utterance time, just as a pronoun, like *she*, refers to a particular (human) individual that is female. Consider (40), which Partee uses to argue that the operator approach does not generate the right interpretation, which can be paraphrased as “At a *particular* past time interval, I did not turn off the stove.”

- (40) I didn’t turn off the stove! (said shortly after leaving the house)

- a. Priorian approach in which tenses are operators on propositions
 - (i) PAST [\neg [I turn off the stove]] (too weak: “There is a past time interval in which I did not turn off the stove”)
 - (ii) \neg [PAST [I turn off the stove]] (too strong: “There is no past time interval in which I turned off the stove”)

Both approaches do not naturally accommodate double access readings. Within a relative tense approach, this reading is usually accounted for by assuming that the English present tense is exceptional in being a relative tense that also has an indexical component. As a result, the time interval it denotes has to be interpreted with respect to some higher tense, while also containing the utterance time. An absolute tense analysis models the indexical element much more easily, but requires further stipulation to explain why the present tense is interpreted relative to a higher past tense. (See Gennari, 2003 for a pragmatic analysis of this phenomenon, and Altshuler et al., 2015 for discussion of the circumstances that give rise to the double access reading.)

Conventional analyses of sequence of tense phenomena are also silent on tense harmony effects. Recent proposals on tense harmony by Sharvit (2003) and Romero (2004) derive these effects by assuming that the present tense in this construction is both indexical and relative to the tense in the main clause. In particular, they stipulate that the tense in the embedded clause is such that the time interval denoted must contain the utterance time and be contained by the time interval denoted by the main clause’s tense. As a result, a past tense in the main clause cannot combine with a present tense in the relative clause, as doing so would produce a contradiction: the time denoted by the present tense would overlap with the utterance time and

yet be contained by some past time interval.

2.1.4 Possible analyses of porous relative clauses

To summarize, compared to regular relative clauses, porous relative clauses are subject to more restrictions on what kinds of tense may appear in them and what kind of interpretations they receive. More abstractly, we can think of tense in relative clauses as being independent, and therefore free of restrictions; in contrast, tense in porous relative clauses is dependent. This generalization raises questions about how this tense dependency is represented and how it might be related to A-bar movement.

As I see it, a complete answer to these questions would require a full theory of tense, including a theory of double access and a theory of tense harmony. Existing analyses of both phenomena invoke the idea that an embedded present tense stands in some relation with a structurally higher tense, but implement this idea in ways that are incompatible with each other. Specifically, as mentioned, conventional analyses of double access facts need to ensure that an embedded present tense denotes a time interval that *contains* the time interval denoted by the main clause's tense, while Sharvit's and Romero's accounts of tense harmony require that an embedded present tense denote a time interval that *is contained* by the time interval denoted by the main clause's tense. (Romero (2004) concedes that her analysis does not account for double access (p. 287).)

For the following discussion, I will abstract away from these technical issues

surrounding the semantic representation of tense. Assuming more generally that there is some tense dependency involved, I will instead focus on the question of whether it has a syntactic correlate, so that we may connect it more precisely with A-bar movement. As I see it, there are two distinct approaches of giving a syntactic analysis of this phenomenon, although other analyses, perhaps more satisfactory ones, could also be possible. For concreteness, I present both approaches below.

2.1.4.1 A movement-based analysis

The first approach is a movement-based analysis. In this proposal, complex NPs modified by regular relative clauses (possessing “independent,” non-anaphoric tense) are presuppositional and therefore move (covertly) to a position higher than the main clause tense projection, as envisioned, for instance, in a classical theory of QR (*pace* Sichel, who suggests that this movement might be a kind of differential object marking and not for quantification reasons; see her fn. 20, p. 355). As mentioned above, as a result of this movement, the tense in the complex NP is no longer c-commanded by the tense in the main clause. In a relative tense framework, this structural configuration also means that the tense in the complex NP is not interpreted relative to the tense in the main clause (Abusch, 1988; Ogiwara, 1996; von Stechow and Grønn, 2013a; Stowell, 1993), thus deriving tense independence (which manifests itself in the form of later-than-matrix readings, for example).

In contrast, an NP that does not move remains in situ. A tense in a relative clause modifying this NP is thus c-commanded by the main clause tense; the em-

bedded clause, and therefore the lower tense, is interpreted relative to the higher tense. This configuration yields tense dependence in the form of simultaneous and backshifted readings or tense harmony effects. Additional assumptions, such as the assumption that an embedded present tense can undergo *res* movement, can derive the availability of double access readings (but see Gennari, 2003 for an account based on pragmatics).¹¹

This analysis aligns rather neatly with the movement-based analysis proposed by Sichel, 2018 (pp. 355ff.) to account for restrictions on A-bar movement from relative clauses in Hebrew. In Sichel’s proposal, the covert movement operation causes these NPs to freeze (Uriagereka, 1999; Wexler and Culicover, 1980, among many others), blocking A-bar movement.¹² In contrast, the complex NPs of porous relative clauses do not freeze, since they do not move.

While the movement-based account can help explain tense dependence and restrictions on A-bar movement, it undergenerates. Specifically, it predicts that porous relative clauses modifying subjects should be incompatible with A-bar movement, if one assumes (standardly) the VP-internal subject hypothesis, in which NPs occupying a subject position move to that position. This prediction is not borne out: in Mandarin Chinese, A-bar movement from porous relative clauses modifying subjects is attested (41). (For an argument that subjects move from a VP-internal position

¹¹That said, these proposals are silent about tense harmony in specificational copular constructions; technically, because the relative clause modifies the subject, the tense in the relative clause does not c-command the matrix tense. Nor does the matrix tense c-command the relative clause. One might thus incorrectly expect the absence of tense harmony effects.

¹²An important assumption is that covert movement of NPs must precede overt A-bar movement. While this ordering of operations is not possible under a Y-model of syntax, Sichel notes that there are other models of syntax that allow it. Jeffrey Lidz (p.c.) points out that it is also possible that the operation that moves NPs is overt but string vacuous.

in Mandarin Chinese, see Huang (1993).)

- (41) [Zhe-ben shu]₁ wo renwei [_{Subject} [du-guo t₁ de] ren] bu duo.
 this-CL book I think read-EXP MOD person not many
 ‘This book, I think there are not many people who have read it.’ (Mandarin Chinese; Xu and Langendoen, 1985 p. 14 ex. 61a) (= (5a))

2.1.4.2 A defective tense, phase-based analysis

An alternative analysis that avoids the undergeneration problem is a phase-based analysis, on the standard assumption that (finite) clauses (CPs) are phases, which are locality domains (Chomsky, 2000, 2001). I will begin this discussion with how a phase-based analysis can explain classic restrictions on A-bar movement from relative clauses (as described by, e.g. Ross (1967)). First, since relative clauses are finite clauses, it is reasonable to think that they are also phases. A-bar movement from relative clauses is effectively ruled out by the Phase Impenetrability Condition (PIC), which (essentially) requires A-bar movement from phases to proceed through the left edge of each phase Chomsky (2000, 2001). A standard assumption for many languages, including English, holds that there is only one position on the left edge for successive cyclic movement; if this position is occupied, e.g. by a relative pronoun or some operator, other phrases cannot move out of the phase without violating the PIC (42). This particular configuration alone can explain why relative clauses are islands for A-bar movement, since relative clauses are formed by A-bar movement of either a relative pronoun or phonologically-null operator to the left edge of the clause.

(42) * $wh_1 \dots [_{Phase} wh_2 \dots t_2 \dots t_1 \dots]$

I now address how the PIC might be voided in porous relative clauses. In a recent proposal, Grano and Lasnik (2018) (also Barros and Frank, 2017, Huang, 2018a) observe that some dependencies cannot cross the boundary of a finite clause, unless the clause has a bound pronoun subject. Assuming that clauses are phases and that these dependencies cannot cross a phase boundary, they suggest that bound pronouns can neutralize the phase. More specifically, they argue that bound pronouns can be syntactically defective and fail to value features on T; unvalued features on T then neutralize the CP phase. (Barros and Frank, 2017 and Huang, 2018a offer different implementations of this effect, but share the core intuition that bound pronouns (among others) are syntactically distinguished and are responsible for this neutralization property.

- (43) *Comparative deletion* (Grano and Lasnik, 2018:472 exx. 9-11) (Struck-out material is silent but interpreted.)
- a. More teachers gave the students pencils than ~~gave the students~~ pens.
 - b. *More teachers claimed that the principal gave the students pencils than ~~claimed [that the principal gave the students pens]~~.
 - c. ?More teachers₁ claimed that they₁ gave the students pencils than ~~claimed [that they₁ gave the students pens]~~.
- (44) *Too/enough construction* (ibid.)
- a. This book is too valuable for James to lend to Bill.
 - b. *This book is too valuable for James to claim [that Mark lent to Bill].
 - c. ?This book is too valuable for James₁ to claim [that he₁ lent to Bill].

This phase neutralization proposal provides another way to explain why porous relative clauses exceptionally allow A-bar movement in languages like English. As pointed out previously, tense in porous relative clauses is dependent. Suppose that

this semantic property is reflected syntactically as an unvalued temporal feature on T. Perhaps because this feature is temporal in nature, it can only be valued by a higher tense morpheme and not by any syntactic object in the same clause. Borrowing the intuition in Grano and Lasnik’s proposal, this unvalued feature neutralizes the CP phase. Consequently, since the relative clause is no longer a phase, A-bar movement from porous relative clauses is no longer subject to the PIC. In contrast, independent tenses have valued temporal features, and therefore do not have the same neutralization effect. Consequently, the regular relative clauses in which independent tense appears are phases, and A-bar movement from these relative clauses violate the PIC.¹³

This adaptation also builds on a number of parallels between dependent tense and bound pronoun subjects. First, by definition, their interpretation depends on other elements outside of the clause they appear in. Second, structurally speaking, they occupy positions in the same region in the left periphery of a clause; subjects are conventionally analyzed as occupying the specifier position of T(ense)P. Further, there is a tradition of treating tenses as being pronominal, as reviewed earlier (Kratzer, 1998; Partee, 1974, for example).

¹³One question that arises is whether the presence of a bound pronoun subject in a nonporous relative clause would make it porous. A plausible-sounding example is not easy to construct; (45) is one somewhat plausible example, and A-bar movement from the relative clause is not acceptable.

(45) a. Hillary₁ married a man₂ [who she₁ later caught t₂ committing adultery].
b. *?What crime₃ did Hillary marry a man [who she later caught committing t₃]?
c. *?That’s the crime₃ that Hillary married a man [who she later caught committing t₃].

It’s not immediately clear that the A-bar movement examples are bad because of this particular structural configuration. These sentences seem to be unnecessarily complicated. For example, both the *wh*-question and relativization examples seem to be about identifying the crime that Hillary’s husband committed. If these are indeed the discourse goals of uttering these sentences, then it would be far simpler and more efficient to just say *What crime did Hillary catch her husband committing?* or *That’s the crime that Hillary caught her husband committing.*

In this defective tense analysis, the porousness of a relative clause depends (in part) on the properties of T, not on whether the relative clause is part of a NP that moves. In principle, this analysis is compatible with A-bar movement from porous relative clauses that modify subjects, as observed in Mandarin Chinese. Of course, for this analysis to account for porous relative clauses in Mandarin Chinese in the first place, one would need to assume the presence of tense projections and anaphoric tense in Chinese, which does not mark tense or finiteness morphologically.¹⁴ The representation of tense in Chinese is a topic that lies beyond the scope of this dissertation, but for proposals that assume the existence of tense(-like) projections or tense morphemes in Mandarin Chinese, see for instance Grano, 2017; Huang, 1982; Li, 1990; Lin, 2015; Sybesma, 2007; N. Huang, 2015, 2018b; Chen, 2017).

All else being equal, this approach would overgenerate for a language like English (46). To avoid over-generation, one would need to assume that unlike Mandarin Chinese, English imposes (more) restrictions on A-bar movement from subjects.

(46) *That's the book₁ that I think [people [who read t₁]] are many in number.

2.1.4.3 Further complications

I previously observed that the movement-based analysis undergenerates. Here, I point out that it might over-generate: all else being equal, it predicts that all NP adjuncts that remain structurally low at LF are compatible with A-bar movement. This is not the case: PP adjuncts and bare participial adjuncts (often descriptively

¹⁴If one assumes that there are no tense projections in Mandarin Chinese, then one might predict that Mandarin Chinese relative clauses are always porous. This is not a desirable prediction, since there are relative clauses that are incompatible with A-bar movement (9) (Zhang, 2002).

labeled as “reduced relative clauses”) of NPs are not compatible with A-bar movement (47), even if the complex NPs they modify appear in environments that should allow A-bar movement, e.g. a non de re construction (47). (As far as I can tell, Sichel (2018) does not discuss A-bar movement from these kinds of adjuncts.) If one wishes to capture the restrictions in using the same freezing mechanism, one must augment the analysis by assuming that these adjuncts obligatorily freeze, even if the NPs they modify do not move.

- (47)
- a. PP adjunct of non de re NP
 - (i) Mary wanted to interview someone [with a special skill].
 - (ii) *What₁/Which skill₁ did Mary want to find someone [with t₁]?
 - (iii) *That’s the kind of skill₁ that Mary wanted to interview someone [with t₁].
 - b. Bare present participle adjunct of non de re NP
 - (i) Mary wanted to interview someone [learning a musical instrument].
 - (ii) *What₁/Which instrument₁ did Mary want to interview someone [learning t₁]?
 - (iii) *That’s the kind of instrument₁ that Mary wanted to interview someone [learning t₁].
 - c. Bare past participle adjunct of non de re NP
 - (i) Mary wanted to interview someone [trained in karate].
 - (ii) *What₁/Which martial arts₁ did Mary want to find a man [trained in t₁]?
 - (iii) *That’s the martial art₁ that Mary wanted to find a man [trained in t₁].
 - d. Bare adjectival predicates
 - (i) Mary wanted to interview someone [familiar with a musical instrument].
 - (ii) *What₁/Which instrument₁ did Mary want to interview someone [familiar with t₁]?
 - (iii) *That’s the kind of instrument₁ that Mary wanted to interview someone [familiar with t₁].

To account for these restrictions, the defective tense analysis requires the additional assumptions that these structures are always phases, (ii) the absence of overt

tense morphology mean that they lack defective tense, and that (iii) the presence of defective tense (as opposed to, for example, the mere absence of independent tense) is necessary to neutralize a phase.

2.1.5 Interim summary

In this section, I discussed several properties of porous relative clauses, drawing together existing observations in the literature and novel observations. While there are still some gaps in our understanding of the syntax of these relative clauses, I pointed out that there are a number of cross-linguistic generalizations: unlike regular relative clauses, in certain A-bar movement constructions, they allow the movement of arguments, although they appear to still impose (some) restrictions on movement of adjuncts. Syntactically, porous relative clauses tend to be subject relative clauses, although acceptable A-bar movement from finite non-subject relative clauses has been observed at least in languages like Swedish. Semantically, certain NPs modified by porous relative clauses have distinct referential properties; a case study of English porous relative clauses shows that these relative clauses also have distinctive tense properties.

2.2 A learning problem

The cross-linguistic survey by Cinque (2010) found that not all languages allow A-bar movement from porous relative clauses. This discovery raises an interesting question about language acquisition: how might a learner determine whether he/she

is learning a language like English, which allows A-bar movement from porous relative clauses, or a language like German, which does not?

Before addressing this issue in detail, I wish to address a question about the extent to which A-bar movement from porous relative clauses is actually acceptable / well-formed. This question is important in light of recent formal experimental results reported by Kush et al. (2013). While A-bar movement from porous relative clauses is usually characterized as being acceptable (examples in Chung and McCloskey, 1983 and McCawley, 1998 are left unmarked), Kush et al. find that in English, A-bar movement from porous relative clauses in existential (48a) and evidential existential environments (48b) is only of “marginal” acceptability (p. 254), even though it is still relatively more acceptable than A-bar movement from regular relative clauses (48c). (I evaluate Kush et al.’s proposal in Chapter 5. In the same chapter (Section 5.3), I report results from an acceptability judgment experiment about A-bar movement from relative clauses in a non de re environment and about A-bar movement from another type of clausal adjunct whose relevance will shortly become clear — purposive clauses.)

- (48) Example stimuli from Kush et al., 2013, experiment 3 (pp. 251–253)
- a. That was the bill that there were many senators [who supported t_1] in the congress.
 - b. That was the bill that he knew many senators [who supported t_1] in the congress.
 - c. That was the bill that he met many senators [who supported t_1] in the congress.

One implication of this finding, then, is that existing reports might have overstated the acceptability of A-bar movement from porous relative clauses in English.

In fact, Kush et al. (2013) propose that the low absolute acceptability indicates that A-bar movement from porous relative clauses is ill-formed (ungrammatical). However, compared to other ill-formed structures, A-bar movement from porous relative clauses is more acceptable because the parser is able to successfully repair the ill-formed structure.

This is certainly a coherent argument and Kush et al. (2013) ought to be recognized for contributing novel judgment data to the literature. That said, I would like to suggest that Kush et al.'s judgment data do not necessarily mean that these structures are ill-formed, especially in light of the fact that there is no widely accepted theory that can relate acceptability judgments to grammaticality.

Further, as noted above, Cinque (2010) reports that languages vary in whether A-bar movement from porous relative clauses is acceptable to their speakers, although Cinque's sample sizes are much smaller than Kush et al.'s. To the extent that the difference reported Cinque are robust, it is straightforward to account for the difference by treating it as a grammatical phenomenon, reflecting different criteria for well-formedness (grammaticality).

The alternative is to posit cross-linguistic differences in how speakers of different languages map ill-formedness to acceptability. Kush et al. (2013) propose that English speakers are able to repair ill-formed A-bar movement from porous relative clauses. Taking this argument seriously, one might consider a generalized version of this proposal: perhaps English (Mandarin Chinese, etc.) speakers are more successful at repairing ill-formed A-bar movement from porous relative clauses than German speakers are, although it is not immediately clear why such an asymmetry should

exist. Similarly, since, by hypothesis, English (and Mandarin Chinese) speakers can repair some instances of A-bar movement from relative clauses, it is not immediately clear why they do not easily repair *all* instances of A-bar movement from relative clauses. I am not aware of any such proposal on the market; in Chapter 5, I show that A-bar movement from porous relative clauses in Mandarin Chinese and regular relative clauses in English poses problems for Kush et al.’s repair account.

One necessary assumption in this line of reasoning is that the judgments and contrasts reported in the literature are valid. Although it is not feasible for the scope of this dissertation, a formal survey *à la* Kush et al., 2013 for languages like Hebrew, Mandarin Chinese, German, Bulgarian, Polish, etc. to confirm the observations of Cinque and others would go some way to determine whether this particular assumption is valid.

A consideration of the structural properties of relative clauses also provides some reason for why A-bar movement from porous relative clauses might be less acceptable in absolute terms, even if they are structurally well-formed. Recall the assumption made above that relative clauses are formed by A-bar movement of either a relative pronoun or phonologically null operator to the left edge of a clause. A-bar movement from a relative clause, whether it is porous or not, involves the syntactic configuration schematized in (49), where wh_1 stands for the syntactic object that moves from the relative clause, and wh_2 the relative pronoun or phonologically-null operator that is coindexed with the head of the relative clause.

$$(49) \quad \dots wh_1 \dots [_{RC} wh_2 \dots t_2 \dots t_1]$$

I suggested that A-bar movement is possible because the complex NP is not frozen (following in part Sichel, 2018) or because defective tense neutralizes the phase. Even if the structure is well-formed in this regard, it is not necessarily easy to parse. To the extent that it is difficult to parse, we predict low acceptability. More specifically, immediately after processing wh_2 , the parser has to look for not one, but two potential gap sites in the relative clause, one corresponding to wh_1 and the other for wh_2 . Maintaining a distinction between these two A-bar dependencies might be difficult for the parser, perhaps due to similarity-based interference (Hofmeister and Sag, 2010; Kluender, 2004; Lewis, 1996). In addition, there are other proposals claiming that the processing of finiteness and of A-bar movement from embedded clauses might interact in ways that reduce acceptability (e.g. Hofmeister, 2007; Kluender, 2004). I return to these issues in more detail in Chapter 5 (Section 5.3).

Having argued that there is reason to think that the phenomenon is a grammatical one, I now return to the learning question: how learners of English might learn that their language allows A-bar movement from porous relative clauses, and how learners of languages like German learn that their language does not.

In a sense, there are really two closely-related questions being asked here. In Section 2.1.3.4, I argued that a key characteristic that distinguishes porous relative clauses from non-porous relative clauses is tense dependence. The first question, then, is how speakers identify tense dependence in a relative clause, so that they can draw conclusions about whether the NP modified by the relative clause has moved (or not) or whether the tense in the relative clause is defective. This is, of

course, not a trivial question, as tense dependence involves identifying a particular relation between tenses in a sentence. Even supposing that learners have innate knowledge of temporal semantics and thus knowledge of temporal relations, it is not necessarily easy for them to determine what temporal relations are encoded in sentences in general and how they are encoded, since the temporal relations intended by speakers have to be determined from context (see similar remarks by Wagner (1998) on this problem, which she refers to as the “mapping problem”).

That said, building off observations in the preceding discussion, it seems to me that there could also be observable morphosyntactic cues that learners can make use of. For example, in a language like English, one might expect there to be distributional differences between matrix and embedded tenses between porous relative clauses and non-porous relative clauses. More specifically, in a number of constructions (e.g. existential constructions), tense dependence means that a present tense in a porous relative clause cannot co-occur with a past tense in the main clause, while there is no such restriction on regular relative clauses. These restrictions could then lead to differences in how frequently certain tense combinations appear in certain constructions. Assuming that learners are able to track these frequencies, they might be able to conclude that in certain constructions, there are tense restrictions — and hence dependencies — that exist between the relative clause and the main clause.

Of course, for a language like Mandarin Chinese, which does not morphologically mark tense, speakers would have to resort to alternative distributional evidence. Here, it seems plausible that learners could draw upon the distribution of various

overt temporal markers, such as the future marker *jiang*, modals, or aspect markers (Huang, 1989; Li, 1990, N. Huang, 2015; Huang et al., 2018).

The second question is a question about evidence for A-bar movement: what evidence do speakers have that their languages allow or disallow A-bar movement from porous relative clauses? Below, I consider the following learning scenarios.

In the first scenario, learners of languages like English get very direct evidence about the acceptability of A-bar movement from porous relative clauses: they actually get to observe that A-bar movement from these relative clauses occurs frequently in their linguistic experience. In contrast, their German counterparts do not. The exposure to A-bar movement from porous relative clauses, or lack thereof, thus allows English learners to conclude that their language has a grammar that allows A-bar movement from porous relative clauses. I will describe prior work that shows that this very direct form of learning might be possible for a language like Danish. However, I also report results from corpus studies showing that this scenario is unlikely to be feasible for a language like English or Mandarin Chinese.

The second and third scenarios flip the logic around, by considering the hypothesis that learners of languages like German receive clear evidence that A-bar movement from porous relative clauses is actually unacceptable. In the second scenario, these learners are explicitly told that such sentences are unacceptable. In the third, learners are not explicitly told about the acceptability of these structures. Instead, they observe some superficially-unrelated cue that leads them to the conclusion that the grammar of their language does not allow A-bar movement from porous relative clauses. I provide arguments against both scenarios.

The upshot of this discussion is that learners of English or Mandarin Chinese cannot count on their linguistic experience providing reliable evidence that A-bar movement from porous relative clauses is possible. Further, it is unlikely that these learners begin with a grammar that allows A-bar movement from porous relative clauses (or perhaps more accurately, A-bar movement from relative clauses with dependent tense). This leads us to the conclusion that learners of English and Mandarin must rely on a more indirect source of evidence. I argue that this evidence takes the form of A-bar movement from non-finite purposive clauses.

2.2.1 Learning an English-like grammar with direct positive evidence

There is reason to think that learners of Scandinavian languages might have reliable access to A-bar movement from porous relative clauses in their linguistic experience. Looking at three corpora consisting of a total of 18 hours of Danish adult speech, Jensen (2002) found 10 tokens of A-bar movement from an relative clause or relative clause-like constituent (as reported in Lindahl, 2017, p. 34). Assuming that speakers are exposed to about 5,200 hours of linguistic input a year (using estimates for child learners provided by Hart and Risley, 2003), this frequency works out to about 2,900 tokens per year. In other words, at least older speakers of Danish get to observe A-bar movement from porous relative clauses in naturally occurring contexts. If similar frequencies are available in child-ambient Danish speech, then Danish-learning children might be able to acquire A-bar movement from porous relative clauses at a relatively young age from direct positive evidence. Confirming

this point will require further research, as there is no analysis of child-ambient Danish speech that I am aware of, nor is there any study on the developmental trajectory of speakers' knowledge of A-bar movement from porous relative clauses, whether within a language or across languages.

But in any event, there is no a priori reason to expect that what is true for Danish will automatically hold for other languages, especially for such a syntactically complex construction. In a study of 101,838 tokens of English child-directed speech from the CHILDES database (MacWhinney, 2000), and 98,819 tokens of adult-directed speech and text from the Penn Treebank (Marcus et al., 1999), Pearl and Sprouse (2013b) reported no instance of A-bar movement from complex NPs with finite clauses, which they define as NPs dominating CPs.¹⁵ This fact suggests the hypothesis that A-bar movement from relative clauses appear at different rates across languages, and therefore the direct evidence is not always available for either child learners (whose experience is approximated by the CHIDLES dataset) or for older learners (whose experience is approximated by the Penn Treebank data).

2.2.2 Corpus study 1: How frequent is A-bar movement from relative clauses in English and Mandarin Chinese?

To test the hypothesis that linguistic experience about A-bar movement from relative clauses vary across languages, I re-ran Pearl and Sprouse's analysis on English and Mandarin Chinese corpora, making the same assumption that they are

¹⁵This fact about English is itself interesting, since English and Danish are genetically and historically related and typologically quite similar, and therefore the null hypothesis is that the distribution of constructions should be largely similar in both languages.

representative of linguistic experience. These languages were chosen partly because they are languages where large parsed datasets are available.

2.2.2.1 Data and methods

Following Pearl and Sprouse (2013b), I wrote a Python script using the Natural Language Toolkit package (Bird et al., 2009) to extract overt A-bar dependencies, including relative clauses and *wh*-questions (root and embedded).

For English, I used the entire Penn Treebank dataset, consisting of 251,255 tokens (more than twice the size of Pearl and Sprouse’s Penn Treebank data), excluding the 572 relatively formulaic tokens of the ATIS corpus, which consists of queries and replies about airline travel. Note that the Penn Treebank data consists of both written (Brown and Wall Street Journal corpora) and spoken (Switchboard) registers. For Mandarin Chinese, I used the Chinese Treebank (Xue et al., 2010), a collection of 51,477 sentences of more formal registers of Mandarin, e.g. newswires, broadcasts, blogs.¹⁶ Since Mandarin Chinese is a *wh*-in-situ language and the Chinese Treebank does not contain information on covert A-bar movement, the script effectively extracted instances of relativization and (to a lesser degree) topicalization from the Chinese Treebank.

Both treebanks are well-suited for testing this hypothesis. First, the tokens found in these treebanks are syntactically more complex, and hence more likely to contain relative clauses in the first place. Second, in both treebanks, constituents

¹⁶I would like to thank Scott Kaplowitz for research assistance, and to Naomi Feldman and Philip Resnik for giving me access to the Penn Treebank and the Chinese Treebank.

are labeled and traces are clearly marked. Consequently, the script was able to straightforwardly identify all the constituents that dominated the trace but not the head of the A-bar dependency, i.e. what Pearl and Sprouse call “container nodes,” or more intuitively, the path of A-bar movement.

2.2.2.2 Results

The algorithm extracted a total of 43,999 A-bar dependencies from a dataset of 251,255 tokens. Replicating Pearl and Sprouse’s findings for English, I found no A-bar movement path through a complex NP with a finite subordinate clause, which in Penn Treebank terms would be an NP that immediately dominates a finite SBAR.¹⁷

For the Chinese Treebank data, the algorithm extracted 24,992 A-bar dependencies. As was the case for the Penn Treebank, I found no dependency in the Chinese Treebank that crossed into a complex NP with a subordinate clause. Because the Chinese Treebank data impressionistically seems to have more manual coding errors, I also undertook a check of a random 20% sample of these dependencies (5,067 sentences). Again, I found no dependency crossing into a complex NP.

¹⁷I note there are actually a handful of instances where A-bar movement takes place from a non-finite subordinate clause that might be analyzed as subordinate to an NP. However, as I note in section 3.3, they might be plausibly reanalyzed as VP adjuncts. It is thus unlikely that these tokens are reliable positive evidence for the acceptability of A-bar movement from a complex NP.

2.2.2.3 Discussion: Learning from direct positive evidence unlikely for English and Mandarin Chinese

I will assume Pearl and Sprouse’s CHILDES dataset to be representative of the variety of syntactic structures encountered by an English-learning child of up to three years of age, and the Penn Treebank to be representative of the written and spoken tokens encountered by an older learner or an adult. I will also assume that the sentences in the Chinese Treebank are representative of what older Mandarin speakers are familiar with.

Given these assumptions and the above null results, we may conclude that the input for English and Mandarin speakers is likely to contain very little direct positive evidence of overt A-bar movement from (porous) relative clauses. This suggests that speakers of these languages either (i) already begin with a grammar that allows A-bar movement from porous relative clauses and German (Bulgarian, etc.) speakers learn a grammar that disallows it, or (ii) speakers of English and Mandarin rely on some less obvious source of evidence.

2.2.3 “Retreating” from an English-like grammar with direct negative evidence

In this section and the next, I consider the logical possibility that learners of German, Polish, etc. come to learn that all relative clauses are islands in their languages.

We can rule out fairly confidently that learners might do so using direct negative evidence. Such evidence for island constraints is effectively non-existent: native speaker adults are generally unlikely to tell learners to avoid sentences with ill-formed A-bar movement in their languages. It is similarly unlikely that learners will actually produce A-bar movement from relative clauses and then receive some kind of negative signal, such as explicit correction or implicit disapproval. And even if negative evidence did exist, it is unclear whether learners make use of it. To take an example from English, there are old prescriptivist injunctions against preposition stranding and split infinitives, but it is clear from the fact that they have existed for a long time that these instances of negative evidence are ineffective.

2.2.4 “Retreating” from an English-like grammar with indirect positive evidence

In the absence of direct negative evidence, another option that a German (or Bulgarian, Polish, French) learner with an English-like grammar has is to rely on indirect positive evidence. Some cue that is readily available in their input, but distinct from A-bar movement from relative clauses, might inform the learner that their language bans A-bar movement from porous relative clauses. The challenge is identifying what such a cue might be, given the differences in the morphosyntax of these languages: what easily-observed linguistic phenomena in these languages could lead learners of these languages to conclude that their initial hypotheses about relative clauses over-generate?

One interesting hypothesis, due to an observation by Cinque (2010), is that learners might rely on how relative clauses are marked. Cross-linguistically, languages may or may not differ in morphosyntactically distinguishing between relative clauses and complement clauses. In German, for example, these two types of clauses are marked distinctly: relative clauses are marked by an article-like particle, while complement clauses are marked by the complementizer *dass*. In contrast, Scandinavian languages can mark both relative clauses and complement clauses with *som/sem* and Hebrew marks both relative clauses and complement clauses with *fe*. Building off these observations, Cinque suggests that this kind of embedded clause marking predicts A-bar movement from relative clauses: languages that mark relative clauses and complement clauses differently, like German, do not allow A-bar movement from relative clauses, while languages that mark them uniformly, like Scandinavian languages, Hebrew, etc. do.

More specifically, Cinque speculates that in languages that mark both types of clauses in a uniform manner, like Scandinavian and Hebrew, A-bar movement might proceed through Spec,CP (p. 86). Although the original discussion is a little vague, I believe that Cinque had in mind an analysis where *som/sem/fe* are heads of a CP, which leave the specifier position of CP free for successive-cyclic movement of a *wh*-phrase (50a). In contrast, in languages where relative clauses are marked distinctly, the relative clause marker indicates that the specifier position is occupied, either by the relative pronoun itself (50b) or by some phonologically-silent operator. Because the specifier position is already occupied, successive cyclic A-bar movement of another syntactic object is blocked, resulting in ungrammaticality.

- (51) a. That's one trick that I've known a lot of people **who**'ve been taken in by.
 b. Then you look at what happens in languages that you know and languages that you have a friend **who** knows. (naturally occurring example, attributed to Charles Ferguson, May 1971).

A related problem for the generalization, also observed by Cinque, comes from Romanian, where it is reported to be acceptable to move from relative clauses marked with the relative pronoun *care* 'who, which' (52).¹⁹

- (52) Ion, căruia nu este nimeni care poate să-i reziste, ...
 Ion who.DAT not is nobody who can PRT-him resist
 'Ion, who there is nobody who can resist ...' (Cinque, 2010, p. 87, fn. 11 ex. ib)

French presents the opposite problem: both relative clauses and complement clauses are arguably marked (relatively) uniformly, with *que* and its variant *qui*, but patterns more like German in having more restrictions on A-bar movement from relative clauses.

Finally, Cinque's suggestion (or rather, what I take his suggestion to be) seems to be theoretically inconsistent with a fact of Bulgarian, namely, it allows multiple *wh*-phrases to move from a clause. In examples like (53), the presence of a *wh*-phrase on the left periphery of an embedded clause does not seem to pose an obstacle for

assume that relative pronouns do not always have this blocking property, unlike relative pronouns in languages like German.

¹⁹Cinque (2010) argues that the acceptability of (52) might be related to the fact that in Romanian, *care* can behave more like a complementizer than a relative pronoun. As I understand the argument, the claim is based on the fact that in examples like (i), *care*, appears without the marker *pe* or case marker, which is not typical of relative pronouns (see Grosu, 1994).

- i. A venit la noi un elvețian, care proiectul lui l-a interesat pe
 has come.PTCP to us one Swiss who project.DEF his him-has interested DOM
 director ...
 director
 Lit. 'A Swiss came to us, who his project interested the director' (Cinque, 2010, p. 87, fn. 11, ex. ii)

A-bar movement of another phrase from the same clause.

- (53) a. Koj₁ kŭde₂ misliš [če t₁ e otišŭl t₂]?
 who where think.2SG that has gone
 ‘Who do you think (that) went where?’ (Rudin, 1988, p. 450, p. 6a)
- b. Vidjah edna kniga, kojato₁ se čudja [koj znae [koj prodava
 saw.1SG a book which wonder.1SG who knows who sells
 t₁]].
- ‘I saw a book which I wonder who knows who sells.’ (ibid. p. 457, ex. 19)

Another problem is more theory-internal. Conventionally, relative clauses have the following analysis: a *wh*-element, coindexed with the head noun, moves to the left edge of the clause. This A-bar movement operation has an important semantic consequence, as it is necessary for lambda abstraction, in turn necessary for ensuring that the relative clause is interpreted as a predicate that modifies the head noun, and not as a proposition. The analysis presented in (50a), however, does not have movement of a *wh*-element that is coindexed with the head noun. To ensure that the structure is interpreted as a predicate, one would need additional assumptions, which may or may not be desirable. For instance, one might assume that the complementizer is an operator that assigns a predicate interpretation to the clause (Jeffrey Lidz, p.c.).

2.3 Learning an English-like grammar using indirect positive evidence

In preceding sections, I argued that learners cannot reliably count on their linguistic experience to provide direct evidence about whether their language allows A-bar movement from relative clauses. The logical solution is that learners must

rely on some other kind of evidence that is more easily observed in their linguistic experience, even though what this might be is not immediately apparent to linguists.

More specifically, I propose that in languages like English and Mandarin Chinese, the relevant evidence for these learners is A-bar movement from (non-finite) purposive clauses – rationale and purpose clauses (Faraci, 1974; Jones, 1991; Nissenbaum, 2005; Whelpton, 1995, among many others). In Chapter 3, using the notion of tense dependence, I argue that these adjunct clauses form a natural class with porous relative clauses, so observing A-bar movement from these clauses would provide reliable evidence that A-bar movement from porous relative clauses are possible.

To motivate this proposal, I provide an argument from comparative syntax, similar to what Cinque (2010) does. A comparative approach is valuable here, because it is hard to identify the evidence that learners use by just looking within a single language. After all, there are many linguistic properties that could be plausibly linked to A-bar movement from porous relative clauses. However, since it is unlikely that all these properties are present cross-linguistically, we can eliminate the irrelevant ones by looking across languages. For this reason, after presenting the case for purposive clauses, I also discuss several alternative hypotheses, evaluating them from a comparative syntax perspective and also from a learnability perspective.

2.3.1 A-bar movement from purposive clauses

The argument that the relevant evidence is A-bar movement from purposive clauses is based on an observation in the literature that tries to derive island effects from discourse-based factors, such as Erteschik-Shir, 1973 and Goldberg, 2006. For example, Goldberg (2006) observe that a number of clausal adjuncts in English, which she describes as being “not backgrounded” or “not presupposed” (p. 145), allow A-bar movement. Adjuncts that she refers to using this label include porous relative clauses (she calls them “presentational relative clauses”) and purposive clauses (54). In this view, purposive clauses and porous relative clauses form a single semantic and syntactic natural class (although characterizing them as “non-presupposed” is not precise enough; see Chapters 4 and 6 for more details), despite their superficial morphosyntactic differences.

- (54) Purposive clauses
- a. Mary went to the store [(in order) to buy chocolate]. [Rationale clause]
 - b. What₁ did Mary go to the store [(in order) to buy t₁?]
 - c. Mary brought a bottle of wine₁ [to give t₁ to John]. [Purpose clause]
 - d. ?Who₂ did Mary bring a bottle of wine₁ [to give t₁ to t₂]?]

If these two types of adjunct clauses do form a natural class, we then expect languages like Hebrew and Mandarin Chinese, which allow A-bar movement from porous relative clauses, to have A-bar movement from purposive clauses. Conversely, languages like German or Polish, which block A-bar movement from relative clauses, should lack A-bar movement from purposive clauses. In the next section, I provide evidence that supports this prediction.

Of course, the fact that languages vary in terms of whether A-bar movement from purposive clauses is acceptable shows that the acceptability of this configuration is also learned; I will suggest that it is learned via direct positive evidence. This fact also raises questions about why this cross-linguistic variation in purposive clauses exists and how it arose. I do not have a ready answer for these questions, except to note that this is at heart a question of why there are different languages.

2.3.1.1 A-bar movement from purposive clauses in Hebrew, and Mandarin Chinese, and Brazilian Portuguese

Hebrew has rationale clauses, optionally marked with *kedey* “in order” preceding the non-finite predicate. Like porous relative clauses, rationale clauses allow A-bar movement from within, with appropriate prosodic stress on the non-finite verb in the rationale clause (55b). A-bar movement is judged to be most acceptable when *kedey* is omitted and prosodic stress is placed on the non-finite predicate (Omer Preminger, p.c.).

- (55) Hebrew (Omer Preminger, p.c.)
- a. Dan halax la-xanut [li-knot jokolad].
 Dan walked to.the-store to-buy chocolate
 ‘Dan went to the store to buy chocolate.’
 - b. Ze ha-jokolad₁ je-Dan halax la-xanut [li-knot t₁].
 this the-chocolate that-Dan walked to.the-store to-buy
 ‘This is the chocolate that Dan went to the store to buy.’

Mandarin Chinese also has rationale clauses (56) (Lin and Liao, 2019; Paul, 2008; Tsai, 1995). As shown in (57), it is possible to move a *wh*-phrase from a rationale clause (Tsai’s “purpose clause,” Lin and Liao’s “*lai*-purposives”).

- (56) Mandarin Chinese
- a. Zhangsan qu Bali [fangwen zhe-ming geshou].
Zhangsan go Paris interview this-CL singer
'Zhangsan went to Paris to interview this singer.'
 - b. Zhangsan mai-le yi-ping hong-jiu [(lai) quyue jingli].
Zhangsan buy-PRF one-bottle red-wine come please manager
'Zhangsan bought a bottle of red wine to please the manager.'
- (57)
- a. [Zhangsan qu Bali [fangwen t₁] de] geshou₁ ...
Zhangsan go Paris interview MOD singer
'The singer that Zhangsan went to Paris to interview ...'
 - b. [Zhangsan mai-le yi-ping hong-jiu [(lai) quyue t₁] de]
Zhangsan buy-PRF one-bottle red-wine come please MOD
jingli₁ ...
manager
'The manager who Zhangsan bought a bottle of red wine to please ...'

Similar facts hold for Brazilian Portuguese (Gesoel Mendes and Kayron Beviláqua,

p.c.):

- (58) Brazilian Portuguese
- a. Eles foram para New York [pra ver o cantor].
They went to New York for to.see the singer
'They went to New York to see the singer.'
 - b. O João foi na loja [comprar o chocolate].
the João went to.the store to.buy the chocolate
'João went to the store to buy chocolate.'
- (59)
- a. Esse é o cantor₁ que eles foram para New York [pra ver t₁].
this is the singer that they went to New York for to.see
'This is the singer that they went to New York to see.'
 - b. Esse é o chocolate₁ que o João foi na loja [comprar t₁].
this is the chocolate that the João went to.the store to.buy
'This is the chocolate that João went to the store to buy.'

2.3.1.2 Restrictions on A-bar movement from purposive clauses

In this section, I discuss parallels between A-bar movement from porous relative clauses and A-bar movement from purposive clauses, in terms of what elements may undergo movement. A-bar movement from purposive clauses is considerably less well-documented, whether in English or in other languages. Other than Truswell (2007, 2011), I am not aware of major, recently-published work that specifically looks at this topic.

For this discussion, I will mostly restrict the discussion to English. As in the case of porous relative clauses, objects of verbs and prepositions can move relatively easily from purposive clauses (60), compared to adjuncts, including *wh*-adjuncts (61).

- (60) a. This is the client₁ that Mary traveled to New York [to meet t₁].
b. This is the client₁ that Mary traveled to New York [to meet with t₁].
- (61) a. *It is [with this client]₁ that Mary traveled to New York [to meet t₁].
b. ??In what hotel₁ did Mary travel to New York [to meet the client t₁]? (a logically plausible answer: “Mary traveled to New York [to meet the client at the Waldorf Astoria].”)

A further parallel lies in the fact that A-bar movement of subjects of purposive clauses is unacceptable, as shown by (62). However, this parallel might be superficial, as A-bar movement of subjects in this context is likely to be due to the complementizer-trace constraint (or whatever deeper principle that is responsible for this constraint): because purposive clauses are non-finite, subjects appear only in the presence of the complementizer *for*. A-bar movement of the subject then

creates a configuration in which its trace is adjacent to *for*. Similar configurations involving *for*-marked complement clauses are also unacceptable (63). This analysis thus contrasts with that suggested for porous relative clauses, in which the unacceptability of A-bar movement of subjects is due to a principle like the Path Containment Condition, Relativized Minimality, or Shortest Move. (It is also, of course, possible that A-bar movement of subjects in purposive clauses is subject to both the complementizer-trace constraint *and* principles like the Path Containment Condition.)

- (62) Context: a terrorist group kidnapped Mary. To secure her release, the government paid a ransom.
- a. The government had to pay a ransom [in order for Mary to be released].
 - b. *{Who₀₁ / [Which victim]₁} did the government have to pay a ransom [(in order) for t₁ to be released]?
 - c. *That is the victim who the government had to pay a ransom [(in order) for t₁ to be released].
- (63)
- a. Mary prefers for John to become the next CEO.
 - b. *{Who₀₁ / [Which executive]₁} did Mary prefer [for t₁ to become the next CEO]?
 - c. *That is the executive who Mary preferred [for t₁ to become the next CEO].

I further note that A-bar movement from a finite clause within a purposive clause is unacceptable (64).²⁰ It is less clear to me what the cause of this low acceptability is. It is certainly possible that the low acceptability is because of some constraint against A-bar movement from an embedded finite clause within a purposive clause. However, embedding a finite clause in a purposive clause seems

²⁰One might wonder about finite adjunct clauses that have purposive semantics, such as *so* (*that*) clauses. These clauses are incompatible with A-bar movement, as Truswell (2011) observes. I discuss them in Chapter 3, section 3.1.3.

to require a relatively complex context, which adds to the length of the sentence.²¹

Consequently, the low acceptability could just be a processing effect that reflects the complex context and/or the overall length of the A-bar dependency.

- (64) Sally is one of several heirs to a billionaire's fortune. John, Sally's husband, discovers compromising material about the billionaire, and decides to blackmail the billionaire, so that she would promise to let Sally inherit a company.
- a. John blackmailed the billionaire [to make her promise [that Sally would inherit the company]].
 - b. *{Who₁/Which heir₁} did John blackmail the billionaire [to make her promise t₁ would inherit the company]?
 - c. *That's the heir₁ who John blackmailed the billionaire [to make her promise t₁ would inherit the company].
 - d. *{What₁/Which company₁} did John blackmail the billionaire [to make her promise (that) Sally would inherit t₁]?
 - e. *That's the company₁ that John blackmailed the billionaire [to make her promise (that) Sally would inherit t₁].

2.3.1.3 Languages that block A-bar movement from relative clauses

block A-bar movement from purposive clauses

In this section, I present evidence from Polish, German, Bulgarian, and French that is consistent with the prediction that languages that do not allow A-bar movement from any relative clauses should not allow A-bar movement from purposive clauses. In the examples below, the *um*-headed clauses in German and *żeby*-headed clauses in Polish are purposive clauses.

²¹More specifically, to introduce a finite clause, one requires a communicative verb ("say," "promise") or mental state verb ("think"). However, these verbs cannot be felicitously used as the main verb of a purposive clause, which expresses some kind of agentivity or intent; in other words a sentence like *Someone did something to say/think that ...* is unfelicitous. Consequently, these verbs need to be introduced by an agentive verb, which naturally increases the length of the sentence. A-bar movement of any element from the finite clause produces a considerably longer dependency.

(65) Polish (Marta Ruda, p.c.)

- a. Jan poszedł do sklepu, [żeby kupić czekoladę].
 Jan.NOM went to store COMP buy.INF chocolate.ACC
 Jan went to the store to buy chocolate.
 (Note: the comma between the *żeby*-marked clausal adjunct is an orthographic convention and does not entail an intonational break)
- b. *To jest ta czekolada, którą Jan poszedł do
 this is this chocolate.NOM which.ACC Jan.NOM went to
 sklepu, [żeby kupić t₁].
 store COMP buy.INF
 This is the chocolate that Jan went to the store to buy.

(66) (Southern) German

- a. Der Hans ist zum Aldi gefahren, [um ein paar Äpfel zu kaufen].
 the Hans is to.the Aldi gone COMP a bunch apple to
 kaufen].
 buy
 ‘Hans went to Aldi to buy a bunch of apples.’
- b. *Was₁ ist der Hans zum Aldi gefahren, [um t₁ zu kaufen]?
 What is the Hans to.the Aldi gone COMP to buy
 ‘What did Hans go to Aldi to buy?’ (above examples from Aaron Doliana, Lara Ehrenhofer, p.c.)
- c. Er hat das Land verlassen, [um sie zu retten].
 He has the land left COMP her to rescue.
 ‘He left the country in order to rescue her.’ (Giusti, 1986 p. 119, ex. 8)
- d. *Wen₁ hat er das Land verlassen, [um t₁ zu retten]?
 whom has he the land left COMP to rescue
 ‘Who has he left the country in order to rescue?’ (ibid. p. 125, ex. 26)

Similar restrictions are found in French (Truswell, 2011, Postal, 1998).

(67) French

- a. Marie est allée au magasin [(pour) acheter des pommes].
 Marie is gone to.the store for to.buy the apples
 ‘Marie went to the store to buy apples.’
- b. ??Ce sont les pommes₁ que Marie est allée au magasin [(pour)
 this are the apples that Marie is gone to.the store for
 acheter t₁].
 to buy
 ‘Marie went to the store to buy apples.’ (both examples and judgments from Anouk Dieuleveut, p.c.)

- c. Elle y est allée en avion [pour confronter le directeur].
 She there is gone by plane for to.confront the manager
 ‘She went there by plane to confront the manager.’ (Truswell, 2011, p. 197, ex. 32c, adapted from examples in Postal, 1998, p. 76)
- d. *Le directeur₁ qu’ elle y est allée en avion [pour confronter t₁]
 the manager that she there is gone by plane for to.confront
 ...
 ‘The manager that she went there by plane to confront ... (ibid., ex. 32d)

Unlike their counterparts in Polish, German, and French, purpose clauses in Bulgarian are finite in the sense that they bear agreement morphology. Nevertheless, Stateva (2005) observes that Bulgarian does not allow A-bar movement from purpose clauses, even though A-bar movement from (finite) embedded clauses are possible in general.

(68) Bulgarian

- a. Dojdox [(za) da te pitam].
 came.1SG in order PRT you ask.1SG
 ‘I came in order to ask you.’ (Stateva, 2005, p. 143, ex. 21)
- b. Berlin₁, vjarvax [če šte posteja edin den t₁].
 Berlin believed.1SG that will visit.1SG some day
 ‘Berlin, I believed that I will visit some day’ (ibid., p. 145, ex. 27b)
- c. *Berlin₁, zaminax na ekskurzija [(za) da posteja t₁].
 Berlin went.1SG on trip in order PRT visit.1SG
 ‘Berlin, I went on a trip in order to visit.’ (ibid. ex. 27a)
- d. *Kakvo₁ dojde v Berlin [(za) da posetiš t₁]?
 what came.2SG in Berlin in order PRT visit.2SG
 ‘What did you come to Berlin (in order) to visit?’ (ibid., p. 144, ex. 26)
- e. *Kakvo₁ otivaš v magazina [(za) da kupiš t₁]?
 what went in store in order PRT buy.2SG
 ‘What did you go to the store to buy?’ (Krapova, 2010b, p. 220, fn. 10, ex. 1, citing Penčev, 1998)

One might wonder whether there are other restrictions that independently prevent A-bar movement out of these clauses in these languages. It is however

difficult to find restrictions that cover enough empirical ground within and across languages.

For instance, it is possible to think of Bulgarian purpose clauses as PPs: Krapova (2010b) argues that Bulgarian *za* is a preposition. The ban on A-bar movement from Bulgarian purpose clauses might follow from a general constraint against any kind of movement from a PP. But this argument does not extend to German, for instance; Abels (2003) observes that German allows A-bar movement from a PP (69), as long as A-bar movement does not result in a stranded preposition.

- (69) [Über welches Thema]₁ hast du mich noch mal [_{PP} nach einem Buch t₁]
 about which topic have you me again after a book
 gefragt?
 asked
 ‘Which topic did you ask me about a book on again?’ (Abels, 2003, p. 211, ex. 284)

As an alternative, let us assume that German *um* and Bulgarian *za* are complementizers (*pace* Giusti, 1986 and Krapova, 2010b, for example), and stipulate that in these languages, A-bar movement from a purposive clause is blocked by the presence of an overt complementizer. Such an account fails to make clear predictions about adjunct clauses without *um* or *za*, much less predict the fact that A-bar movement from such adjuncts is also degraded (70).

- (70) ??Was₁ bist du gekommen [(um) t₁ anzusehen]?
 what are you come COMP look-at
 ‘What did you come to look at?’ (Müller, 1995, p. 87 ex. 134a, his judgment)
 [German]

The above restriction is also unique to German and Bulgarian, and it is not at all clear how it can be extended to other languages. For example, in Polish,

żeby-marked clauses allow A-bar movement of objects (71), so it is not possible to attribute the unacceptability of (65) to the presence of *żeby*.

- (71) Co₁ Maria chce, żeby Janek kupił t₁?
 what Maria wants COMP Janek bought
 ‘What does Maria want Janek to buy?’ (Lasnik and Saito, 1984, p. 279 ex. 158a)

2.3.2 Alternative hypotheses about indirect evidence

One might wonder whether there are other kinds of indirect evidence that learners might be using. In this section, I consider three other potential sources of indirect evidence involving embedded clauses. I give arguments from comparative evidence and learning considerations against these alternative accounts.

2.3.2.1 Long-distance A-bar movement from (finite) complement clauses

The first hypothesis is that the ban on A-bar movement from relative clauses follows from a more general ban on A-bar movement from all embedded finite clauses. German and Polish, for example, have been reported to impose restrictions on A-bar movement from embedded finite clauses in general (for discussion of restrictions on A-bar movement from complement clauses, see Chapter 4). Northern German varieties, for instance, are claimed to ban long-distance A-bar movement from *dass*-headed clauses (72a); alternative strategies, such as *wh*-copying, must be used instead (Haider, 2010; Kvam, 1983; Salzmann, 2017, etc.). Likewise, Polish generally disallow A-bar movement from embedded finite clauses, not even for a verb like *myśleć* ‘think’ (72b) (see Witkoś (1995) and references therein), although for some

speakers, *mówić* “say” and *powiedzieć* “tell” exceptionally allow A-bar movement to cross them (Cichocki, 1983).

- (72) a. %Wen₁ denkst du [dass Irina t₁ einlädt]?
 who.ACC think you that Irina invites?
 ‘Who do you think that Irina invites?’ (Fanselow et al., 2005, p. 48 ex. 16; % = variation in acceptability) [German]
 b. *Co₁ Janek myśli [że studenci czytają t₁]?
 what Jon think that students read
 ‘What does John think that the students read?’ (Witkoś, 1995, p. 229, ex. 39) [Polish]

There is, however, reason to be cautious about this line of reasoning. Long distance A-bar movement of the kind in (72a) is reported to be acceptable in southern German varieties (Fanselow et al., 2005; Featherston, 2004; Giusti, 1986; Haider, 2010), and there is some experimental evidence suggesting that the restriction might be extragrammatical: Featherston (2004) finds no difference in acceptability ratings of long-distance A-bar movement by northern German speakers or southern German speakers, while Fanselow et al. (2005) find that exposing northern speakers to long-distance A-bar movement increases their likelihood of producing the same structure.

In addition, Bulgarian and French allow long-distance A-bar movement from complement clauses, unlike (northern) German and Polish. In fact, Bulgarian famously freely allows *multiple wh*-phrases to move from an embedded clause, including embedded *wh*-questions (73) (e.g. Rudin, 1988; Stateva, 2005). French long-distance A-bar movement is well-known for triggering a *que/qui* alternation in complementizers (74) (see Sportiche, 2011 for a recent analysis).

- (73) Bulgarian

- a. Berlin₁, vjarvax [če šte posteja edin den t₁].
Berlin believed.1SG that will visit.1SG some day
'Berlin, I believed that I will visit some day' (Stateva, 2005, p. 145, ex. 27b) (=68b))
- b. Koj₁ kŭde₂ misliš [če t₁ e otišŭl t₂]?
who where think.2SG that has gone
'Who do you think (that) went where?' (Rudin, 1988, p. 450, p. 6a)
- c. Vidjah edna kniga, kojato₁ se čudja [koj znae [koj prodava
saw.1SG a book which wonder.1SG who knows who sells
t₁]].

'I saw a book which I wonder who knows who sells.' (ibid. p. 457, ex. 19)

(74) French (Sportiche, 2011, p. 83, exx. 2 and 3)

- a. [Avec qui]₁ tu crois [**que** Jean danse t₁]?
with whom you think that Jean dances
'Who do you think that Jean dances with?'
- b. Qui₁ tu crois [**qui** t₁ danse avec Jean]?
who you think that dances with Jean
'Who do you think dances with Jean?'

2.3.2.2 How relative clauses are marked

For the sake of comprehensiveness, I note that the marking of relative clauses and complement clauses in principle could be a source of indirect positive evidence (Cinque, 2010). However, as mentioned in Section 2.2.4, there are empirical and conceptual problems with this hypothesis.

2.3.2.3 Raising vs. matching relative clauses

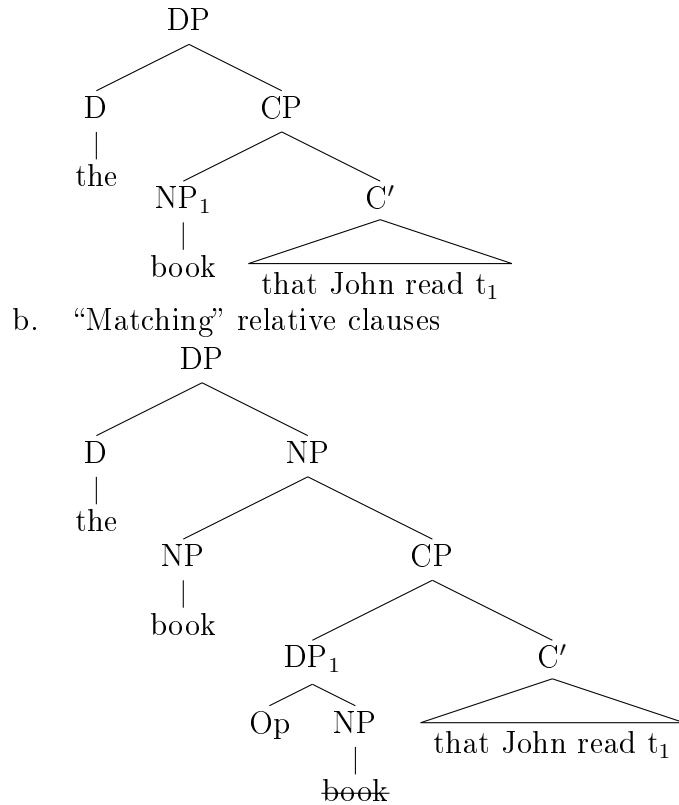
Another possible distinction, briefly floated in a footnote by Sichel (2018) (p. 344, fn. 3) in a discussion of the relative clause marking analysis mooted by Cinque (2010), is that the difference reduces to a distinction between raising and matching

relative clauses. This distinction in part stems from Sichel’s analysis of porous relative clauses in Hebrew. Sichel argues that there are two distinct types of relative clauses in Hebrew: raising and matching relative clauses. Porous relative clauses are raising relative clauses, and not matching ones.

Broadly speaking, the distinction between these two analyses of relative clauses is in the way the head NP of the relative clauses is represented, and consequently in the overall structural analysis of these complex NPs. (I will defer more detailed discussion of Sichel’s raising analysis of relative clauses to Section 5.2.3.1; the details do not bear on the discussion in the present section.)

In raising analyses (75a), the relative clause is the complement of the determiner; the head NP is represented inside the relative clause, having moved from the gap position to the periphery of the relative clause. In matching analyses (75b), the determiner’s complement is an NP, consisting of the head NP, which is represented outside of the relative clause (for ease of reference, call this an “external head”), and the relative clause, which adjoins to the head NP. In the relative clause, a phrase consisting of an operator and a NP moves from the gap position to the periphery of the relative clause. Because the head NP “matches” the NP inside the phrase, it licenses the ellipsis of the latter NP. In other words, in raising analyses, the representation of relative clauses involve only A-bar movement, but in matching analyses, the representation of relative clauses involve both A-bar movement and ellipsis.

(75) a. “Raising” relative clauses



Sichel argues using binding evidence that Hebrew porous relative clauses are raising relative clauses and not matching relative clauses. If this is the case, one way to capture the cross-linguistic difference in A-bar movement from relative clauses is to claim that languages like German (Polish, ...) all lack raising relative clauses; perhaps they are all matching relative clauses. If so, then there is no analysis of these relative clauses in these languages that is compatible with A-bar movement, in contrast to Hebrew.

In principle, this hypothesis about porous relative clauses should be easily testable. To support this hypothesis, one might show that the raising analysis of relative clauses is generally inappropriate for languages like German, Bulgarian, and Polish.

At first glance, it seems that this hypothesis is too strong, though. It has

been independently claimed that relative clauses in general require both raising and matching analyses. For example, standard arguments for raising analyses involve VP idioms and reconstruction effects: suppose that a NP must be found (or must not be found) in a particular configuration inside a clause, such as the object of a VP idiom (76). If this NP can be relativized, then there must be a level of representation in which the NP is found inside the relative clause. This is a scenario that straightforwardly follows from a raising analysis, as in (77a). The matching analysis, on the other hand, posits the existence of an external NP, whose idiomatic status is unclear. For example, in (77b), there are two tokens of *strings*. The first is found inside the relative clause, and it is reasonable to think that it receives an idiomatic interpretation. The second one is the external head, outside the relative clause. It is unclear how this *strings* is interpreted, since it is not part of an idiom.²²

- (76) a. The strings Mary pulled got John into college.
 b. *The strings got John into college.

- (77) a. The [_{RC} strings₁ Mary pulled t₁] got John into college. [Raising analysis]
 b. The [_{NP} strings [_{RC} strings_T Mary pulled t₁] got John into college. [Matching analysis]

Reconstruction and VP idiom effects can be found in German, Bulgarian, and Polish relative clauses, consistent with the idea that relative clauses in these languages can be derived with a raising analysis. If so, then these datapoints pose a problem for the hypothesis that relative clauses in these languages only have a

²²For thoroughness, not all idioms relativize easily, as Jeffrey Lidz points out (p.c.). For example, *the cat* in the idiom *let the cat out of the bag* cannot be relativized to produce a sentence like “The cat that Mary let out of the bag shocked everyone,” even though *the cat* can be reasonably taken to be a metaphor for some contextually-salient secret.

matching analysis.

- (78) a. Der [Wesenszug von sich₁]₂, den Peter₁ noch nicht t₂ kannte,
the trait of self which Peter still not knew
störte niemanden.
annoyed no.one
‘No one was annoyed by the side of himself that Peter did not know yet.’ (Salzmann, 2018, p. 191 ex. 4a) [German]
- b. Natiskăt₁, deto Evropa okazva t₁ na Bălgarija zaradi OMO
the.pressure that Europe exerts on Bulgaria because.of OMO
Ilinden, e nepravomeren.
Ilinden is illegal.
‘The pressure that Europe puts on Bulgaria because of OMO Ilinden is illegal.’ (Krapova, 2010a, p. 1247 ex. 17b) [Bulgarian]
- c. Słów₁ co on nie rzucił t₁ na wiatr ...
words that he not throw on wind
‘Empty promises that he did not make ...’ (Szczegielniak, 2004, p. 377 ex. 12b) [Polish]

A further problem for testing this hypothesis is the fact that these effects can be modeled under either analysis, once certain ancillary assumptions are made; this means that it is difficult to locate a phenomenon in the recent literature that might unambiguously adjudicate between either analysis. This is the approach that Henderson (2007) explicitly takes in his argument for a raising-only analysis (for English). For example, a traditional argument for the matching analysis involves the absence of Principle C effects; a raising analysis incorrectly predicts a sentence like *The [picture of John₁]₂ that you thought he₁ liked t₂ is on the mantel* (from Henderson, 2007) to be unacceptable. Henderson argues against this analysis by assuming that vehicle change is possible under A-bar movement, following Safir (1999). Salzmann (2018), arguing for a matching-only analysis, obviously does not adopt such a proposal. Instead, he tries to account for phenomena that motivate the raising analysis, such as the preservation of an idiomatic reading in relative clauses,

with the assumption that unlicensed external heads can exceptionally delete at LF.

It is also interesting to see that the relative clause literature is not concerned about the cross-linguistic distribution of these relative clauses, i.e. whether one type of relative clause is found in some languages and another in a different set of languages. Instead, the literature is primarily concerned with a parsimony question: whether both raising and matching analyses (or a combination of raising, matching and “head external” analyses) are necessary cross-linguistically (Bhatt, 2002; Hulsey and Sauerland, 2006; Sauerland, 1998), or whether one of these analysis is sufficient for modelling relative clauses cross-linguistically (Henderson, 2007; Salzmann, 2018). Salzmann (2018), who strongly argues for the matching analysis and against the raising analysis, bases his arguments on with evidence from English and German relative clauses. If Salzmann’s claim that English only has matching relative clauses is essentially correct, then Sichel’s analysis of porous relative clauses can only apply to Hebrew but not to English, an asymmetry that we might find curious. Likewise, assuming again that Sichel’s analysis of porous relative clauses is correct, Henderson’s argument for a raising-only analysis extends beyond English to a language like German, then one would expect that both Hebrew and German should allow A-bar movement from relative clauses to the same degree, a prediction that is inconsistent with existing descriptions.

2.4 Conclusion

In this chapter, I reviewed existing observations about cross-linguistic variation on A-bar movement from relative clauses. I also presented experimental results that confirm the claim that A-bar movement from finite relative clauses in English shows an acceptability contrast, complementing previous research by Kush et al. (2013). Corpus evidence suggests that English and Mandarin Chinese learners have minimal direct evidence that A-bar movement from relative clauses is possible under exceptional circumstances in their languages. I argued that learners of these languages might learn about this particular phenomenon indirectly, through A-bar movement from purposive clauses, and showed that cross-linguistically, the acceptability of A-bar movement from porous relative clauses covaries with the acceptability of A-bar movement from purposive clauses, consistent with this indirect learning account.

Chapter 3: Learning with purposive clauses

The previous chapter described the following learning problem: A number of languages, like English and Mandarin Chinese, allow A-bar movement from relative clauses under exceptional circumstances. However, because A-bar movement from these porous relative clauses is relatively infrequent in these languages, it is unlikely that learners actually get to observe A-bar movement from any kind of relative clause. Nevertheless, learners succeed in acquiring a grammar that allows A-bar movement from porous relative clauses.

The solution proposed at the end of the chapter looked like this: In the case of English and Mandarin Chinese (and possibly Hebrew, etc.), learners encounter indirect positive evidence for an acceptability contrast within A-bar movement from relative clauses. I proposed that the evidence might take the form of acceptable A-bar movement from purposive clauses, and provided cross-linguistic evidence to support this account. In contrast, speakers of a language like German, Bulgarian, etc., do not observe A-bar movement from either purposive clauses or porous relative clauses, since these are generally unacceptable. Consequently, they do not get evidence that their languages allow A-bar movement from porous relative clauses (or purposive clauses).

The goal of this chapter is to develop this account further: why might purposive clauses be the relevant evidence, and what reason is there to think that this is a feasible learning account? I suggest that this is because purposive clauses and porous relative clauses form a natural class. To make this argument, I show how the two possible analyses of porous relative clauses presented in the previous chapter can be extended or adapted to accommodate purposive clauses. If these analyses are on the right track, then it suggests that among the many properties that purposive clauses and porous relative clauses have, learners are particularly sensitive to their tense and temporal properties or height within a main clause.

Of course, showing cross-linguistic covariation and a formal basis for it does not prove with certainty that learners actually use A-bar movement from purposive clauses to learn about A-bar movement from porous relative clauses. This account also requires that A-bar movement from purposive clauses should be present in the linguistic experience of English and Mandarin Chinese speakers, and absent in languages like German or Bulgarian. In the second part of the chapter (sections 3.3 and 3.4), I analyze three corpora: the CHILDES Treebank, the Penn Treebank, and the Chinese Treebank. These datasets collectively represent child-ambient English speech and the kind of English and Mandarin Chinese speech and texts that older speakers have access to. Consistent with the learning account, I find that A-bar movement from purposive clauses occur naturally in the Penn Treebank and Chinese Treebank, at least at a rate higher than A-bar movement from porous relative clauses.

3.1 How purposive clauses, porous relative clauses might form a natural class

My goal in this section is to argue that porous relative clauses and purposive clauses form a natural class within the larger class of clausal adjuncts. Specifically, I argue that both porous relative clauses and purposive clauses show tense dependence. I further argue that learners are sensitive to this particular property, and use it to draw conclusions about A-bar movement from purposive clauses and porous relative clauses.

In this section, I describe the two types of purposive clauses (in part following the classification of Whelpton, 1995) and discuss tense dependence in purposive clauses, showing how they form a natural class with porous relative clauses. I then show how the analyses proposed for porous relative clauses in the previous chapter can be adapted for purposive clauses.

3.1.1 Two types of purposive clauses

Following Faraci, 1974; Jones, 1991; Whelpton, 1995 (also Nissenbaum, 2005), I will divide purposive clauses into two classes: purpose clauses and rationale clauses. For comprehensiveness, in this section, I summarize some of the more salient syntactic properties of these two types of clauses.

First, both types of clauses can be distinguished by the (optional) presence of *in order* and the gaps that are allowed in these clauses (examples are based on

adapting examples and discussion in pp. 5–6 of Whelpton, 1995).

- (1) a. Purpose clauses cannot be marked with *in order*, rationale clauses can.
 - (i) Mary brought a book along [(**in order*) _ to read _]. [Purpose clause]
 - (ii) David spoke Welsh [(*in order*) for Damian to feel more at home]. [Rationale clause]
- b. If there is a gap in a rationale clause, it must be a subject gap.
 - (i) David₁ spoke in Welsh [_₁ to keep the gossip secret]. [Rationale clause]
 - (ii) *David₁ spoke in Welsh [in order for Damian to understand _₁]. (unacceptable on the reading “... for Damian to understand David,” assuming that Damian only understands Welsh.)
- c. The theme argument of the main clause controls a gap (or the gap, if there is only one) in the purpose clause, while the agent argument of the main clause controls the subject gap (if there is one) in a rationale clause.
 - (i) Mary brought a book₁ along [for John to read _₁].
 - (ii) David₁ spoke Welsh to Damian₂ [__{1/*2} to impress the visitors].

Structurally speaking, both types of clauses adjoin low in a clause, specifically, at a VP level (or lower). The key evidence comes from VP preposing: both types of clauses can be preposed with a VP (2) (Whelpton, 1995, pp. 100 and 109). Acceptability here is also sensitive to phonological weight: the more material there is in a preposed VP, the less acceptable preposing becomes.

- (2) a. Mary said she would bring a book along [to read], and [_{VP} bring a book along [to read]], she did.
- b. David said he would speak in Welsh [(*in order*) to keep the gossip secret], and [_{VP} speak in Welsh [(*in order*) to keep the gossip secret]], he did.

A number of diagnostics also show that purpose clauses adjoin to a lower position than rationale clauses do. To give one example, when a VP is preposed, a purpose clause must be preposed along with the VP, while rationale clauses can be stranded (3).¹

¹For other diagnostics, such as *do so* anaphora and linear precedence, see Whelpton, 1995, pp.

- (3) a. Mary said she would bring a book along [to read], and *[_{VP} bring a book along], she did [to read].
 b. David said he would speak in Welsh [(in order) to keep the gossip secret], and [_{VP} speak in Welsh], he did [(in order) to keep the gossip secret].

3.1.2 Tense dependence

In the previous chapter, I argued that porous relative clauses can be distinguished from other relative clauses in terms of their tense and temporal interpretation properties. More specifically, porous relative clauses display what I call tense dependence: their tense is semantically dependent on the tense of the matrix clause. This dependence manifests itself either semantically, in that tense in porous relative clauses lacks a later-than-matrix reading, and/or morphosyntactically, in the form of tense harmony.

In this section, I point out that purposive clauses also exhibit tense dependence. If so, one reason why learners would use purposive clauses to draw inferences about A-bar movement and porous relative clauses is because of the tense dependence property that is common to both purposive clauses and porous relative clauses. In other words, even though purposive clauses and porous relative clauses are morphosyntactically different, the tense dependence property is distinct enough for learners to treat them as members of a natural class.

Temporally, the main event denoted by the predicate of a purposive clause can only be located in the future of the main clause predicate in some possible world, and not the other way around. In (4), the buying of chocolate or giving of wine

99–100, 109, 121.

comes after the act of going to the store or bringing a bottle of wine.

- (4) a. Mary went to the store [to buy chocolate].
- b. Mary brought a bottle of wine along [to give to John].

One cannot use the purposive clause to describe a situation that temporally preceded and is causally related to the main clause predicate (5), even though broadly speaking, purposive clauses describe a causal relation between the main clause predicate and the adjunct predicate. This temporal restriction is, of course, closely related to the causal / teleological semantics of the construction, in which the adjunct describes the goal or outcome that is intended to follow from the action denoted by the predicate in the main clause.

- (5) a. #Mary went to the store [to want to buy chocolate]. (Scenario: Mary wanted to buy chocolate, and then went to the store to do so.)
- b. #Mary brought a bottle of wine along [to be invited by John to the party]. (Scenario: Mary was invited by John to the party, and consequently brought a bottle of a wine along.)

There is also a morphosyntactic dimension to the tense dependence of purposive clauses. A key characteristic of purposive clauses is non-finite tense. Generally, non-finite tense is found in embedded contexts, but not main clauses.² The general absence of non-finite tense in main clause contexts is arguably consistent with the notion that non-finite tense is dependent, requiring the presence of a structurally higher tense morpheme. Because of this requirement, these tenses cannot appear in main clause contexts, where there is, by definition, no higher tense morpheme.

²Exceptions in English include non-finite exclamatives (*To think that they would do such a thing!*) or certain non-finite *wh*-questions (*How to write well?*)

3.1.3 *So (that), because, and only to* clauses

I next discuss a number of different finite clausal adjuncts that appear to show some kind of tense dependence and yet are incompatible with A-bar movement of arguments. To preview the discussion, I argue that these do not necessarily challenge the generalization that relates tense dependence and A-bar movement; these finite adjuncts arguably have independent tenses; the tense dependence observed is instead a semantic artifact of these constructions.

The first type of adjunct clauses are *so (that)* clauses, which are semantically very similar to purposive clauses (6). As Truswell (2007, 2011) points out, these finite adjunct clauses do not allow A-bar movement, not even of NP objects.

- (6) a. John₁ left early [so (that) he₁ could catch a flight]. (\approx “John left early to catch a flight.”)
b. *What₂/Which flight₂ did John₁ leave early [so (that) he₁ could catch t₂]?
c. ?*That’s the flight₂ that John₁ left early [so (that) he₁ could catch t₂].

In *so (that)* constructions, the tense must morphologically match that of the main clause.

- (7) a. John left early [so that he {could/??can} catch a flight].
b. John leaves at six tomorrow morning [so that he {??could/can} catch a flight].

The second type of adjunct clauses are *because* clauses, which are also semantically very similar to purposive clauses.

- (8) a. John₁ left early [because he₁ had to catch a flight]. (\approx “John left early to catch a flight.”)
b. *What₂/Which flight₂ did John₁ leave early [because he₁ had to catch

- t_2]?
 c. ?*That's the flight₂ that John₁ left early [because he₁ had to catch t_2].

For *because* constructions, a present tense can appear in the *because* clause when the main clause is in the past tense; this configuration produces a double access reading (Ogihara, 1996, chapter 6): for (9a) to be felicitous, the obligation for John to catch the flight must be true at the time of John's leaving and at the time (9a) was uttered. In contrast, past tense in the adjunct clause cannot co-occur with a present tense in the main clause.

- (9) a. John left early [because he {had/has} to catch a flight].
 b. John leaves early [because he {*had/has} to catch a flight].

The third type of clauses are *only to* “telic” adjuncts (Whelpton, 1995). *Only to* adjuncts are non-finite — argued to be a hallmark of defective tense — and the time of the embedded predicate is located in the future of the main clause predicate.

- (10) a. John left early [only to run into Mary].
 b. *Who₁ did John leave [only to run into t_1]?
 c. *That's the person₁ that John left [only to run into t_1].

For these three types of clauses, I would like to suggest that these do not necessarily counter-exemplify the generalization about tense dependence. More specifically, I would like to suggest that there is no inherent dependence between the embedded and main clause tenses; the tenses here are independent. The tense dependence we observe is instead an artifact of the semantics of the constructions.³ For example, *so that* clauses describe outcomes intended at the time of the main clause predicate. When one says that *John left early so that he could catch a flight*,

³Special thanks to Valentine Hacquard for discussion on these issues.

at the point of John's leaving (say, time t), he also had the intent (at time t) of being able to catch a flight. As a result, the tense of the adjunct has to match that of the main clause. Similarly, *because* clauses describe the cause(s) behind the action denoted by the main clause predicate. When one says *John left early because he had to catch a flight*, the cause of John's leaving early at time t was his desires (at time t) to catch a flight. Telic clauses, on the other hand, appear to describe unintended actual outcomes; *John left early only to run into Mary* is felicitous only if the reason of John's leaving early was to avoid Mary and he actually ran into Mary. Since outcomes are by definition temporally located in the relative future, there has to be a temporal dependency between the embedded predicate and the main clause predicate.

In the same vein, one might wish to argue that the future reading of purposive clauses can be attributed to the construction. Put differently, in this alternative analysis, purposive clauses have independent tense; the tense dependence observed for purposive clauses also has a semantic or pragmatic origin, and not a syntactic one. This is, of course, not a desirable analysis in this context, and it strikes me that the difference between purposive clause and the adjunct clauses described in this section might ultimately have a structural explanation: there is a case to be made that purposive clauses adjoin to a position inside a VP, while *so (that)*, *because*, and *only to* adjuncts arguably adjoin to a higher position outside a VP; see Section 3.1.5.1 for evidence.

3.1.4 Other issues

3.1.4.1 Temporal adjunct clauses

Temporal adjunct clauses, such as those headed by *before* and *after*, also appear to pose a problem for the tense dependence generalization. In English, when the clause in the temporal adjunct is simplex (without embedded clauses), the tense in the temporal adjunct must match that of the main clause (11), a phenomenon first described by Geis (1970) with the label “tense harmony.”⁴ The matching thus suggests a dependency and raises the possibility that these temporal adjuncts have defective tense. However, these adjuncts are incompatible with overt A-bar movement of arguments (12).⁵

- (11) a. Mary leaves [after/before John *called/calls Sam].
b. Mary left [after/before John called/*calls Sam].
- (12) a. ??Who did Mary leave [before/after John called t_1]?
b. ??That’s the person Mary left [before/after John called t_1].

As I see it, there are three theoretical options for dealing with this problem. All three are based on independent observations in the literature on temporal adjunct clauses and temporal adjuncts in general.

The first is to argue that the tenses in temporal adjuncts are actually inde-

⁴This sense of “tense harmony” should be kept distinct from the sense of “tense harmony” found in the literature on specificational copular clauses. For more discussion about the tense harmony rule and how it affects the interpretation of temporal adjuncts, I refer readers to Geis, 1970; Kusumoto, 2017.

⁵But see Truswell (2007, 2011) for extensive discussion of A-bar movement from temporal adjunct clauses whose complements are bare present participials, e.g. *%What did John read the manual before using t_1 ?*

pendent, and the restrictions exemplified in (11) are derived from semantic and pragmatic considerations. There is thus no tense dependence in these adjuncts. Here, I present an argument developed by Kusumoto (2017). Making the standard assumption that the present tense in English has an indexical component, Kusumoto argues, quite reasonably, that sentences like (13) are ruled out as a matter of contradiction. In (13a), Mary’s leaving is in the past, while the phone call between John and Sam is not, but it is also asserted that the phone call precedes Mary’s leaving. Following Stump (1985), she argues that sentences like (14) are unacceptable because they are semantically “redundant” (p. 204). In (14a), Mary’s leaving is in the past, and the phone call is not. Even without the temporal adjunct, it is already clear that Mary’s leaving precedes the phone call.

- (13) a. *Mary left after John calls Sam.
 b. *Mary leaves (tomorrow) before John called Sam.

- (14) a. #Mary left before John calls Sam.
 b. #Mary leaves (tomorrow) after John called Sam.

The second option is to argue that A-bar movement from temporal adjuncts actually involves A-bar movement from an unpronounced definite description that refers to a time interval that is presupposed to exist; such movement is known to be unacceptable. To see this, consider the examples in (15), which are close paraphrases of each other. What distinguishes (15a) from (15b) and (15c) is the complements of *before*: in (15a), the complement is a clause, while in the other two examples, the complement is a nominal, one that refers to a specific time interval (2 o’clock in the afternoon or John’s phone call time).

- (15) Context: John called Sam at 2 p.m. Mary left at 1 pm.
- a. Mary left before John called Sam.
 - b. Mary left before 2 p.m.
 - c. Mary left before the time of John’s calling Sam.

To capture the semantic similarities, some have proposed that there is a silent operator in the *before* clause in (15a). This operator takes the clause *John called Sam* as an argument and returns a definite description, the earliest time interval of this event denoted by the clause (for formal implementation of this idea, see Beaver and Condoravdi, 2003, Sharvit, 2013, among others). An illustration of this general idea is shown in (16), where the operator is notated as THE-EARLIEST; note that this analysis abstracts away from the fact that *before* clauses are not veridical, in that proposition described in a *before* clause is not necessarily true (see Beaver and Condoravdi, 2003 for comments on how time and veridicality/modality might be encoded on the operator).

- (16) ... before [THE-EARLIEST [John called Sam]].

Seen in this light, A-bar movement from these temporal adjuncts becomes a case of A-bar movement from a definite description. Further, if I understand Beaver and Condoravdi’s analysis correctly, this description picks out a particular time interval that exists in the timeline. In this regard, this definite description resembles the one in (17a), which picks out a particular photograph. Since A-bar movement from definite descriptions is known to be unacceptable ((17b), (17c)) (Chomsky, 1973; Davies and Dubinsky, 2003; Fiengo and Higginbotham, 1981; Guéron, 1980; Huang, 2018a; Simonenko, 2015), it is not surprising that (18) is also unacceptable.

- (17) a. Mary saw [this photo of John].
 b. ??Who did Mary see this photo of t_1 ?
 c. ??That's the person who Mary saw this photo of t_1 .

- (18) ??That's the person Mary left [before/after John called t_1]. (= (12b))

The third option for ruling out A-bar movement from *before* clauses is an older, but related, idea that a *before* clause contains A-bar movement of a phonologically null time argument to form a relative clause, as schematized in (19), where capitalized elements are phonologically null (Geis, 1970; Larson, 1990; von Stechow and Grønn, 2013b; also see Sharvit, 2013 paper for a critique).

- (19) Mary left before [TIME₁ [John called Sam t_1]].

There are two arguments for this analysis. The first is the observation that there is a close paraphrase of sentences like (15a) that involves relative clauses (20), and hence A-bar movement.

- (20) Mary left before the time [at which John called Sam].

Combining the definite description and relative clause analyses yields an analysis of temporal adjuncts where a preposition like *before* or *after* takes a definite NP that has a presuppositional reading and is modified by the clause. A-bar movement from the *before* clause in this analysis becomes a case of A-bar movement from relative clause inside a definite complex NP from another adjunct, which is unacceptable (21). Seen in this light, it is unsurprising why A-bar movement from *before* (or *after*) clauses is unacceptable.

- (21) a. *Who₁ did Mary leave before the time at which John called t_1 ?
 b. *That's the person₁ that Mary left before the time at which John called

t_1 .

The relative clause/A-bar movement analysis receives further support from an ambiguity that arises when *before* appears with a clause that has an attitude verb with a complement clause. The ambiguity can be modeled as A-bar movement of either a time adverbial in the higher clause or in the embedded clause.

- (22) Joan left before Harry told her to leave. (Geis, 1970, p. 127, ex. 42)
- a. Reading 1: “Upstairs” reading
 - (i) Joan left at 10 a.m. Harry was going to talk to her at 11 a.m. to tell her to leave at 3 p.m.
 - (ii) ...before [TIME₁ Harry told her t_1 [to leave]]
 - b. Reading 2: “Downstairs” reading
 - (i) Joan left at 10 a.m. Harry told her yesterday to tell her to leave at 11 a.m., but she left early.
 - (ii) ...before [TIME₁ Harry told her [to leave t_1]]

As evidence for a A-bar movement analysis, consider the fact that the downstairs reading disappears when the embedded clause is found in an island configuration.

- (23) Joan left before Harry told her of his desire for her to leave.
 Only reading: Joan left at time t_1 before Harry told her at time t_1 that he wanted her to leave. (ibid. p. 129, ex. 54)

3.1.4.2 Mandarin Chinese *wei(le)* adjuncts

As mentioned previously, Mandarin Chinese also has purposive clauses that allow A-bar movement; these purposive clauses appear in a position after the main VP (24) (= (57) in the previous chapter).

- (24) a. [Zhangsan qu Bali [fangwen t_1] de] geshou₁ ...
 Zhangsan go Paris interview MOD singer

- ‘The singer that Zhangsan went to Paris to interview ...’
- b. [Zhangsan mai-le yi-ping hong-jiu [(lai) queyue t₁] de]
 Zhangsan buy-PRF one-bottle red-wine come please MOD
 jingli₁ ...
 manager
 ‘The manager who Zhangsan bought a bottle of red wine to please ...’

However, Mandarin Chinese also has another purposive clause construction where the adjunct clause is marked by *wei(le)* and precedes the main verb (25); A-bar movement from this clause is not possible (26).

- (25) a. Zhangsan [weile fangwen zhe-ming geshou] qu-le Bali.
 Zhangsan WEILE interview this-CL singer go-PRF Paris.
 ‘Zhangsan went to Paris to interview this singer.’
- b. Zhangsan [weile shuaxin zhe-xiang jilu] fushi jin-yao.
 Zhangsan WEILE break this-CL record consume banned-drug
 ‘Zhangsan consumed performance-enhancing drugs in order to break this record.’
- (26) a. *?[Zhangsan [weile fangwen t₁] qu-le Bali de] geshou₁ ...
 Zhangsan WEILE interview go-PRF Paris MOD singer
 ‘The singer that Zhangsan went to Paris to interview ...’
- b. *?[Zhangsan [weile shuaxin t₁] fushi jin-yao de]
 Zhangsan WEILE break consume banned-drugs MOD
 zhe-xiang jilu₁ ...
 this-CL record
 ‘This record that Zhangsan consumed performance-enhancing drugs to break ...’

This difference cannot be easily attributed to a difference in how tense is (abstractly) represented; in modal and temporal terms, there is no difference between *wei(le)* adjuncts and post-VP purposive clauses. Nor is there clear evidence that *wei(le)* clauses are structurally different than post-VP purposive clauses, beyond how they are linearly ordered with respect to the VP; for instance, both types of clauses can be elided as part of a VP (27).

- (27) a. Lisi hui [weile canjia bisai] qu Bali, Zhangsan ye hui.
 Lisi will WEILE participate competition go Paris Zhangsan also will
 ‘Lisi will go to Paris to participate in the competition. Zhangsan will
 (go to Paris to participate in the competition), too.’
 b. Lisi hui qu Bali [canjia bisai], Zhangsan ye hui.
 Lisi will go Paris participate competition Zhangsan also will
 ‘Lisi will go to Paris to participate in the competition. Zhangsan will
 (go to Paris to participate in the competition, too), too.’

I would like to suggest that the low acceptability of (26) might follow from independent properties of Mandarin Chinese, on the assumption that *wei(le)* is a preposition. Mandarin Chinese PPs generally do not allow A-bar movement from within, as shown in (28) and (29). Evidence for the prepositional nature of *wei(le)* comes from the fact that it can take a nominal complement (28) and appears in a pre-verbal position typical of Mandarin Chinese PPs.

- (28) a. PPs with nominal complements
 (i) Zhangsan [_{PP} weile Lisi] cizhi.
 Zhangsan for Lisi quit
 ‘Zhangsan resigned because of Lisi.’
 (ii) Zhangsan [_{PP} dui Lisi] hen manyi.
 Zhangsan about Lisi very satisfied
 ‘Zhangsan is satisfied with Lisi.’
 (iii) Zhangsan hui [_{PP} gen Lisi] qu Deguo.
 Zhangsan will with Lisi go Germany
 ‘Zhangsan will go to Germany with Lisi.’
 b. No preposition stranding
 (i) *Lisi₁, Zhangsan [weile t₁] cizhi.
 Lisi Zhangsan for quit
 ‘Lisi, Zhangsan resigned because of him.’
 (ii) *Lisi₁, Zhangsan [dui t₁] hen manyi.
 (iii) Lisi₁, Zhangsan hui [gen t₁] quo Deguo.
- (29) a. PPs with clausal complements
 (i) Zhangsan [_{PP} dui Lisi bu hui shuo deyu] hen
 Zhangsan about Lisi NEG can speak German very
 zaiyi.
 be.bothered
 ‘Zhangsan is very bothered that Lisi cannot speak German.’

- (ii) Zhe-jian shi [PP gen Lisi bu hui shuo deyu]
 this-CL matter with Lisi NEG can speak German
 wanquan mei-you guanxi.
 completely NEG-exist relation
 ‘This matter has nothing to do with Lisi’s not being able to speak German.’
- b. No A-bar movement from clausal complements of prepositions
 - (i) *[Zhangsan [PP dui Lisi bu hui shuo t₁] hen zaiyi]
 Zhangsan about Lisi NEG can speak very be.bothered
 de] yuyan₁ ...
 MOD language
 ‘The language that Zhangsan is very bothered that Lisi cannot speak it ...’
 - (ii) *[Zhe-jian shi [PP gen Lisi bu hui shuo t₁] wanquan]
 this-CL matter with Lisi NEG can speak completely
 mei-you guanxi de] yuyan₁ ...
 NEG-exist relation MOD language
 ‘The language that this matter has nothing to do with Lisi’s not being able to speak it ...’

For transparency, I note that Lin and Liao (2019) analyze a *lai*-marked rationale clause not as an adjunct, but (somewhat unconventionally) as the complement of the main verb, with a secondary predicate function. They argue against an adjunct analysis by pointing out that Chinese generally blocks right adjunction. In their analysis, the object is assumed to be generated in a specifier position, and the verb raises to a position that precedes the object and the rationale clause. However, their complement analysis has a number of weaknesses. First, Mandarin duration and frequency phrases appear on the right of a VP. If these phrases are adjuncts, they challenge the generalization that Chinese lacks right adjunction (a point that Lin and Liao concede in their footnote 4). Second, it is difficult to evaluate their proposal in the absence of more clearly articulated assumptions about the syntax of secondary predication and how secondary predication is syntactically distinct from

adjunction. In fact, Lin and Liao’s proposal seems to imply that secondary predicates appear post-verbally, but this is not the case for all secondary predicates in Mandarin (Zhang, 2001). Third, this analysis is silent on why these clauses cannot contain a *wh*-adverb like *weishenme* “why” (30a), especially in light of the fact there are clausal complements in Mandarin that can (30b). In contrast, the low acceptability of (30a) can be captured more easily under an adjunct analysis, since it is known that *wh*-adverbs like *weishenme* cannot appear in adjuncts (and islands) in Mandarin Chinese (30c) (see J.-W. Lin, 1992).⁶

- (30) a. *Zhangsan mai shu [lai weishenme quyue Lisi]?
 Zhangsan buy book come why please Lisi
 ‘What is the reason such that Zhangsan bought books to please Lisi for that reason?’ (Plausible answer: “Because a happy Lisi would help Zhangsan get promoted.”)
- b. Zhangsan shuo [Lisi weishenme cizhi]?
 Zhangsan say Lisi why resign
 ‘Why₁ did Zhangsan say [that Lisi resigned t₁]?’
- c. *Zhangsan [zai jingli weishenme kaichu Lisi zhihou] cizhi?
 Zhangsan at manager how dismiss Lisi after resign
 ‘What is the reason such that Zhangsan resigned after the manager fired Lisi for that reason?’

3.1.5 Extending the analysis for porous relative clauses to purposive clauses

Given that the argument that purposive clauses also exhibit tense dependence, it is interesting to also consider the question of how tense dependence is represented in purposive clauses, and how this representation explains why A-bar movement

⁶Of course, there could well be some independent factor that explains why *weishenme* is unacceptable in a clausal complement, but what this factor might be is not addressed in Lin and Liao’s proposal.

from purposive clauses is possible. In the previous chapter, I suggested two ways of modeling tense dependence and A-bar movement in porous relative clauses. In this section, I discuss ways to adapt these analyses to also account for A-bar movement from purposive clauses.

3.1.5.1 Adapting a movement-based analysis

The first analysis of porous relative clauses presented in the previous chapter claims that they are porous because they do not undergo any movement and therefore do not freeze (echoing Sichel, 2018); this movement-based analysis accounts for some of the interpretations associated with NPs modified by porous relative clauses and can explain a number of restrictions on tense and temporal interpretations in porous relative clauses.

Extending this approach to other adjuncts poses a problem. The null hypothesis is that adjuncts, in general, do not move, except for e.g. stylistic reasons when they are fronted to a clause-initial position. Consequently, all else being equal, any (clausal) adjunct that remains in situ should be compatible with A-bar movement. This prediction is too strong, as it allows *because*, *so* (*that*) clauses (among others) to be compatible with A-bar movement.

In order to extend this movement-based analysis to purposive clauses but not other adjuncts, other assumptions are necessary. As I see it, a relatively simple option is to reframe this movement-based analysis as a height-based one (echoing a part of the proposal in Truswell, 2007, 2011). Specifically, one might hypothesize

that only clausal adjuncts that remain within a VP at LF are compatible with A-bar movement. This formulation includes porous relative clauses, on the assumption that these relative clauses modify VP-internal NPs that remain in situ. It also captures purposive clauses, which adjoin to positions inside a VP (see VP preposing data in Section 3.1.1), while excluding clausal adjuncts like *so (that)* and *because* clauses. The VP preposing diagnostic (31) shows that both *so (that)* and *because* clauses do not prepose as easily as a (non-finite) purposive clause; in (31c), I changed the object from *a flight* to *a seven a.m. flight* to make the VP heavier and thus more comparable to the examples with *so that* and *because*. The same can be said for *only to* telic adjuncts, which attach to a relatively high position in a clause (Whelpton, 1995) (32).

- (31) a. ??Mary thought that John should leave early [so that he could catch a flight], and [leave early [so that he could catch a flight]] he did.
 b. *Mary thought that John should leave early [because he had to catch a flight], and [leave early [because he had to catch a flight]] he did.
 c. Mary thought that John should leave early [(in order) to catch a seven a.m. flight], and [leave early [(in order) to catch a seven a.m. flight]] he did.
- (32) ??Kate predicted that John would leave [only to run into Mary], and [leave [only to run into Mary]] he did.

Strictly speaking, what the VP preposing data show is that purposive clauses are found in a VP-internal position in overt syntax. This alone does not mean that purposive clauses remain in this VP-internal position at LF. One thus requires the additional assumption that purposive clauses do not move further at LF, which strikes me as a fairly reasonable assumption, since there is no independent evidence

to think that they do.

This height-based reframing overgenerates, predicting that all VP-internal adjuncts are compatible with A-bar movement. As Truswell (2007, 2011) observes, this prediction is only partially borne out. It is thus necessary to introduce other constraints on A-bar movement from adjuncts to prevent overgeneration.

For English at least, A-bar movement can take place from structurally-low PP adjuncts, resulting in preposition stranding (33), but there are notable exceptions. For example, stranding is less acceptable for temporal prepositions like *before* or *during* and for latinate ones like *via* (cf. *from*, which is similar semantically) (34). Cross-linguistically, preposition stranding is rare, occurring robustly only in a small number of Germanic languages. Additional constraints are thus needed to explain the limited availability of P-stranding under A-bar movement.

- (33) John said he would observe the leaf [with a microscope], and [observe the leaf [with a microscope]] he did.
- a. What_{t1} did John observe the leaf [with t₁]?
 - b. That's the microscope_{t1} that John observed the leaf [with t₁].
- (34) a. John said he would leave [before 3 pm], and [leave [before 3 pm]] he did.
- (i) ??What time_{t1} did John leave [before t₁]?
 - (ii) *That's the time of the day_{t1} that John left [before t₁].
 - b. Mary said she would order the hat [via the website], and [order the hat [via the website]] she did.
 - (i) *Which website_{t1} did Mary order the hat [via t₁]?
 - (ii) *That's the website_{t1} that Mary ordered the hat [via t₁].

As for gerundival adjuncts, which are also structurally low, Truswell (2007, 2011) argues that only those bear a particular event semantic relation with the

main VP may do so, as set out by his Single Event Grouping Condition⁷ (35).

- (35) a. Mary said John would drive crazy [whistling *Happy Birthday*], and [drive her crazy [whistling *Happy Birthday*]] he did.
 (i) [What song]₁ did John drive Mary crazy [whistling t₁]?
 (ii) That's the song₁ that John drove Mary crazy [whistling t₁].
 b. John said he would arrive [wearing a suit], and [arrive [wearing a suit]] he did.
 (i) [What kind of clothing]₁ did John arrive [wearing t₁]?
 (ii) That's the suit₁ that John arrive [wearing t₁].
 c. John said he would work on his homework [whistling *Happy Birthday*], and [work on his homework [whistling *Happy Birthday*]] he did.
 (i) *[What song]₁ did John work on his homework [whistling t₁]?
 (ii) *That's the song₁ John worked on his homework [whistling t₁].
 (adapted from various examples in Truswell, 2011)

For thoroughness, temporal adjuncts are also VP-internal (36). but as mentioned in Section 3.1.4.1, there might be independent reasons why A-bar movement from temporal adjuncts is unacceptable.⁸

- (36) Mary said she would leave [{before/after} John called Sam], and [leave [{before/after} John called Sam]] she did.
 a. ??Who₁ did Mary leave [before John called t₁]?
 b. *That's the person₁ that Mary left [before John called t₁].

Setting aside these instances of overgeneration, from a cross-linguistic variation perspective, this height-based reframing means that languages vary in terms of whether A-bar movement is possible from clausal adjuncts that are found within a VP at LF. While this analysis allows us to accommodate purposive clauses and a

⁷Truswell intends for the Single Event Grouping Condition to cover A-bar movement from purposive clauses. It is logically possible, although perhaps a little redundant, that A-bar movement from purposive clauses can be accounted for by both tense dependence (or more precisely, a height-based analysis or defective tense analysis that derives tense dependence) and by the Single Event Grouping Condition.

⁸But see Truswell, 2007, 2011 for discussion on relatively acceptable A-bar movement from temporal adjuncts that have gerundival complements, like *Which book did John design his garden after reading?*. Truswell however acknowledges that not all speakers accept such sentences, but does not address this fact in detail.

range of other adjuncts, it leaves us with a somewhat unsatisfying account of why regular relative clauses and certain adjuncts are incompatible with A-bar movement. In the original movement-based analysis, the fact that regular relative clauses are incompatible with A-bar movement is attributed to the idea that the NPs they modify move and then freeze. The height-based reframing does away with freezing effects, since freezing does not explain why many adjuncts that adjoin to VP are incompatible with A-bar movement. Instead, it replaces freezing with a stipulation: VP-internal adjuncts are compatible with A-bar movement; VP-external ones are not.

In addition, this height-based analysis still predicts that A-bar movement is not possible from adjuncts outside of a VP; this prediction is inconsistent with the Mandarin Chinese examples where A-bar movement is observed with porous relative clauses modifying a subject (37).

- (37) [Zhe-ben shu]₁ wo renwei [_{Subject} [du-guo t₁ de] ren] bu duo.
 this-CL book I think read-EXP MOD person not many
 ‘This book, I think there are not many people who have read it.’ (Mandarin Chinese; Xu and Langendoen, 1985 p. 14 ex. 61a) (= (41) in Chapter 2)

3.1.5.2 A defective tense analysis

A defective tense analysis avoids some of the stipulation and undergeneration issues associated with the movement/height-based analysis. In this alternative analysis, tense dependence is the semantic reflex of defective tense morphemes. At the same time, this defectiveness neutralizes the locality domain (a phase that corresponds to the clause), thus allowing A-bar movement from porous relative clauses

without incurring a violation of the Phase Impenetrability Condition.

This analysis can be easily extended to accommodate purposive clauses. As mentioned above, purposive clauses are clauses with non-finite tense, which we might take to be a morphological realization of defectiveness. Further, in purposive clauses, the interpretation of this tense morpheme is necessarily in the future of the time interval denoted by the tense in the main clause. From a cross-linguistic variation perspective, what this analysis means is that languages vary in terms of whether defective tense can neutralize phases or not.

As presented, this particular analysis is silent about the well-formedness of A-bar movement from other non-clausal adjuncts, such as PPs and present participial adjuncts. To make a clear prediction, one needs to take a position as to whether these adjuncts are phases. If they are, one needs to further take a position on whether they contain “escape hatches” on the left edge of the phase for A-bar movement. Further, in the context of present participial adjuncts, because these adjuncts do not contain a non-finite *to* and are not inflected for tense, one must also take a position on whether they contain (silent) tense morphemes.

The lack of clear predictions is perhaps not an undesirable empirical outcome, because these adjuncts do not behave uniformly with respect to A-bar movement. As noted above, it is not unreasonable to think that there are other conditions on A-bar movement from these adjuncts.

3.2 Alternative characterizations of purposive clauses and porous relative clauses

In this section, I consider other treatments of purposive clauses and porous relative clauses. I consider three distinct approaches: a discourse-based one, centered on the notion of “backgroundedness,” a semantic one, based on the notion of veridicality, and a morphosyntactic one, based on mood. Generally, there are two ways in which these characterizations are less ideal than the tense dependence one put forward in the previous chapter and the above sections. First, as described in greater detail below, these approaches have empirical shortcomings; they either undergenerate, predicting that certain porous relative clauses are incompatible with A-bar movement, or overgenerate, incorrectly predicting acceptable A-bar movement from certain regular relative clauses. Second, it is not always clear how to tie these characterizations to A-bar movement, short of introducing a stipulation like “no A-bar movement from backgrounded/veridical adjuncts.” To the extent that the tense dependence approach yields less stipulative analyses of A-bar movement, it is more desirable.

3.2.1 Backgroundedness

There is a tradition of framing constraints on A-bar movement in discourse terms. For example, structures (including adjuncts) that are incompatible with A-bar movement are often described as being “backgrounded” (Goldberg, 2006) or “not

dominant” (Erteschik-Shir, 1973).

For the purpose of discussion, I will use as a case study the analysis of A-bar movement from porous relative clauses and purposive clauses put forward by Goldberg (2006), as this is the most recent worked out account in this literature, as far as I am aware of. Goldberg suggests that both kinds of adjuncts form a natural class in discourse terms: they are “non-backgrounded,” unlike other adjuncts.

One limitation of Goldberg’s approach (and often of discourse-based approaches in general) is that the notion of “backgroundedness” is difficult to make precise, because it partly requires one to reliably identify what a speaker intends to assert when he/she produces a particular utterance. For example, Goldberg considers a constituent to be “backgrounded” if it “correspond[s] neither to the primary topic nor to part of the potential focus domain [of the sentence]”, such that a topic serves to “contextualize other elements in the clause” and a potential focus domain is “that part of a sentence that is interpretable as being asserted” (p. 130; see references therein for more detail).

Goldberg also offers a diagnostic for backgroundedness: a negation test, variants of which have been previously proposed in the literature, starting with Erteschik-Shir, 1973. In this particular version, an embedded clause is backgrounded if sentential negation (in the main clause) does not “imply a negation of the proposition expressed by the subordinate clause” (p. 143). Although she does not fully explain the test, it is quite straightforward to see from her examples to see how the negation test is intended to work.

The negation test in the existential construction, as presented by Goldberg,

predicts correctly that the relative clause is not backgrounded and therefore compatible with A-bar movement (38). Applying it to a definite NP in a non-porous context shows that it is backgrounded (39), and therefore blocks A-bar movement.

- (38) There are many children [who like this kind of ice cream]. (Goldberg, 2006, p. 146 ex. 59)
- a. Sentential negation: There are not many children [who like this kind of ice cream].
 - b. Proposition expressed by relative clause⁹: “Many children like this kind of ice cream.”
 - c. Negation of proposition by relative clause: “Many children don’t like this kind of ice cream.”
 - d. (a) can imply (c): *There are not many children [who like this kind of ice cream]* does imply “Many children don’t like this kind of ice cream.”
- (39) Mary saw the children [who like this kind of ice cream].
- a. Sentential negation: Mary didn’t see the children [who like this kind of ice cream].
 - b. Proposition expressed by relative clause: “The children like this kind of ice cream.”
 - c. Negation of proposition by relative clause: “The children don’t like this kind of ice cream.”
 - d. (a) does not imply (c): *Mary didn’t see the children [who like this kind of ice cream]* does not imply “The children don’t like this kind of ice cream.”

The negation test shows that purposive clauses pattern like porous relative clauses.

- (40) Mary went to the store [to buy apples].
- a. Sentential negation: Mary didn’t go to the store [to buy apples].
 - b. Proposition expressed by purposive clause: “[Mary] bought apples”
 - c. Negation of proposition by purposive clause: “Mary didn’t buy apples.”
 - d. (a) can imply (c): *Mary didn’t go to the store to buy apples* is compatible with “Mary didn’t buy apples”; for all we know, Mary went to the store to buy only bananas.

⁹Note that in standard formal semantic analyses, relative clauses denote properties, not propositions. I will simply follow Goldberg’s discussion in these examples.

However, Goldberg concedes that the test overgenerates. Specifically, she points out that it predicts that indefinite NPs are always not backgrounded, giving an example like (41), and therefore should always be compatible with A-bar movement, contrary to fact (42).

- (41) She met a boy [who resembled her father]. (adapted from *ibid.* p. 147, ex. 63)
- a. Sentential negation: She didn't meet a boy who resembled her father.
 - b. Proposition expressed by relative clause: "A boy resembled her father"
 - c. Negation of contents of relative clause: "A boy did not resemble her father"
 - d. (a) can imply (c): *She didn't meet a boy who resembled her father* is compatible with "A boy did not resemble her father"; for all we know, no boys resemble the father in question.
- (42) a. *Who₁ did she meet a boy [who resembled t₁]?
b. *That's the relative₁ she met a boy [who resembled t₁].

Even supposing that a more appropriate negation test can be found, this particular discourse-based approach is silent about cross-linguistic variation. For this analysis to cover the facts for languages like German, one would need to assume that either backgroundedness or negation somehow works differently in German and languages like English. This would pose non-trivial questions about how learners might acquire such cross-linguistic distinctions, since backgroundedness and negation are highly abstract notions that are not explicitly taught.

3.2.2 Veridicality

Another potential approach, very similar to the intuition that underlies the negation test and the backgroundedness analysis, is to analyze both porous relative

clauses and purposive clauses as non-veridical clausal adjuncts and to claim that in languages like English, such adjuncts are exceptionally compatible with A-bar movement. For the sake of argument, I will define the notion of “adjunct proposition” as the proposition denoted by the (highest) TP in a porous relative clause or purposive clause, after existential closure of any unbound arguments. A clausal adjunct is non-veridical if the adjunct proposition is not entailed by the proposition denoted by the highest finite TP that contains the adjunct.

By these definitions, the porous relative clause in a non de re construction is non-veridical (43a). In this construction, the complex NP receives a de dicto or “third reading,” and does not denote any actual individual. Consequently, the adjunct is a predicate that does not describe any actual individual, and the corresponding proposition is not necessarily true. A purposive clause is also non-veridical; in the example in (43b), it could well be the case that there were no apples to be bought; perhaps the store had run out of apples.

- (43) a. Mary wants to find a programmer [who can solve this problem]. \nrightarrow “someone can solve this problem” [Non de re construction]
 b. Mary went to the store to buy apples. \nrightarrow “someone bought apples” [Purposive clause]

It also arguably correctly predicts that *because*, *so that*, *only to*, and *after* adjunct clauses are veridical, and therefore block A-bar movement.

- (44) a. Mary went to the store [because she wanted to buy apples]. \rightarrow “someone wanted to buy apples” (namely, Mary)
 b. Mary went to the store [because she could buy apples]. \rightarrow “someone could buy apples” (namely, Mary)
 c. Mary left the room [only to run into John]. \rightarrow “someone ran into John” (namely, Mary)
 d. Mary left [after John called Sam]. \rightarrow “John called Sam”

However, this approach appears to under-generate; the definitions adopted show that the other porous relative clauses are veridical, and so should block A-bar movement (45). It also over-generates for *before* clauses, since these are not veridical (46), although as observed above in Section 3.1.4.1, there are independent reasons for why A-bar movement from *before* clauses should be unacceptable.

- (45) a. Stevie is the only person [who wanted to record the song]. → “someone wanted to record the song” (namely, Stevie)
 b. There are many people [who condone violence] in this town. → “someone condones violence”
 c. I know many people [who’ve been taken in by this trick]. → “someone has been taken in by this trick”
- (46) Mozart died [before he completed his *Requiem*]. \nrightarrow “Mozart completed his *Requiem*”

3.2.3 Mood

Alternatively, one could posit the presence of mood morphology, and tie islandhood to that, with a constraint like “No A-bar movement from an adjunct marked in the indicative mood.” Some initial support for such a constraint comes from Romance languages, where a complex NP that receives a *de dicto* reading has a relative clause that is marked in the subjunctive. In contrast, when the relative clause is in the indicative, the complex NP receives a *de re* reading.

- (47) Spanish (Romero, 2004, p. 272, exx. 16–17, also Bleam, 1999 and references therein)
- a. En 1990, Juan estaba buscando a un profesor que podía
 in 1990 Juan was looking-for PRT a professor that could.IND
 hablar 7 idiomas.
 speak 7 languages

- ‘In 1990, Juan was looking for a professor that could.IND speak 7 languages.’ [Only de re reading of complex NP]
- b. En 1990, Juan estaba buscando a un profesor que pudiese
 In 1990 Juan was looking-for PRT a professor that could.SBJ
 hablar 7 idiomas.
 speak 7 languages
 ‘In 1990, Juan was looking for a professor that could.SBJ speak 7 languages.’ [Only de dicto reading]

It is also necessary to assume some kind of covert mood morphology. Doing so is necessary for purposive clauses, which are non-finite and do not show overt indicative or subjunctive mood morphology, not even in Brazilian Portuguese; one might hypothesize that purposive clauses have phonologically null subjunctive mood. In a similar way, there are also languages in which finite clauses do not make a clear morphological distinction, like English. One solution is to assume that these languages make the same mood distinction as Romance, except that mood morphology is not directly observable.

For the sake of argument, suppose that purposive clauses and porous relative clauses bear (abstract) subjunctive mood, even though their verbal morphology does not suggest it. Learners observe A-bar movement from purposive clauses, and conclude that all subjunctive-marked adjuncts, including porous relative clauses, are compatible with A-bar movement.

However, this analysis overgenerates. Consider affirmative existential constructions and predication constructions. In Romance, the relative clause of the complex NP is marked in the indicative in these constructions (48). If mood in English tracks mood in Romance, then the relative clause in English sentences like

There are many Americans who condone violence or *Maria is the person who wanted to record this song* should bear indicative mood, which, by hypothesis, is incompatible with A-bar movement. This prediction is not borne out: A-bar movement from the relative clauses in these circumstances is relatively acceptable.

(48) Brazilian Portuguese (Gesoel Mendes, p.c.)

- a. Tem muitos americanos que aceitam violência.
have many Americans that condone.IND violence
'There are many Americans who condone violence.'
- b. A Maria é a pessoa que quis gravar essa música.
the Maria is the person that wanted.IND record this song
'Maria is the person who wanted to record this song.'

3.3 Corpus study 2: A-bar movement from purposive clauses in the input in English

In previous sections, I observed that porous relative clauses and purposive clauses appear to pattern together with respect to their A-bar movement properties. I argued that this is because they are members of a natural class: adjuncts that show tense dependence. I also presented formal analyses of how tense dependence might be derived and be connected to A-bar movement.

Of course, showing that porous relative clauses and purposive clauses form a natural class does not immediately validate the proposed indirect learning account. In fact, the account also requires that learners get to observe A-bar movement from purposive clauses in the input. Using English and Mandarin Chinese corpus data, I will argue that such structures are indeed available. I will then discuss what kind of learning biases and knowledge learners need to make the appropriate inferences

to arrive at an adult-like grammar.

In principle, to really establish this point, one would ideally show that A-bar movement from purposive clauses or porous relative clauses is absent in the linguistic experience of German (Bulgarian, Polish, etc.) speakers, perhaps through the analysis of comparable corpora. Unfortunately, this is not feasible, as I do not have the relevant language skills or the relevant datasets to work with. However, as noted previously, existing descriptions suggest that these structures are unacceptable to native speakers. It is thus likely that such structures are either absent, or occur only extremely rarely, such as in the event of a production error. It is thus plausible to believe that A-bar movement from these kinds of clauses are much less likely to be readily attested in the linguistic experience for speakers of these languages.

3.3.1 Datasets

Following Pearl and Sprouse (2013a,b), I chose two English language datasets for analysis: the CHILDES Treebank (ibid.) and the Penn Treebank (Marcus et al., 1999). As was the case for the first corpus study (section 2.2.2), The ATIS-3 dataset was excluded from the Penn Treebank analysis because it consists of queries about air travel.

These two treebanks were chosen for several reasons.

First, the data in these treebanks can be thought to represent linguistic input at different stages in the language acquisition process. The CHILDES Treebank is a proxy of the input a monolingual learner of English encounters in the first 5 years of

life (age of child = 0;6–5;1), while the Penn Treebank is intended as a proxy (albeit an imperfect one) of the input encountered by an older monolingual English learner.

The Penn Treebank also makes up for certain limitations of the CHILDES data. The CHILDES dataset studied is relatively small, pooling data from the Brown, Soderstrom, Suppes, and Valian corpora (Brown, 1973; Soderstrom et al., 2008; Suppes, 1974; Valian, 1991). For these four corpora, utterances of all types were annotated, yielding a total of 173,058 utterances. Assuming that children hear 1 million utterances in the first three years of learning a language, or approximately 333,000 utterances a year (Pearl and Sprouse, 2013a,b), these four corpora would constitute only half a year of data.

A null result from a CHILDES corpus analysis — i.e. the absence of A-bar movement from purposive clauses — might simply be an artifact of its size. The slightly larger Penn Treebank (251,255 utterances, excluding the 572 utterances from ATIS) compensates for this limitation to a certain extent.

Alternatively, learners might learn about A-bar movement from purposive clauses and porous relative clauses at a relatively late age, after exposure to more sophisticated syntax, which, for the purposes of this paper, is represented by the Penn Treebank.

3.3.2 How much input does a learner get?

We need to normalize corpus counts so that we can estimate how frequently a learner might observe such constructions. To that end, it is important to also

determine how much input a learner gets. Hart and Risley (1995) report that the quantity of input varies widely across households, but generally increases with family socioeconomic status (SES). I therefore estimated annual parent utterances for “professional” families (i.e. high SES) and “welfare” families (low SES), using Hart and Risley’s average utterances per hour for these families (487 and 176, respectively) and extrapolating this per-hour figure to a “5200-hour year” (Hart and Risley, 2003, p. 8). I note that they used the same extrapolation method to make the claim that children from low SES backgrounds face a 30-million word gap. This method produced a range of about 900,000 to 2.5 million utterances a year.

In contrast, other researchers have adopted more conservative estimates. Pearl and Sprouse (2013b) (p. 40, also Pearl and Sprouse, 2013a) assume that children hear only 1 million utterances in the first three years of learning a language, or approximately 333,000 utterances a year or about 64 utterances per hour. In a paper on syntactic bootstrapping, White et al. (2018), adopting a conservative estimate, assume that children hear at least 633 sentences a day (p. 10) or 231,000 sentences a year (approximately 45 sentences an hour, given a 14-hour day).

One might be skeptical of Hart and Risley’s assumption that children get exposed to as many as 5,200 hours of linguistic input a year. I note, however, that halving their estimates yields 450,000 to 1.25 million utterances a year, which are still substantially higher than Pearl and Sprouse’s or White et al.’s estimates.

| Utterances encountered a year | |
|-------------------------------|--|
| (49) | White et al. estimate 230,936 |
| | Pearl and Sprouse estimate: 333,333 |
| | Hart and Risley estimates for ... |
| | ... “Welfare” (low SES) families 915,200 |
| | ... “Professional” (high SES) families 2,532,400 |

Of course, quantity of input is not the only thing that varies for learners; quality varies as well. For instance, there is evidence that children from low-SES households are more likely to observe tokens with simpler syntax (e.g. Hoff, 2003; Huttenlocher et al., 2002, 2007). Put differently, in the context of purposive clauses, compared to their higher-SES peers, learners from low-SES backgrounds might observe purposive clauses less frequently in absolute terms (because they observe fewer tokens in a given time period in general) and in relative terms (because purposive clauses and other syntactically complex structures are under-represented in their input). Consequently, they are also less likely to observe A-bar movement from purposive clauses. While I do not have any reliable way to measure this difference in quality, this fact means that frequency estimates calculated below is likely to have a large variance, i.e. it is likely to both overstate and understate the amount of input available for sizeable parts of the population.

3.3.3 CHILDES Treebank study: Methods

As Pearl and Sprouse noted, the data in the CHILDES Treebank is much more conversational in nature, containing more speech errors and fragments, which in turn raises concerns about how an utterance might be assigned a tree representation. Out of an abundance of caution, I extracted sentences of the surface forms “... V ...

to ... V ...” with the Python Natural Language Toolkit (Bird et al., 2009).

This extraction algorithm generated many false positives. For instance, it is intended to extract sentences containing purposive clauses like *Mary left [to catch the bus]*. However, it also extracts sentences with non-finite arguments that resemble the adjuncts of interest, e.g. *Mary wanted [to catch the bus]*.

Most tokens can be straightforwardly identified as complements or adjuncts. However, there are a small number of cases where it is less clear whether a clausal constituent is a rationale clause (an adjunct) or a complement clause. In these instances, the following tests were used; a clausal constituent needs to pass all tests to be considered a rationale clause.

(50) Tests for rationale clauses

- a. Fronting: an adjunct can typically be fronted.
- b. Omission: an adjunct can typically be omitted (Ernst, 2001).
- c. *In order* insertion for rationale clauses: in a VP of the schema *V ... (for NP) to VP*, the *to VP* is a rationale clause if *in order* can be inserted immediately before *(for NP) to* (Whelpton, 1995).
- d. *Do so* test for rationale clauses adjoined to the VP headed by an agentive main verb: in a VP of the schema *V ... to VP*, the *to VP* is a rationale clause if the preceding material can be replaced with *do so* (Rissman and Rawlins, 2017).
- e. Actuality entailment test for rationale clauses: The proposition denoted by a rationale clause can be denied in a following sentence.

3.3.4 CHILDES Treebank: Results

The CHILDES Treebank script yielded 11,880 sentences containing at least one non-finite clause. Half (5,907 sentences) were randomly selected for manual coding. Of this set of 5,907 sentences, only one was a clear case of A-bar movement

from the adjunct (51).¹⁰

- (51) `because that 's what they were born to be *t*-1 .` [Brown corpus, Adam]

The results suggest that out of 173,000 sentences, there are approximately 2 sentences with A-bar movement from a purposive clause. In absolute terms, this is, of course, very rare.

3.3.5 Penn Treebank study: Methods

I wrote a script using the Python Natural Language Toolkit to extract all A-bar dependencies. For each A-bar dependency, following Pearl and Sprouse (2013a,b), the script constructed a sequence of container nodes: the maximal projections that dominate the gap but not the *wh*-phrase. The container nodes therefore represent the path of movement of the *wh*-phrase.

I then selected A-bar dependencies whose container node sequences contain maximal projections labeled as S-PRP and S-CLR. These projections are likely to be adjuncts of verbal projections, according to the Penn Treebank documentation. I also selected A-bar dependencies whose container node sequences contain an NP that immediately dominates an SBAR or S, with the goal of identifying finite and non-finite relative clauses. These sentences were then manually checked to ensure that the A-bar dependencies involve A-bar movement from what are unambiguously

¹⁰(51) exemplifies a purpose clause, not a rationale clause: the (subject) gap is bound by the internal argument of the matrix verb; see e.g. Jones, 1991. There were also three examples of A-bar movement from a *to VP* constituent following *go*, such as *who did ya go to see ?* (Brown corpus, Sarah). Applying the criteria in (50), I do not count these examples as clear examples of adjuncts. For example, this constituent cannot be freely omitted or preposed like adjuncts, e.g. **To see Mary, John went.*

adjuncts.

3.3.6 Penn Treebank: Results

The above process yielded 0 tokens of A-bar movement from a finite complement or adjunct of an NP, as mentioned in Section 2.2.1. The process did yield 16 tokens that contained A-bar movement from non-finite clausal constituents that quite clearly have a purposive interpretation (52); I list all 16 examples in (52). The majority of these tokens feature relativization; no *wh*-question example was observed. A minority of these clausal adjuncts (5, to be specific) were analyzed as adjoining to NPs in the Treebank, although a case for a VP adjunction analysis can also be made, especially since they appear in the same position as an adjunct of VP and there is no clear positive morphosyntactic evidence that they are adjoined to NPs. Overall, the rate of occurrence of A-bar movement from a non-finite clausal adjunct, 16 out of 251,000 utterances, is higher relative to the rate in the CHILDES Treebank. In absolute terms, though, these A-bar movement examples are still fairly uncommon in the Penn Treebank.

- (52) Non-finite clauses that are unambiguously adjuncts in the Penn Treebank
- a. A-bar movement from what the Penn Treebank analyzes as VP-level adjuncts
 - (i) That is one thing 0 the experiments are designed *-2 *-3 to find *T*-1 out .
 - (ii) What I am here * to do *T*-2 is * to report on the gyrations of the struggle - a struggle that *T*-1 amounts to self-redefinition - to see if we can predict its future course .
 - (iii) He is throttling the liberty 0 my father gave his life * to win *T*-1 ’’ ! !
 - (iv) Beyond that misty gray of the rain , he saw the stretch-

ing hutment , low diminutive log cabins , chinked * with mud , with doorways 0 a man would have *-2 to crouch * to get through *T*-1 , with roofs of tenting laid * over boughs or boards from hardtack boxes , or fence rails , with cranky chimneys of sticks and dried mud .

- (v) I think 0 the last movie that we went out *-1 to see *T*-2 was DANCES WITH WOLVES . E_S
 - (vi) and \[it will , \+ depending on what topic you called in *-1 to hear about *T*-2 whether it was the news or the weather or a soap opera update , it will \] give you , um , updated information . E_S
 - (vii) We do have a lot of things \[that , \+ you know , that , \] you know , the taxes are there * to support *T*-1 , E_S
 - (viii) \[he , \+ he \] said that 's what we were going there *-3 to do *T*-1 E_S
 - (ix) And I think though that we need *-1 to have some liquid *ICH*-3 around that you do n't have *-2 to go through the company *-5 to get *T*-4 . E_S
 - (x) Not only does this come close to a violation of law , it violates the trust 0 we have all worked *-1 to develop *T*-2 . „
 - (xi) It also takes money that CNN has been reluctant *-1 to spend *T*-2 *-3 to make programs and hire talent that viewers will tune in specially *-5 to see *T*-4 .
- b. A-bar movement from what the Penn Treebank analyzes as NP-level adjuncts
- (i) It was all 0 Greg had time 0 * to see *T*-2 *T*-1 .
 - (ii) It has identified itself with the very tension and terror 0 it once did so much 0 *T*-1 to alleviate *T*-2 .
 - (iii) and \[the one , \+ I have another one \] that *T*-1 's three and a half and have all these clothes , and toys and stuff that we 're just trying *-2 to find places 0 * to put *T*-4 *T*-3 , E_S
 - (iv) It seems 0 that 'd be a subject that \[I , \+ I \] do n't have much 0 *-1 to say *T*-2 on *T*-3 . E_S
 - (v) but \[I , \+ uh , I \] basically never charge anything 0 I do n't have the money in the bank 0 *-2 to pay for *T*-1 *T*-3 . E_S

3.3.7 General discussion

I first summarize the CHILDES Treebank and Penn Treebank studies, giving estimates for the number of utterances with A-bar movement from a purposive clause that a learner might hear in a year (53).

(53) Summary of corpus study results

| | 50% random sample of CHILDES Treebank | Penn Treebank sample |
|---|--|----------------------------|
| A-bar movement from purposive clauses | 1 | 16 |
| Extrapolated to ... | | |
| - 231k utterances (White et al. estimate) | 3 | 15 |
| - 333k utterances (P&S estimate) | 4 | 21 |
| - 915k utterances (low-SES families) | 11 | 58 |
| - 2.5m utterances (high-SES families) | 29 | 161 |

If A-bar movement from purposive clause is indeed the positive evidence learners use to infer that A-bar movement from porous relative clauses is possible, then the CHILDES corpus data suggest that this evidence is relatively rare in the input that a child receives in the first three years of language acquisition. Exactly how rare it is in absolute terms depends in part on one's assumptions about the amount of input (setting aside questions about the quality of input or how accurately children can parse their input, of course). Assuming Pearl and Sprouse's estimate of 333,000 utterances a year, a child comes across about 4 instances of A-bar movement from rationale clauses a year, or about one example every three months. Adopting Hart and Risley's estimates, however, one concludes that children from low-SES families might hear as many as 11 such examples every year, or about one example a month; children from high-SES families hear maybe 3 times as many examples. It is plausi-

ble, however, that these figures are still too infrequent for the learner, especially for a child learner who might not be able to attend to all examples or assign a correct parse to the ones that are attended to.

The frequency of positive evidence that A-bar movement is much higher in the Penn Treebank than in the CHILDES dataset. Whether the rate of occurrence is high enough in absolute terms depends in part on one's assumptions about the size of the input, as well as whether older learners are more likely than younger learners to assign the right parse to these utterances, and how they use positive evidence to learn about their grammars. However, if Hart and Risley's methodology and conclusions are sound, it appears that children from low SES backgrounds, who are exposed to relatively little input, come across an average of 58 examples a year, or about one example a week. The median English learner, who is exposed to even more utterances, is therefore even more likely to come across examples like these, parse them, recognize that their languages allow A-bar movement from purposive clauses and therefore other (adjunct) clauses that exhibit tense dependence, such as porous relative clauses.¹¹

¹¹More specifically, if Hart and Risley's conclusions are sound, they predict that (i) the rate of learning for young learners about the well-formedness of A-bar movement from porous relative clauses might vary along SES lines and (ii) adult judgments about A-bar movement from porous relative clauses might vary along SES lines.

3.4 Corpus study 3: A-bar movement from purposive clauses in the input in Mandarin Chinese

One might be concerned about drawing conclusions about this indirect learning strategy from English data alone. To address this concern, I repeat the same analysis on the 51,774-sentence Chinese Treebank (Xue et al., 2010), whose range of registers is comparable to that of the Penn Treebank. To preview the results, A-bar movement from purposive clauses in Mandarin Chinese occur at a rate not dissimilar to that of English. The Mandarin data thus provide independent support for this learning account.

3.4.1 Methods

An inspection of the trees in the Chinese Treebank shows that purposive clauses are annotated as VPs that are sisters to another VP. This annotation is too coarse, as it does not indicate which VP contains the main predicate of the clause, and groups purposive clause constructions with several others, such as manner and coordination constructions (54).

- (54) a. *Nan Bao* ... [_{VP1} zhizao jia xinwen] [_{VP2} wumie
Southern Metropolis Paper create fake news slander
Wang Hongbin].
Wang Hongbin
‘The *Southern Metropolis* newspaper ... created fake news to slander
Wang Hongbin.’ [VP1 = main predicate; VP2 = purposive clause]
- b. ... zhiyao bu shi “ [_{VP1} bu zou zheng tu] [_{VP2} moude]
as.long.as NEG be NEG walk correct path obtained
de liyi ...
MOD advantage

- ‘...as long as these were not advantages that were obtained (through) improper means’ (lit. ‘obtained by not walking along the correct path’)
[VP1 = manner; VP2 = main predicate]
- c. ... yi-ge [VP1 zuo de jingmei] [VP2 dan meiyou duoshao
one-CL make PRT beautiful but NEG.exist how.many
ren zhidao] de wangzhan ...
person know website
‘...a website that is beautifully made but known by only a few people
...’ [Coordination]

Subsequently, I wrote a Python script that extracted these pairs of VPs, yielding 7,744 VP pairs in total. Since the objective was to identify A-bar movement from purposive clauses, which are the second of a sequence of two VPs, I selected for tokens where the second VP ended with a trace, and then manually checked each of the selected 150 sentences to ensure that the second VP was a purposive clause and not the main VP. I used the following criteria, classifying the second VP as a purposive clause if it meets all three of these criteria: (i) the first VP describes a situation necessary for the situation described in the second VP to take place, (ii) there is some (implied or explicitly-expressed) agent shared between both VPs, (iii) the first VP cannot have *use* or *expend*-like semantics, just in case these verbs all take the second VP as a complement, and (iv) the proposition denoted by the second VP is not necessarily true, i.e. it can be negated with a follow-up clause.

I further excluded structures that resembled idioms or fixed expressions and structures where the second VP contained the focus particles *cai* and *jiu*, which are usually found with main predicates, and hence likely to indicate that this VP is a main predicate.

3.4.2 Results

This process yielded three relative clause examples, listed below. I have bracketed the relative clauses and underlined the purposive clause within each relative clause.

- (55) a. ... [yue qian wo qu Huasha canjia] de “Diyijie Shijie
month before I go Warsaw participate MOD inaugural world
Minzhu Luntan” ...
democracy forum
‘... The “Inaugural Forum on Global Democracy” that I went to Warsaw a month ago to participate in ...’
- b. ... [yumin chu-chun gandao Diaoyutai huo Dong Hai qu
fisherman early-spring rush Diaoyutai or East Sea go
lanjie] de xiao xiaojuan ...
intercept MOD small squid
‘the juvenile squid that fishermen rush to Diaoyutai or the East Sea in early spring to intercept’
- c. ... hen duo ziliao-pian dou shi [Heiyoulong ziji dao
very many informational-film all be Heiyoulong self go
guowai xunzhao] de ...
overseas find MOD
‘... many of the informational videos were all such that Heiyoulong went overseas to find them ...’

3.4.3 Discussion

For ease of comparison, I will assume that Mandarin-learning children are exposed to the same amount of utterances as their English-learning peers. This assumption allows us to estimate the number of A-bar movement from purposive clauses observed by a Mandarin learner in a year, which I report in (56).

- (56) Summary of corpus study results

| | Chinese Treebank |
|---|------------------|
| A-bar movement from purposive clauses | 3 |
| Extrapolated to ... | |
| - 231k utterances (White et al. estimate) | 13 |
| - 333k utterances (P&S estimate) | 19 |
| - 915k utterances (low-SES families) | 53 |
| - 2.5m utterances (high-SES families) | 147 |

The frequency of direct positive evidence for the A-bar movement from purposive clauses (and indirectly for A-bar movement from porous relative clauses) in the Chinese Treebank is comparable to that for the Penn Treebank. For example, assuming learners are exposed to 915,000 tokens a year (for “low-SES families”), a Chinese learner might observe about 53 examples of A-bar movement from purposive clauses a year, compared to the 58 examples observed by their English counterparts.

3.5 Corpus study 4: How much positive evidence is necessary? Evidence from four other constructions in English

I argued above that speakers of English (Mandarin, etc.) might learn that A-bar movement from porous relative clauses is acceptable in their languages by observing A-bar movement from purposive clauses. The corpus studies showed that while A-bar movement from purposive clauses do occur, they do so infrequently, which raises valid questions about whether there are sufficient positive examples for the learner to revise the default assumption. As far as I know, there is no theory or consensus in the literature on the specific relationship between the availability of evidence and acquisition outcomes.

In the absence of a consensus or a theory that offers testable predictions, I

look at other constructions that have to be learned on the basis of sparse evidence. Ideally, one would focus on constructions that are minimally different from A-bar movement from porous relative clauses, namely, constructions whose syntactic properties are independently known to be learned indirectly from a superficially different construction that occurs infrequently. However, I have not been able to identify a construction that meet these criteria: certainly, there are constructions that have been claimed to be learned indirectly (e.g. the compounding parameter (Snyder, 2001) or A-bar movement that does not exhibit the *that*-trace effect (Chacón, 2015; Rizzi, 1982)), but it is not clear whether the relevant evidence is as sparse as is needed for the purpose of this analysis.

The next best alternative is to look at constructions that have to be learned directly from sparse evidence. I identified four other constructions (57): (pseudo-)gapping involving the subject and a non-subject (suggested to me by Howard Lasnik, p.c.), pseudopassives, and two constructions related to A-bar movement, namely, swiping (also known as “sluice-stranding”), and what I will call the “verbless *no matter*” construction, where *no matter* appears with a *wh*-question that lacks a verb (see Culicover, 1999 for more discussion of the properties of the last two constructions). I will use these constructions to estimate how little positive evidence (measured in terms of frequency of appearance in a corpus) is needed to learn a particular construction by adulthood.

- (57)
- a. John likes Coke, and Mary Pepsi. [Gapping]
 - b. This bed was slept in. [Pseudopassives]
 - c. Mary and John had a meeting, but I don’t know what about. [Swiping]
 - d. We suggest that you say very little, no matter how strange the idea.

Three criteria guide the selection of these constructions. First, they are likely to have been learned from direct (positive) evidence. To the best of my knowledge, these constructions are not uniformly attested across a wide range of languages; in fact, they are typologically marked and in the case of *no matter*, idiosyncratic to English.

Second, to the best of my knowledge, these phenomena do not appear to correlate with another more easily-observable property of English, making it less likely that they are learned indirectly. For example, one might imagine that the distribution of pseudopassives and swiping is identical to that of preposition-stranding, but as Truswell (2008) and Merchant (2002) show, this is not the case; there are preposition-stranding languages that lack pseudopassives and/or swiping.

Third, impressionistically, these are low-frequency constructions, which arguably pose learning problems not unlike that posed by porous relative clauses/purposive clauses. A search of a corpus, in this case, the Penn Treebank, for these constructions therefore yields an estimate of how much direct evidence is available in an English speaker's linguistic experience.

Because the analysis is done on constructions that are learned directly, there is an important caveat in interpreting the results of this analysis. For these four constructions, the evidence that learners get is unambiguously direct — an instance of pseudo-gapping constitutes evidence that pseudo-gapping is grammatical. The same directness of evidence clearly holds for A-bar movement from purposive clauses,

but less so for A-bar movement from porous relative clauses, since purposive clauses are morphosyntactically different from porous relative clauses in English (Mandarin Chinese, Hebrew, and so on), differing at least in terms of finiteness and/or tense morphology, whether subjects are overtly expressed, and what they adjoin to.¹²

3.5.1 Methods

The Penn Treebank has its own annotation scheme for various constructions that it considers to be gapping; the subject/non-subject gapping tokens were extracted by running a search for trees with the relevant annotation.

Pseudo-passives were identified by identifying tokens where a verb in the past participle form (“VBN”) preceded a preposition that in turn immediately preceded an A-trace (e.g. “*-1”).

Swiping tokens were identified manually after extracting strings that consisted of a bare *wh*-phrase followed by a preposition; in this regard I follow Merchant (2002) in assuming that the most acceptable tokens of swiping involve a bare *wh*-phrase, *pace* Radford and Iwasaki (2015), who report naturally-occurring examples with D-linked *wh*-phrases.

Verbless *no matter* constructions were identified manually by a search for sentences containing the string *no matter*.

¹²Thanks to Jeffrey Lidz for discussion on this point.

3.5.2 Results

- (58) Frequency of gapping, pseudo-passives, swiping, and verbless *no matter* constructions in the Penn Treebank

| | Gapping | Pseudo-passives | Swiping | Verbless <i>no matter</i> |
|---|---------|-----------------|---------|---------------------------|
| In entire PTB dataset | 235 | 94 | 7 | 2 |
| Extrapolated to ... | | | | |
| - 200k utterances (White et al. estimate) | 216 | 86 | 6 | 2 |
| - 333k utterances (P&S estimate) | 312 | 125 | 9 | 3 |
| - 915k utterances (low-SES families) | 856 | 342 | 25 | 7 |
| - 2.5m utterances (high-SES families) | 2,369 | 947 | 71 | 20 |

The results bear out our intuition that these constructions occur infrequently, i.e. positive evidence for the learner is sparse. Of the four constructions, the most common is subject/non-subject gapping, which appears 235 times in the corpus. In contrast, only 7 tokens were found for swiping and 2 tokens for the verbless *no matter* construction.

3.5.3 Discussion: Further inferences a learner has to make

The results suggest that, first, the sparsity of positive evidence is true not only for A-bar movement from clausal adjuncts but also for at least several other constructions. Second, sparsity itself is not necessarily a problem for learning a particular rule or constraint. More specifically, if the Penn Treebank frequency estimates are a reasonable approximation of an (American) English speaker's linguistic experience, English speakers can acquire constructions like swiping and verbless *no matter* constructions with as few as 20–71 tokens a year (assuming Hart and Risley

(1995)’s estimates) (58). It is thus not implausible that they can also draw conclusions about A-bar movement from porous relative clauses by observing A-bar movement from purposive clauses, which occur at a higher rate.

One might object to this argument from swiping and the verbless *no matter* construction. First, the argument assumes that there is no significant difference in the nature of the rules and constraints that underlie swiping, verbless *no matter* construction, and A-bar movement from porous relative clauses (and purposive clauses). It is logically possible that there is a stronger innate bias for the rules and constraints involved in the first two constructions, so that the sparsity of direct evidence is less of an obstacle. Second, even if it were the case that there is no significant difference in biases, it might be the case that the rules and constraints for these two constructions are in some sense less complex, and therefore easier to learn. For instance, as mentioned above, the inferences from evidence that learners have to make about swiping, the verbless *no matter* construction, and A-bar movement from purposive clauses are much more direct, and thus in a way easier, than the inferences learners have to draw about A-bar movement from porous relative clauses. I note that this difference holds even when one assumes that at some abstract level of representation, porous relative clauses and purposive clauses involve the same structures.

I will not have much else to say about the first assumption, since there is no independent evidence for the biases learners have for any of these constructions. However, it is possible to qualitatively evaluate the complexity of the learning task for each construction, by spelling out more explicitly the inferences learners have to

make.

I assume that the learner can identify the appropriate predicate-argument relations denoted by these constructions, even if they might be unfamiliar with the construction. On the assumption that these relations are encoded at a D(eep) Structure-like representation, the learner has to deduce the rules and conditions that apply on this representation to generate the strings observed in the input.

3.5.3.1 Swiping

The learning task here turns out to be fairly challenging. Swiping is subject to several conditions that are difficult to learn from a small number of examples. First, as Merchant points out, swiping is most acceptable when the *wh*-phrase is not D-linked (i.e. when the *wh*-phrase is monomorphemic, but see Radford and Iwasaki for counterexamples). There are additional constraints on what prepositions may appear; for example, the preposition must also be a simplex one, appearing without modifiers (Culicover, 1999). A learner might be able to infer these properties when presented with a large enough set of examples, but it is not clear whether he/she can do so on the basis of 6–71 tokens a year (58).

Because of these restrictions on the form of swiping, swiping tokens are short. Consequently, learners might misanalyze instances of swiping as monomorphemic lexical items and/or idiomatic expressions that happen to resemble the concatenation of a bare *wh*-phrase and a preposition, rather than the result of a productive phenomenon. Alternatively, the low frequency of swiping tokens might cause learn-

ers to incorrectly treat them as speech errors.

Further, even though a swiping token consists of only a *wh*-phrase and a preposition, it is interpreted as if there were an entire clause that was elided.¹³ As noted in the literature on swiping and ellipsis, this clause must be recovered from the context. It is not at all clear whether the need to recover a clause is obvious to the learner. Ideally, there should be cues that a clause is involved: perhaps there would be a morphosyntactic sign that a clause has been elided — the clausal equivalent of *do*-support, which applies when a VP is elided in the absence of a modal auxiliary) — or perhaps at least the preposition in the swiping token might be found prominently in a previous utterance.

Such cues are absent. There are of course no morphological signs of clausal ellipsis in English. In the examples seen in the PTB, the preposition and *wh*-phrase do not have any obvious linguistic antecedents, so there is no clear syntactic evidence that the swiping token is related to some clause in the context. For example, in the following dialogue taken from the Penn Treebank, *What for?* is interpreted along the lines of “What are you on your way to see the Jacobs woman for?” but neither *for* nor *what* are found in the previous sentence, “I’m on my way to see the Jacobs woman.”

- (59) I 'm on my way *-1 to see the Jacobs woman ” .
 “ Gilborn 's secretary ? ? What for *T*-1 ? ? You do n't think
 0 Gilborn is the - ” ? ?

Despite the obscurity of the restrictions on swiping and the relative sparsity of

¹³It is unclear whether there is syntactic structure present in the ellipsis site (Merchant, 2001); swiping does not provide the kind of “connectivity effects” that are needed to substantiate such a claim.

positive evidence, there is some (rather weak) evidence that swiping can be acquired relatively early, although this seems to be the exception than the rule. In a study of longitudinal CHILDES corpora for 20 children, Sugisaki (2008) found two children who produced swiping constructions. Excluding one child that produced only *what for*, the other child (Aran, from the Manchester Corpus (Theakston et al., 2001)) produced a variety of forms from 2 years 7 months of age, namely: *who for* (2 tokens), *what for* (2 tokens), *what with* (1 token), and *who from* (1 token).

Assuming that production is a reliable indicator of acquisition (admittedly a assumption that many might question), the production data would mean that Aran was able to deduce the syntax of swiping at from relatively few tokens. Note that this would be true even if one assumes that Aran grew up in a linguistic environment where swiping is atypically common, since he would have only at most about two years of linguistic input to work with.¹⁴

3.5.3.2 Verbless *no matter* construction

As Culicover (1999) notes, there are three features unique to this construction: (i) *no matter* appears to take a small clause-like complement, without any overt verb, (ii) the *wh*-phrase and NP that follows it are interpreted as predicate and subject respectively (60a), and (iii) the subject must be a definite generic (60b). The sparsity of evidence makes all three features difficult to detect: learners need to infer that the complement lacks a verb and thus is not, for instance, a finite clause that

¹⁴Although Aran used swiping relatively frequently, this does not seem to be the case for the adult speaker in the corpus, his mother. In the entire corpus, Aran's mother produced only one token of swiping: *what for*.

just happens to occur without a verb due to some speech error or perception error. Similarly, it is difficult to tell from the evidence whether the presence of definite generic and the fact that the *wh*-phrase is always a predicate are simply coincidences due to the small sample or reflect a restriction specific to the construction.

- (60) a. Everyone has certain basic rights, no matter who *(is / might be) president. [wh-phrase is the subject]
 b. We suggest that you say as little as possible, no matter how upset {Mary and John / she and he / clients} *(might be). [Subject is not definite generic]

One possibility is that learners do eventually come across enough tokens of the verbless *no matter* construction to support the hypothesis that there are actually two, and not one, *no matter* constructions. At this point, for a learning account to work, one would need to assume that the learner compares the distribution of *wh*-phrase predicates and definite generic subjects in these verbless *no matter* constructions with the equivalent distribution in regular *no matter* constructions; it seems likely that there will be clear differences in the distributions to suggest that the verbless *no matter* construction is subject to additional restrictions.

3.6 What kind of learner do we need?

In this section, I describe how learners of a language like English might use observations of A-bar movement from purposive clauses to infer that A-bar movement from porous relative clauses is possible. There are several distinct problems here.

The first problem relates to the observation and representation of the evidence:

learners must be able to observe *and* correctly analyze A-bar movement from purposive clauses and recognize it as such, as opposed to, for instance, treating these tokens as mere production errors or as well-formed tokens that do not involve A-bar movement. It is arguably simple for a learner to observe that A-bar movement has taken place; the tokens in the input are mostly in the form of relative clauses, which are prototypical A-bar movement constructions. I will also assume that learners are exposed elsewhere to sufficiently many instances of adjuncts and have a familiarity with the argument structure of lexical items, so that they can tell that these examples involve A-bar movement from an adjunct (specifically, a purposive clause), as opposed to A-bar movement from a specifier or complement.

Further, learners must analyze purposive clauses and porous relative clauses in a particular manner so that they can be treated as members of a natural class. At the very least, they need to recognize that both purposive clauses and porous relative clauses are distinguished by their tense dependence. I hypothesized in Chapter 2 (Section 2.2) that learners might use the distribution of tense morphemes in porous relative clauses; they might use the presence of non-finite *to* to determine that purposive clauses have dependent tense. Only then can they use an observed instance of A-bar movement from purposive clauses to conclude that A-bar movement from another type of adjunct with tense dependence (i.e. porous relative clauses) is also possible.

The second problem, an important one theoretically, relates to how learners interpret the positive evidence. This problem lies in the fact that purposive clauses are ultimately different from porous relative clauses, even though purposive clauses

and porous relative clauses form a natural class. Consequently, there are many other natural classes that purposive clauses belong to, and logically speaking, the observation of A-bar movement from purposive clauses does not automatically invite the inference that A-bar movement from porous relative clauses is possible.

In other words, in principle, there are many alternative conclusions a learner could draw from A-bar movement from purposive clauses. (61) presents some of these possible conclusions, obtained via a superficial introspection of the syntax, semantics, and pragmatics of the tokens involving A-bar movement from purposive clauses in the Penn Treebank dataset. Note that this set of conclusions here is stated with respect to adjuncts; one can imagine other conclusions that are stated in non-adjunct terms.

- (61)
- a. Syntactic conclusions: Allow A-bar movement from ...
 - (i) ...any adjunct
 - (ii) ...an adjunct whose subject is bound by the matrix subject.
 - (iii) ...a non-finite adjunct.
 - b. Conclusions based on truth-conditional semantics: allow A-bar movement from ...
 - (i) ...adjuncts whose propositions are not always true of the actual world
 - (ii) ...an adjunct that is temporally located to the future of the event of the main predicate, since these clauses describe goals.
 - (iii) ...an adjunct that is temporally located to the future of utterance time, since these clauses describe goals.
 - c. Conclusions based on event semantics: allow A-bar movement from an adjunct that describes a result where the main predicate is a necessary condition for that result.
 - d. Conclusions in construction/idiom terms: allow A-bar movement from ...
 - (i) ...an adjunct that has some combination of the above syntactic and semantic properties, e.g. a non-finite adjunct that is temporally located to the future of the main predicate ...
 - (ii) ...an adjunct that is lexically and structurally identical to the counterexamples.

Despite the range of options, learners of English (Mandarin, Hebrew, etc.) seem to invariably draw the “right” conclusion about their languages, allowing A-bar movement from purposive clauses and porous relative clauses but not from the adjuncts listed above. This raises the question of why they converge and how they rule out the other options.

The most likely solution involves a very restricted hypothesis space about A-bar movement: the range of hypotheses about their grammars that learners actually consider is small. The size of this hypothesis space and its contents (i.e. the hypotheses) are presumably innately determined.

More specifically, in this context, there are at least two distinct hypotheses, one that is responsible for generating languages like Polish and German, where A-bar movement from relative clauses and purposive clauses is not acceptable, and another that generates languages like English and Mandarin Chinese, where A-bar movement from these adjuncts is acceptable. For example, supposing that the defective tense analysis of porous relative clauses and purposive clauses is correct, learners consider at least the following two hypotheses about their languages: (i) Defective tense morphemes neutralize phases, (ii) Defective tense morphemes do not neutralize phases.

Because there are only a small number of hypotheses to begin with, the observation of A-bar movement from purposive clauses counts as evidence for an even smaller number of hypotheses (possibly only one, e.g. the defective tense analysis or the movement/height-based analysis), which explains convergence.¹⁵

¹⁵Of course, as mentioned in the start of Chapter 2, there appears to be more fine-grained

We may contrast this conclusion with an alternative in which learners entertain a much larger set of hypotheses, as in (61), and arrive at the right conclusion by trial and error. In the latter scenario, convergence is only possible if A-bar movement from purposive clauses is abundant in the input, so that learners get enough tokens to rule out inappropriate conclusions. However, corpus analyses show that in at least English and Mandarin Chinese, A-bar movement from purposive clauses occurs only infrequently.

This particular conclusion recalls key ideas from the Principles and Parameters framework, in which languages were hypothesized to differ along a number of innately-defined dimensions (parameters; ideally a very small number), such that there are only a few ways in which each parameter might vary. These limits on parameters and parameter values are also restrictions on a learner's hypothesis space.

A third problem pertains to the mechanism by which the evidence is used to determine one's grammar. There is a wide range of proposals in the literature that can be applied straightforwardly to the case of porous relative clauses and purposive clauses; these adjuncts do not pose a major theoretical problem in this domain.

In the classical Principles and Parameters framework, this task is accomplished by assuming that the hypotheses are ranked, such that the most restrictive hypothesis is the default parameter setting. Where necessary, learners switch to the next

cross-linguistic variation even within languages that allow A-bar movement from porous relative clauses, e.g. whether adjuncts can move from porous relative clauses. Given current gaps in our knowledge of this particular kind of variation, it is unclear to me whether this kind of variation reflects differences in the specific condition(s) that govern A-bar movement from porous relative clauses or differences in other aspects of A-bar movement. For example, perhaps this particular difference relating to adjuncts actually reflects differences in terms of what kind of adjuncts may undergo A-bar movement.

most conservative alternative setting that can accommodate positive evidence that is incompatible with the current setting (Berwick, 1985; Dell, 1981; Manzini and Wexler, 1987). Alternatively, it is also possible to produce similar outcomes through more probabilistic approaches. To briefly summarize some of these approaches: For example, Gibson and Wexler (1994) present a non-deterministic analysis where positive evidence causes learners to consider an alternative grammar, by resetting a parameter chosen at random. Yang (2002) suggest that learners assign probabilities to multiple grammars. They increase the probability associated with grammars that can best accommodate observed linguistic evidence, while decreasing the probability associated with grammars that cannot do so. Pearl (2007) suggests a Bayesian updating procedure and shows how this procedure works on different kinds of hypothesis spaces.

3.7 Conclusion

This chapter started with the proposal that learners of languages like English might use A-bar movement from purposive clauses to learn that their languages allow A-bar movement from porous relative clauses. I discussed various hypotheses about why purposive clauses might be the relevant evidence in this context, suggesting that this is because both purposive clauses and porous relative clauses exhibit tense dependence. I then presented corpus studies to argue that A-bar movement from purposive clauses occurs relatively frequently (compared to A-bar movement from porous relative clauses) in natural contexts in both English and Mandarin Chinese,

a necessary condition if this learning account is to work.

That said, positive evidence is not sufficient to explain why learners of these language succeed. In particular, I argued that in this case, circumstances suggest that there must be restrictions on the hypothesis space. In absolute terms, A-bar movement from purposive clauses occurs infrequently in English and Mandarin Chinese, so the evidence for A-bar movement from porous relative clauses is sparse, in addition to being indirect. Without restrictions on the hypothesis space, there would be too many logically coherent conclusions for learners to draw about their languages by just observing A-bar movement from purposive clauses; there is no guarantee that they use it to infer that their languages allow A-bar movement from porous relative clauses. These restrictions thus allow learners to overcome the evidence sparsity problem and ensures that learners exposed to the same language converge on the same kind of grammar.

Chapter 4: Variation in A-bar movement from complement clauses

4.1 Introduction

While researchers following Ross’s footsteps have proposed constraints on overt A-bar movement from a variety of embedded clauses, one class of embedded clauses has remained relatively exempt from these proposals: declarative complement clauses of verbs, especially verbs that describe mental states and communication, such as *think* and *say*. The absence of constraints on A-bar movement from these clauses is perhaps not surprising, since that makes it possible to straightforwardly explain why an English sentence like (1) is acceptable.

- (1) Who₁ does John {think/say} [that Mary likes *t*₁]?⁹

However, within English and many other languages, not all verbs freely allow (long-distance) A-bar movement from their declarative clausal complements. In descriptions of long-distance A-bar movement, it is common to split the class of verbs into two sub-classes, typically labeled as “bridge verbs” and “non-bridge verbs”, such that A-bar movement across the first class is acceptable (taken to indicate well-formedness) and A-bar movement across the second is not (2).

⁹For discussions about some of the issues presented in this chapter, I would like to thank Amy Rose Deal, Sandhya Sundaresan, Aaron Steven White, and Charles Yang. Errors are mine alone, of course.

- (2) *Who₁ does John {shout/quip} [that Mary likes t_1]? [Non-bridge verb]

A question that naturally arises is which verbs are bridge verbs — whether they vary across languages — and why these verbs have such an impact on A-bar movement. Supposing that there is clear reason to think there is cross-linguistic variation, one might ask about how children learn these points of variation.

For ease of reference in this chapter, I will define the following terms:

- (3)
- a. “Representational attitude verbs,” or “attitude verbs” for short, refer to clause-embedding verbs that describe communication and representational mental states. These include verbs like “say,” “think,” “believe,” “predict,” and so on, where the speaker asserts a proposition or believes in the truth of the proposition denoted by the verb’s clausal complement. This definition excludes attitude verbs with preferential or control semantics, like *want* or *try*.
 - b. “Bridge verbs,” as a descriptive term, refers to the set of attitude verbs that allow A-bar movement. Because there is no widely accepted list of bridge verbs for English (or for any other language, as far as I can tell), I will mostly rely on informal intuitions to determine whether to describe a verb as a bridge verb or not.
 - c. “Bridge effects” refers to the acceptability (or lack thereof) of A-bar movement from the clausal complements of verbs.
 - d. “Bridge contexts,” or “long-distance A-bar movement,” refers to syntactic configurations where a phrase, such as a *wh*-phrase, moves from the clausal complement of a verb to an A-bar position, whether the verb is a bridge verb or not.

This chapter is organized as follows. First, in Section 4.2, I discuss complications with the bridge/non-bridge distinction and point out a general data quality issue in existing discussion of this distinction. With these caveats in mind, I discuss existing competing generalizations about bridge verbs in Section 4.3. Specifically, I review a number of hypotheses about bridge effects.

Second, I evaluate existing hypotheses in Section 4.4. I describe a larger scale acceptability judgment study for 100 verbs in English, showing that existing propos-

als about bridge verbs provide relatively little coverage of the range of acceptability. In Section 4.5, I present a post-hoc analysis of the data, showing that the relevant dimensions are likely more fine-grained and specific than those suggested in existing proposals.

Third, I discuss consequences of this study for these generalizations and our theories of the learning of long-distance A-bar movement. In Section 4.6, I discuss the extent to which bridge effects might be pragmatic or syntactic in nature; the former suggestion is often made in the context of long-distance *wh*-questions (Ambridge and Goldberg, 2008; Erteschik-Shir, 1973; Erteschik-Shir and Lappin, 1979; Müller, 2015b). In Section 4.7, I present data from a smaller scale, informal survey of English and Dutch native speakers that examines the effect of the presence or absence of a suitable context on long-distance A-bar movement. To preview the results, speakers across both languages seem to find that long-distance A-bar movement improves (somewhat) in acceptability with the presence of a suitable context for manner of speaking verbs. The survey also provides some evidence that long-distance A-bar movement for cognitive factive verbs has different acceptability profiles in both languages. This fact suggests that in at least some languages, some aspect of bridge phenomena is learned from linguistic experience.

In Section 4.8, I discuss the possibility that the differences between English and Dutch for cognitive factive verbs might be derived from English learners getting direct evidence that long-distance A-bar movement is compatible with these verbs. I compare two accounts about the kinds of generalizations English learners might make on the basis of the evidence they get.

This chapter also seeks to make an empirical contribution to the literature; the data collection reported in this chapter is aimed at addressing the data quality issue mentioned in Section 4.2. The formal experiment in Section 4.4 seeks to expand our understanding of bridge effects across a larger set of clause-embedding verbs in English, while the informal survey in Section 4.7 seeks to evaluate the extent of cross-linguistic variation between English and Dutch and the effect of context on acceptability of long-distance A-bar movement.

4.2 An overview of the literature on bridge verbs

It is important to note that the bridge/non-bridge distinction, while useful and influential in the literature on A-bar movement, understates the complexity of A-bar movement from complement clauses. In this section, I enumerate several issues pointed out in the literature, which I also intend as a summary of the state of affairs in the literature. The takeaway is that there are a range of factors contributing to acceptability. The bridge/non-bridge distinction arguably captures only one particular dimension, which manifests itself in the acceptability of A-bar movement of arguments (such as objects). A lack of data means that it is harder to tell whether this particular dimension affects A-bar movement of other kinds of *wh*-phrases.

4.2.1 Restrictions on what moves

The first issue involves restrictions on the items that move. A number of verbs, such as *admit*, are said to allow long-distance A-bar movement of (*wh*-)arguments

(typically objects) but not (*wh*-)adjuncts (4), while another set of verbs, such as *whisper*, are held to block long-distance A-bar movement of both *wh*-arguments and *wh*-adjuncts. (In other words, the complements of the first set of verbs are weak islands, while those of the second set are strong islands, in the sense of Szabolcsi and Zwarts, 1993, Honcoop, 1998, and Abrusán, 2014, among others. I am not aware of any verbs that allow long-distance A-bar movement of (*wh*-)adjuncts but not (*wh*-)arguments.) The nature of this argument/adjunct asymmetry is less well-studied. It is unclear whether there is systematic cross-linguistic variation for the A-bar movement of adjuncts, or whether there is some universal semantic or discourse property that characterizes the verbs that allow A-bar movement of adjuncts (see Cattell, 1978; Hegarty, 1992; Honcoop, 1998). More basic cross-linguistic data collection is necessary, and I leave this to future research.

- (4) a. Who₁ did John admit [that Mary likes t₁]?
 b. *Why₁ did John admit [that Mary likes Ben t₁]?

- (5) a. ??Who₁ did John whisper [that Mary likes t₁]?
 b. *Why₁ did John whisper [that Mary likes Ben t₁]?

A related complication involves A-bar movement of subjects, which is sometimes said to be degraded relative to A-bar movement of objects for at least certain attitude verbs (typically factives). While I do not wish to challenge the validity of the judgments, I would like to point out that the datapoints in English might require additional support for the point to be valid, due to a confound involving the *that*-trace effect. As Grimshaw (2015) notes, a number of these verbs, especially low-frequency, high-register ones, might require their complement clause to contain

the complementizer *that*. However, in English, a subject gap in a complement clause cannot appear immediately following a *that*. In other words, it is hard to determine whether examples like (6) show that A-bar movement of subjects is degraded without evidence showing that these complement clauses allow a null complementizer. Ideally, one could address the confound by including the overt complementizer *that* and an adverb that comes between *that* and the subject gap, which neutralizes the *that*-trace effect (an observation due to Bresnan, 1977 and more recently elaborated by Kandybowicz (2006) and Douglas (2017)). (7), for instance, does not seem too bad to me, compared to (6a).

- (6) a. *Who do you regret [_t₁ stole the cookies]? (Basse, 2008, p. 54, ex. 3)
- b. *Who do you remember/deny [(that) stole the cookies]? (Kastner, 2015, p. 165, ex. 30)

- (7) Who do you regret [that, during the blackout last night, _t₁ stole the cookies]?

Finally, I note that there appears to be a slight improvement in acceptability when the *wh*-phrase is discourse-linked (“D-linked,” Pesetsky, 1987), at least for certain non-bridge verbs in Dutch, although existing descriptions are sketchy. Specifically, Broekhuis and Corver (2016) report that in Dutch a factive verb like *weten* ‘know’ typically blocks A-bar movement of a bare *wh*-argument like *wat* ‘what,’ while a verb like *denken* ‘think’ does not. Making the *wh*-argument D-linked improves acceptability for long-distance A-bar movement across *weten*, at least for a subset of speakers (8).

- (8) Dutch (a and b examples from Broekhuis and Corver, 2016, p. 1397, ex. 214).

- a. Wat {dacht/*wist} Marie [dat Marie t₁ gekocht had]?
 what thought/knew Jan that Marie bought had
 ‘What did Jan think/know that Marie had bought?’
- b. Welk boek₁ {dacht/%wist} Marie [dat Marie t₁ gekocht had]?
 which book thought/knew Jan that Marie bought had
 ‘What did Jan think/know that Marie had bought?’ (% = some speakers only)

4.2.2 Construction-specific effects

A second issue involves the type of A-bar movement construction. Typically, examples intended to show whether a verb is a bridge verb or not involve *wh*-questions: if a *wh*-phrase can move from the complement clause of an attitude verb, then the verb is a bridge verb; if the *wh*-phrase cannot, the verb is not a bridge verb.

However, as various researchers have pointed out, *wh*-questions come with their own pragmatics and felicity conditions (Abrusán, 2011; Gibson, 2018; Liu et al., 2019; Müller, 2015b; Oshima, 2006; Schwarz and Simonenko, 2018; Simonenko, 2013, 2015). If this point holds, an unacceptable *wh*-question formed by long-distance A-bar movement might not be clear evidence that the main verb blocks A-bar movement from the complement clause. Instead, the low acceptability might just be an artifact that arises jointly from the properties of *wh*-questions and the verb. For example, a number of proposals report that *wh*-questions involving A-bar movement from factive verb complements are relatively unacceptable (Abrusán, 2011; Müller, 2015b; Oshima, 2006; Schwarz and Simonenko, 2018). Although technical details and background assumptions vary, these proposals tend to attribute the low ac-

ceptability to a conspiracy between the semantics of *wh*-questions and the fact that the complements of these verbs are presupposed to be true or part of the common ground.

A further consequence of this line of reasoning is that it predicts that there are other A-bar movement constructions in which A-bar movement from complement clauses is more acceptable; a claim most recently put forward by Gibson (2018)/Liu et al. (2019) with *it*-clefts, which feature A-bar movement (9).¹

- (9) a. What_{t₁} did Susan know that Anthony liked t₁? [*Wh*-question] <
 b. It was the pie_{t₁} that Susan knew that Anthony liked t₁. [*It*-cleft]
 ('A < B' = A is less acceptable than B)

4.2.3 Cross-linguistic variation

Cross-linguistically, bridge effects appear to vary across languages, a fact that further complicates efforts to derive an empirically adequate generalization. I did a cross-linguistic literature survey, looking at informal descriptions of bridge verbs and A-bar movement from finite (indicative) complement clauses in the literature. The languages covered were: English (Abrusán, 2014; Ambridge and Goldberg, 2008; Dąbrowska, 2008, 2013; Erteschik-Shir, 1973; Fodor, 1992; Gibson, 2018; Goldberg, 2006; Kastner, 2015; Truswell, 2011), Danish (Erteschik-Shir, 1973), German (Fanselow et al., 2005; Featherston, 2004; Haider, 2010, also Aaron Doliana, p.c.), Dutch (Broekhuis and Corver, 2016, 2017, also Annemarie van Dooren, p.c.), Kashmiri (Bhatt, 1999; Manetta, 2011), Polish (Cichocki, 1983; Witkoś, 1995), Ar-

¹A bibliographic note: Gibson, 2018 is a report of various projects, including the one independently presented as Liu et al., 2019.

menian (Anyadi and Tamrazian, 1993), Russian (Antonenko, 2010; Khomitsevich, 2008; Ross, 1967), Hebrew (Kastner, 2015; Preminger, 2014), Hungarian (Kiss, 2002; Marácz, 1991), Georgian (Harris, 1981), and Sundanese (Davies, 2003).

Of these languages, a number are claimed to generally lack A-bar movement from indicative complement clauses: these include Sundanese, Armenian, and Georgian; Georgian only allows A-bar movement from the complement clauses of three modal verbs: *unda* ‘he wants,’ *šeuǰlia* ‘he can/is able to,’ *sčirdeba* ‘he needs it’ (Harris, 1981, p. 18). Certain varieties of Polish have a uniform ban on A-bar movement from indicative complements, while other varieties reported by Cichocki (1983) apparently allow A-bar movement of *co* ‘what’ (but not other kinds of *wh*-phrases) from the indicative complements of *mówić* ‘say’ and *powiedzieć* ‘tell.’² Witkoś (1995) reports that Polish also blocks A-bar movement from subjunctive complements in general, unless the verb that takes a subjunctive complement can also take a non-finite complement. Russian imposes a ban on A-bar movement from indicative complements, while A-bar movement from subjunctive complements is more acceptable, although the degree of amelioration appears to vary by native speakers.

The other languages surveyed allow A-bar movement from (indicative) complements, although to varying degrees, as the following set of examples show. For instance, Kashmiri, Dutch, and certain varieties of German are said to allow long-distance A-bar movement from verbs like ‘say’ and ‘think,’ but not for factive verbs, verbs such as ‘know’ or ‘realize.’ Finally, English, Hebrew, Scandinavian languages,

²It is unclear to me why there is such a distinction. Cichocki (1983) does not discuss this further in the paper, and I am not aware of subsequent work that deals with it. Since ‘what’ appears to be the exception, I take that this restriction is likely to reflect idiosyncratic properties of ‘what,’ such as its syntax or pragmatics.

and some varieties of Hungarian have a fairly liberal definition: A-bar movement from the complements of these verbs is usually reported to be acceptable. There is also what appears to be at least interspeaker, if not inter-dialectal differences. For example, it has been suggested that speakers of northern German dialects do not allow long-distance A-bar movement at all (Haider, 2010, citing Kvam (1983)), although Featherston (2004) and Fanselow et al. (2005) report experimental results suggesting that the differences might be not as clear-cut as it is usually presented. For instance, Featherston (2004) presents experimental results showing that speakers of northern and southern German varieties rate long-distance A-bar movement in similar ways, contrary to generalizations reported in the literature. Marácz (1991) also reports that there are Hungarian speakers who do not accept any kind of long-distance A-bar movement, although I am not aware of any follow-up work on that, as in the case of German.

(10) Verbs of saying

- a. What_{t1} did Mary say [that John saw t₁]? [English]
- b. Wen₁ hat sie prophezeit [dass er t₁ heiraten würde]?
whom has she prophesied that he marry would
'Who has she prophesied that he would marry?' [German, from
Haider, 2010 p. 91 ex. 13a, his judgment]
- c. Wat zei Jan [dat Marie t₁ gelezen had]?
what said Jan that Marie read had
'What did Jan say that Marie had read?' [Dutch, Broekhuis and
Corver, 2016, p. 758, ex. 327a]
- d. ?Co₁ Janek powiedział [że studenci czytają t₁]?
what Jan said/told that students read
'What did Jan say/tell that students read?' [Polish, Witkoś, 1995 p.
229 ex. 41, his judgment]

(11) Verbs of thinking

- a. What_{t1} did Mary think [that John saw t₁]?

- b. Was₁ glaubst Du den [dass t₁ verantwortlich ist für die
what thinks you PRT that responsible is for the
Abweichung]?
deviance
'What do you think is responsible for the deviance?' (Haider, 2010 p. 88, ex. 6a)
- c. *Wat denk je [dat Peter t₁ gekocht heeft]?
what think you that Peter bought has
'What do you think that Peter has bought?' (Broekhuis and Corver, 2016, p. 1124, ex. ib)
- d. *Co₁ Janek myśli [że studenci czytają t₁]?
what Jan thought that students read
'What did Jan think that students read?' (Witkoś, 1995 p. 229, ex. 39, his judgment)

(12) Cognitive factive verbs

- a. What₁ did Mary realize [that John saw t₁]?
 - b. *Wen₁ hat sie eingesehen [dass er t₁ heiraten würde]?
whom has she realized that he marry would
'Who has she realized that he would marry?' (Haider, 2010, p. 91, ex. 13a, his judgment)
 - c. *Wat weet je [dat Peter t₁ gekocht heeft]?
what knows you that Peter bought has
'What do you know that Peter has bought?' (Broekhuis and Corver, 2016, p. 1124, ex. ib)
 - d. *?Co₁ Iwona wie [że Tomek je t₁ zachłannie]?
what Iwona know that Tom eats greedily
'What does Iwona know that Tom eats greedily?' (Witkoś, 1995 p. 229, ex. 38, his judgment)

Even though the literature reports variation in terms of what verbs allow long-distance A-bar movement, the survey also suggests that the variation is not completely random. For example, no description of languages I looked at included manner of speaking verbs in their list of bridge verbs or examples of long-distance A-bar movement.

I further note that Hebrew, Scandinavian languages, Romance languages, Bulgarian, and Hungarian (among others) are also reported to allow A-bar movement

from embedded *wh*-questions, although the acceptability and well-formedness of A-bar movement from embedded *wh*-questions in Romance and Scandinavian have been questioned in recent work (Almeida, 2014; Kush et al., 2018; Sprouse et al., 2016). I will not have much to say about this phenomenon here. To the extent that these languages freely allow A-bar movement from embedded *wh*-questions in these languages (contrary to the core intuition in proposals such as Relativized Minimality or Shortest Move (Chomsky, 1995; Preminger, 2014; Rizzi, 1990)), this phenomenon provides yet another example of cross-linguistic variation in bridge verbs. Alternatively, to the extent that it is ill-formed, there are several conclusions one could draw. First, there are grammatical principles that block A-bar movement from *wh*-questions, as envisioned under standard theories of A-bar movement. Alternatively, if one believes that there are no such constraints in these languages, then one might attribute the low acceptability either to the notion that these verbs are not bridge verbs or perhaps to some pragmatic principle barring certain movement from questions.

4.2.4 Concerns about empirical generalizations

The issues mentioned above hint at a larger data quality issue in the literature on bridge verbs. There is no definitive list of bridge verbs, although there are a number of proposals on the market about which classes of verbs are bridge verbs (or are compatible with A-bar movement). However, as far as I can tell, the data and hypotheses reported in the literature are based on informal judgments, often

for a small number of speakers, for a small number of verbs relative to the class of clause-embedding verbs. In English, and presumably in other languages, there are likely to be easily dozens of clause-embedding verbs, if not hundreds of them, in the lexicon (cf. White and Rawlins, 2018, White and Rawlins, 2016, Anand et al., to appear, among others). However, the largest lists of bridge verbs I have seen are a list of 21 Hungarian predicates found in Marácz, 1991 (p. 159, ex. 12)³ and a list of 23 Dutch predicates in Broekhuis and Corver, 2016 (p. 760, ex. 331, which is in turn based on data reported by Hoeksema (2006)).

This is not an issue that is confined to papers that use informal judgments; papers that report formal experiments also usually look at a fairly small number of verbs, even though they get judgments from a relatively larger pool of native speakers. For example, Featherston (2004) looked at eight German clause-embedding verbs, while Ambridge and Goldberg (2008) and Dąbrowska (2013) look at about a dozen verbs. The one exception that I am aware of is Gibson, 2018/Liu et al., 2019, which looked at 50 verbs in English.

To compound the problem, existing discussions do not always provide clarity about what the appropriate generalizations might be. To give an example from English that I will return to later, the bridge verb status of factive verbs, such as *know*, *realize*, and *regret*, is disputed. Impressionistically, there is a majority opinion in the formal linguistics literature that long-distance A-bar movement is compatible with these verbs; recent proposals that have adopted this position include

³To be precise, the 21 predicates are predicates that are compatible with long-distance A-bar movement; Marácz (1991) (p. 159, fn 5) mentions another 29 predicates that are compatible with long-distance left dislocation but not with long-distance A-bar movement.

de Cuba, 2007, Abrusán, 2014, Kastner, 2015, among others. However, there are also dissenting views: Truswell (2011) finds them to be unacceptable. In the experimental literature, Ambridge and Goldberg (2008) report that native speakers find them unacceptable, but Gibson (2018)/Liu et al. (2019) dispute this finding. Broekhuis and Corver (2016, pp. 1397–1398) also report some interspeaker variation for the factive verbs *betreuren* ‘regret’ and *weten* ‘know’ in Dutch.

Setting aside for now the dispute in the literature about the acceptability of A-bar movement from the complement clauses of factive verbs, I note that instances of A-bar movement from these clauses do occur naturally in English. For example, a search of the Penn Treebank yielded examples that seem perfectly acceptable, such as the following:

- (13) “ Unless the market goes to 19 million units - which we all know it ’s not going to do - we have the inescapable fact that the transplants are adding capacity , ” Mr. Lutz said last month .

4.3 Hypotheses about bridge effects

In this section, I turn my attention to existing proposals about what property (or properties) of verbs distinguish bridge verbs; in other words, what properties are responsible for certain verbs being compatible with A-bar movement. I will abstract away from the theoretical question about what the ultimate nature of these properties might be. The primary goal of this section is to identify the dimensions that affect the acceptability of long-distance A-bar movement, and so what is more important for the discussion in this section is the higher-level generalizations.

To avoid misrepresenting the reasoning behind these proposals, I will try to use examples that are provided in the literature. One should keep in mind that some of these examples might actually not be sufficient for illustrating the relevant point. For example, it is common to see an unacceptable *wh*-question used as an example to show that a verb is incompatible with long-distance A-bar movement. As mentioned earlier, the low acceptability of this *wh*-question might have an alternative explanation: the verb could well be compatible with A-bar movement, but just not with *wh*-questions, due to the pragmatics of questions.

4.3.1 Factivity

The first hypothesis is that factive verbs block long-distance A-bar movement. These verbs presuppose the truth of their complements; a classic diagnostic checks if the proposition denoted by the complement is perceived to be true regardless of whether the verb is negated.

- (14) a. *Factive verb*: regret
 (i) John regrets that he saw the movie. \rightarrow John saw the movie.
 (ii) John doesn't regret that he saw the movie. \rightarrow John saw the movie.
 b. *Non-factive verb*: believe
 (i) John believes that he saw the movie. \nrightarrow John saw the movie.
 (ii) John doesn't believe that he saw the movie. \nrightarrow John saw the movie.

A strong version of the claim about factive verbs is found in descriptions of German (Haider, 2010) (p. 91) and Dutch (Broekhuis and Corver, 2016) (p. 759), in which A-bar movement of both arguments and adjuncts is reported to be degraded. As pointed out above, there is some disagreement about the validity of this claim

for English: A-bar movement of arguments (but not adjuncts) is usually claimed to be acceptable (Abrusán, 2014; de Cuba, 2007; Gibson, 2018; Honcoop, 1998; Kastner, 2015; Kiparsky and Kiparsky, 1970; Liu et al., 2019; Postal, 1972); that said, Truswell (2011), Ambridge and Goldberg (2008), and Dąbrowska (2013) report that A-bar movement of arguments are degraded in the context of factive verbs; the latter two providing evidence from formal acceptability judgment experiments.

- (15) a. Who₁ did John {say/think/(*)regret} [that Mary kissed t₁]? (adapted from Truswell, 2011, p. 178 and 180, exx. 5 and 7, his judgment)
 b. ??What₁ did she realize [that he saw t₁]? (Ambridge and Goldberg, 2008, p. 351, Table 1, their judgment)

In addition to a classic binary factive–non-factive distinction, more fine-grained distinctions can be drawn. More specifically, verbs can be sorted into four distinct classes using the following entailment tests (Karttunen, 1971, see also White and Rawlins, 2018 and references therein):

- (16) Factive verb, e.g. *regret*
 a. “VERB p” entails p.
 Mary regrets that she offended John. → Mary offended John.
 b. “NEG VERB p” entails p.
 Mary does not regret that she offended John. → Mary offended John.
 c. “if VERB p, q” entails p.
 If I regret that I have made a mistake, I will let you know. → The speaker has made a mistake.
- (17) Semifactive verb, e.g. *realize*
 a. “VERB p” entails p.
 Mary realized that the earth is flat → The earth is flat.
 b. “NEG VERB p” also entails p.
 Mary did not realize that the earth is flat → The earth is flat.
 c. “if VERB p, q” does not entail p.
 If I realize that I have made a mistake, I will let you know. ↗ The speaker has made a mistake.

- (18) Veridical verb, e.g. *prove*
- a. “VERB p” entails p.
Mary proved that the earth is flat \rightarrow The earth is flat.
 - b. “NEG VERB p” does not entail p.
Mary did not prove that the earth is flat \nrightarrow The earth is flat.
 - c. “if VERB p, q” does not entail p.
If I prove that the earth is flat, I will let you know. \nrightarrow The earth is flat.
- (19) Non-factive verb, e.g. *think, say*
- a. “VERB p” does not entail p.
Mary thinks/said that the earth is flat \nrightarrow The earth is flat.
 - b. “NEG VERB p” does not entail p.
Mary didn’t think/say that the earth is flat \nrightarrow The earth is flat.
 - c. “if VERB p, q” does not entail p.
If I think that I have made a mistake, I will let you know. \nrightarrow The speaker has made a mistake.

We can then construct hierarchies based on how many of these entailments a verb might trigger. The most fine-grained is a four-way hierarchy (20), but it is possible to collapse the factive and semifactive classes (and possibly the veridical verbs) to produce a more classic binary classification.

- (20) *Factivity hierarchy*
Non-factive > Veridical > Semifactive > Factive

4.3.2 An “indexical shift” hierarchy

Another theme that surfaces in the literature is that bridge verbs can be defined in terms of non-entailment semantic properties. For example, as mentioned in the introduction, it is not uncommon to read that “verbs of saying” (Marácz, 1991, p. 159) or “verbs of believing” (Haider, 2010, p. 91) are bridge verbs.

Here, I would like to build on this intuition to point out what looks like an

implicational hierarchy. The survey of the literature suggests the following implications: If a language allows A-bar movement across a verb of knowledge, it will allow A-bar movement across a verb of thought. If a language allows A-bar movement across a verb of thought, it will allow A-bar movement across a verb of saying. The reverse implications, however, do not seem to hold true. Just because A-bar movement across a verb of thought is acceptable does not entail that A-bar movement across a verb of knowledge is. Likewise, there is some limited evidence from Polish varieties suggesting that just because A-bar movement is acceptable across a verb of saying does not necessarily entail it is acceptable across a verb of thought. Cichocki (1983) observes that for these varieties, *mówić* ‘say’ and *powiedzieć* ‘tell’ allow A-bar movement of *co* ‘what’ (but not other kinds of *wh*-phrases), but verbs like ‘think’ do not.

- (21) a. Cross-linguistic variation in bridge verbs (% = only some varieties of a language)

| Languages | Verbs of saying | Verbs of thought | Verbs of knowledge |
|---|-----------------|------------------|--------------------|
| English, Hebrew, Hungarian%, Scandinavian | Y | Y | Y |
| English%, Dutch, German%, Kashmiri | Y | Y | * |
| Polish% | Y | * | * |
| Armenian, Georgian, German%, Hungarian%, Polish%, Sundanese | * | * | * |

- b. (i) Verbs of saying: say, claim, announce, tell, explain, allege, deny, admit, confirm, agree
(ii) Verbs of thought: think, expect, believe, feel, guess,
(iii) Verbs of knowledge: know, realize, find out, discover, notice, see

This hierarchy offers an alternative perspective on the status of factive verbs.

In this view, long-distance A-bar movement is not sensitive to factivity *per se*.

Rather, it is sensitive to verb class, and the verbs of knowledge happen to have factivity (among other properties) as a distinguishing characteristic.⁴

This hierarchy of verbs might strike one as arbitrary. However, there appears to be some independent empirical support for it: very similar hierarchies have been proposed independently for other kinds of phenomena, such as indexical shift and logophoricity (Culy, 1994; Deal, 2017; Sundaresan, 2018). A natural hypothesis to pursue is that the *same* hierarchy is found in various cross-clausal phenomena like indexical shift and long-distance A-bar movement. To the best of my knowledge, this is a novel hypothesis about bridge verbs.

Further, for all its arbitrariness, I would like to note that there have been proposals to derive such a hierarchy from more abstract properties. Speas (2004), for example, argues that the hierarchy reflects how pragmatic features are encoded on syntactic categories. Since my goal is not to build a case for this particular thesis, I will refer interested readers to Speas’ paper for details and additional references.

For the sake of discussion, I will provide a quick review of the indexical shift literature.

Generally, indexical shift refers to the fact that in some languages, indexical lexical items, such as pronouns like *I*, *me*, and *you* do not always have to refer to the speaker or the listener. In complement clauses of attitude verbs, these indexicals can co-refer with arguments in a higher clause. An embedded ‘I’ or ‘me,’ for example,

⁴From my reading of the literature, it is difficult to say with certainty what the membership of this class might be, again reflecting gaps in our data. Cross-linguistically, many have noted that cognitive factives like ‘know’ and ‘realize’ are not compatible with long-distance A-bar movement. It is less clear if emotive factives like *regret* or *hate* belong to this class. Conceptually, they do not seem incompatible: intuitively, *someone regrets that p* appears to presuppose *someone knows that p*.

can co-refer with the subject of the attitude verb, for instance. An example of this is illustrated in (22), for the Indo-Iranian language Zazaki (Anand and Nevins, 2004).

- (22) H_{esen}_i va kε ε_{Z1/2} dεwletia.
Hesen.OBL said that I rich.be-PRES
‘Hesen said that {I am, Hesen is} rich.’ (Anand and Nevins, 2004, p. 21, ex. 4)

However, in Zazaki, not all clause-embedding verbs shift. As Anand and Nevins observe, “[o]ther attitude verbs (e.g., believe, think, dream), including those of verbal discourse (e.g., hear, yell) do not allow ε_Z [the first person indexical] to shift” (ibid. p. 36, fn. 3).

- (23) H_{esen}_i termine keno kε ε_{Z*1/2} nεweshā.
Hesen believe does that I sick.be-PRES
‘Hesen believes that {I am, *Hesen is} sick.’ (ibid. p. 36, note 3, ex. i)

Synthesizing descriptions of indexical shift, Sundaresan and Deal argue for an implicational hierarchy (24) that bears a striking resemblance to the one described above for long-distance A-bar movement.

- (24) Cross-linguistic variation in indexical shift (adapted from Sundaresan, 2018, p. 28, ex. 54)

| Languages | Verbs of saying | Verbs of thought | Verbs of knowledge |
|--|-----------------|------------------|--------------------|
| Nez Perce, Japanese% | Y | Y | Y |
| Slave, Laz | Y | Y | * |
| Tamil, Telugu, Zazaki, Amharic, Kurmanji | Y | * | * |
| English, French | * | * | * |

It is important to point out that the same caveat about data quality that I made about bridge verbs also applies here. Like bridge verbs, the data on indexical shift are based on judgments for a small number of verbs, elicited from what is likely a small pool of native speakers. It is unclear to what extent the generalizations

provided above are robust. For example, contrary to descriptions in the indexical shift literature, it turns out that indexical shift in Japanese is not widely accepted (Masato Nakamura, Yohei Oseki, Hisao Kurokami, Yasutada Sudo, Yoshiki Fujiwara p.c.). Nor is it immediately clear from the literature whether manner-of-speaking verbs shift. Anand and Nevins are clear that they do not do so in Zazaki, while Yasu Sudo judged indexical shift to be acceptable for the Japanese verb *sasayaku* ‘whisper, murmur’ (p.c.).

Setting aside these issues for now, to the extent that the parallels between long-distance A-bar movement, indexical shift, and logophoricity are valid, this particular analysis of bridge verbs can be taken as novel independent evidence for the hierarchy.⁵

4.3.3 A comment on manner of speaking verbs

As presented, the two hypotheses presented might create the impression that the manner of speaking verbs like “shout” or “whisper” pattern together with verbs like *claim* and *say* in allowing long-distance A-bar movement, since both types of verbs are non-factive verbs of verbal communication. This is an undesirable outcome, since, as far as I can tell, there is no language in which manner of speaking verbs freely allow long-distance A-bar movement. For these two hypotheses to be viable

⁵In fact, to the extent that the A-bar movement generalizations are robust, they further suggest that this hierarchy might have an important role in our theories of syntax and semantics, especially for theories of cross-clausal phenomena like logophoricity, indexical shift, and long-distance A-bar movement. After all, there is no a priori reason that attitude verbs might be ordered in this particular fashion. Likewise, there is also no a priori reason to expect that these cross-clausal phenomena, which have very distinct morphosyntactic and semantic profiles, might be subject to the same hierarchy.

hypotheses about bridge verbs, we require some independent principle that renders manner of speaking verbs incompatible with long-distance A-bar movement.

As one might expect, there are several options for implementing this. One straightforward way of doing so is to stipulate that there is some general syntactic constraint against A-bar movement from the complement clause of a manner of speaking verb. This would provide an explanation why there appears to be no language in which manner of speaking verbs are compatible with long-distance A-bar movement. Alternatively, one might posit some kind of discourse or pragmatic principle.

Whatever the correct implementation might be, it should be clear from the discussion that the restriction is likely to be related to the fact that manner of speaking verbs encode manner semantics in a way that the other verbs do not (Beavers and Koontz-Garboden, 2012; Rappaport Hovav and Levin, 2008). In this section, I present diagnostics proposed by Beavers and Koontz-Garboden (2012) that suggest that manner of speaking verbs form a distinct class from the other non-manner of speaking verbs: specifically, the distinction between these two classes parallels that between Beavers and Koontz-Garboden’s “manner verbs” and “result verbs.” I have adjusted the descriptions of these diagnostics slightly to make them more precise.

- (25) Diagnostics for result and manner verbs (Beavers and Koontz-Garboden, 2012)
- a. Result verbs cannot be followed with a denial of results.
 - (i) #Shane just broke the vase, but it is not broken. (p. 337, ex. 9a)
 - (ii) Tracy just swept the floor, but nothing is different about it. (ex. 11a)

- b. Result verbs do not allow object deletion
 - (i) Intransitive use
 - 1. *All last night, Kim broke. (ex. 16b)
 - 2. All last night, Kim scrubbed. (p. 339, ex. 14b)
 - (ii) *Out*-prefixation
 - 1. ??Kim outbroke the other vase-smasher. (ex. 19a)
 - 2. Cinderella outscrubbed her stepsisters. (ex. 15b)
- c. Result verbs impose restrictions on resultatives (“unsubcategorized objects”)
 - (i) Cinderella scrubbed her knees sore.
 - (ii) *Kim dimmed her eyes sore.
- d. Manner verbs impose selectional restrictions (on subjects)
 - (i) {John/The hammer} broke the vase with a hammer. (based on p. 344, ex. 31)
 - (ii) {John/*The stiff brush} scrubbed the floor. (based on ex. 32)
- e. Manner verbs do not allow denial of action (by the subject) (NH: I find the contrast less clear; to the extent that the contrast is hard to get, this is a less convincing diagnostic)
 - (i) Jim destroyed his car, but didn’t move a muscle—rather, after he bought it he just let it sit on his neighbor’s lawn on cinder blocks, untouched, until it disintegrated! (p. 346, ex. 36)
 - (ii) #Jim ran/jogged/blinked, but didn’t move a muscle. (p. 345 ex. 35)
- f. Manner verbs that denote complex actions are durative. (NH: this fails to identify manner verbs that denote simple actions)
 - (i) It took Jim five minutes to break the window. (window breaking must occur at the end of five minutes; p. 348, ex. 42a)
 - (ii) It took Jim five minutes to clean the table. (cleaning can take place throughout the five minutes; ex. 42b)

These diagnostics can be applied to verbs of saying and manner of speaking verbs; I will use *claim* and *shout* as examples of the respective classes. As the examples in (26) show, some of these diagnostics, such as the denial of result and the non-punctuality diagnostics are inconclusive. However, verbs of saying and manner-of-speaking verbs behave quite differently with respect to the object diagnostic, the resultative diagnostic, and the subject selectional restriction diagnostic. For comparison, I also apply the same diagnostics to verbs of thought and knowledge,

taking *believe* and *realize* as examples.

(26) Diagnostics for result and manner verbs, as applied to various attitude verbs

- a. Result verbs cannot be followed with a denial of results:
 - (i) Drew realized / believed / claimed that the earth was flat, but #there was no such realization / no such belief / no such claim on his part.
 - (ii) Drew shouted that the earth was flat, but #there was no shout.
- b. Result verbs do not allow object deletion
 - (i) Intransitive use
 - 1. *Drew realized / believed / claimed. (excluding null complement anaphora, which have an anaphoric reading.)
 - 2. Drew shouted. (no anaphoric reading)
 - (ii) *Out*-prefixation
 - 1. *Drew out-knew / out-believed / out-claimed Mary.
 - 2. Drew out-shouted Mary.
- c. Result verbs impose restrictions on resultatives (“unsubcategorized objects”)
 - (i) *Drew claimed himself hoarse. (e.g. he made so many claims that he lost his voice)
 - (ii) Drew shouted himself hoarse.
- d. Manner verbs impose selectional restrictions (on subjects)
 - (i) {John/The paper} claimed that the earth was flat. (cf. Anand et al., to appear; Anand and Hacquard, 2009, 2014)
 - (ii) {Drew/*Drew’s vocal tract} shouted.
- e. Manner verbs do not allow denial of action by the subject
 - (i) The paper claimed that the earth was flat. (since papers are inanimate, there is no action by the subject to be denied. But this test is problematic for mental state verbs like *think*, since these verbs arguably do not describe any action.)
 - (ii) #Drew shouted, but didn’t move his articulatory muscles.
- f. Manner verbs that denote complex actions are durative: n/a; doxastics are stative or achievements (e.g. *realize*), while communicative verbs are

4.3.4 Bridge effects are sensitive to fine-grained semantic distinctions

There is of course no a priori reason to think that long-distance A-bar movement must be sensitive to relatively coarse-grained lexical semantic distinctions like

the ones described above. There are proposals on the market that divide the set of attitude verbs in a much more nuanced way. Here, I will discuss two distinct classification systems: Anand et al., to appear and Levin, 1993, which both cover a relatively large set of attitude verbs in English. While these researchers do not discuss bridge effects at all, a number of their proposed verb classes correspond rather neatly to verb classes that have been conventionally held to be incompatible with long-distance A-bar movement, such as factive verbs or manner of speaking verbs.

In their survey of more than 400 clause-embedding verbs, Anand et al. proposed three dimensions for classifying attitude verbs: their general lexical semantics (doxastic (mental states), communicative, ...), whether they are factive or not, and whether they allow “non-agentive repository of information” subjects. The last property refers to the fact that a number of these verbs have the option of having an inanimate subject, as long as that subject denotes a “repository of information” and it is understood that there is an agent responsible for the creation of that repository of information. For example, *book* and *article* are both agentive repository of information nouns, and can appear as the subject of a verb like *state* (27a). In contrast, they cannot occur as the subject of *shout* (27b).

- (27) a. {Mary / The book} stated that the earth was flat. [Agentive
 repository of information subject possible]
 b. {Mary / *The book} shouted that the earth was flat. [Agentive
 repository of information subject impossible]

In this classification system, factive verbs form a natural class. While there is no dedicated class for manner of speaking verbs, I note that these verbs form the bulk of non-factive communicative verbs that are incompatible with agentive repository

of information subjects (the remainder, as noted in their footnote 3, being a small but semantically diverse set of verbs, including phrasal verbs like *add in*, *put in*, verbs of “publishing” (for lack of a better term) such as *record*, *publish*, *editorialize*, and the high-frequency *tell*).

Levin proposes an even finer classification system, based on a verb’s semantics and syntactic properties. (To the extent that there is a principled correlation between a verb’s syntax and its semantics, Levin’s system is ultimately organized along semantic lines.) In this system, attitude verbs appear in seven major semantic classes, such as “verbs with predicative complements,” “verbs of perception,” “verbs of desire,” “verbs of social interaction” and so on. Verbs within each semantic class are then sorted into smaller subclasses in part based on the syntactic frames that they can appear in.

In this system, manner of speaking verbs form a distinct class of their own (Section 37.3, pp. 204–206). However, there is what appears to be a major omission in this system: Levin (1993) does not mention factive verbs at all. Nor does she discuss verbs that take embedded question as complements. This particular subcategorization property is often hypothesized to be a feature that characterizes factive verbs (see e.g. Spector and Egré, 2015; White and Rawlins, 2018).

4.3.5 Bridge effects reflect backgroundedness effects

Another approach, often found in functionalist or discourse-based discussions, claims that bridge effects follow from two independent properties: (i) certain verbs

“foreground” or draw attention to the proposition denoted by their complement, and (ii) there is a general constraint against A-bar movement from backgrounded complements (Ambridge and Goldberg, 2008; Deane, 1991; Erteschik-Shir, 1973; Goldberg, 2006).

Despite its conceptual simplicity, this approach faces a major problem: it has always been difficult to make precise in theoretical terms what it means for something to be foregrounded (or backgrounded). There are also few clear diagnostics for backgroundedness. The preferred diagnostic that Goldberg and colleagues use is negation, where an embedded clause is judged to be foregrounded if negation of the main clause entails that the proposition denoted by the embedded clause is negated (28). One problem with this diagnostic, especially in the domain of attitude verbs, is that it introduces a confound, since a proper subset of verbs like *think* are neg-raising, and so easily imply the negation of the embedded proposition. Consequently, it is unclear whether a verb passes this diagnostic because it foregrounds its complement or because it is neg-raising.

- (28) V foregrounds p ... to the extent that NEG V p \rightarrow \neg p
- a. She didn’t think that he left. $?$ \rightarrow He didn’t leave. [*that he left* is foregrounded]
 - b. She didn’t notice that he left. \nrightarrow He didn’t leave. [*that he left* is backgrounded.]
- (adapted from Ambridge and Goldberg (2008), p. 368, exx. 26–27)

Another potential issue is about the range of data this approach is intended to cover. As I read it, Ambridge and Goldberg, 2008 is an account of the circumstances in which long-distance A-bar movement to form *wh*-questions is acceptable: “...

even when questions appear to be semantically appropriate, there are constraints on what can count as a question” (p. 358); their examples and critical sentences all involve *wh*-questions. However, Goldberg (2006), which also put forward essentially the same backgroundedness proposal, discusses examples featuring *wh*-questions and relativization. For concreteness, I will assume that the proposal is intended to cover a broader range of A-bar dependencies, as implied in Goldberg, 2006.

4.3.6 Exemplar effects

In this hypothesis, the acceptability of long-distance A-bar movement for a given verb is ultimately related to how semantically similar that verb is to some of the most common bridge verbs like *think* and *say*. The intuition is as follows: like most verbs, bridge verbs follow a power law distribution in naturally-occurring context (Dąbrowska, 2013). Hence, when asked to judge (or produce or process) novel long-distance A-bar movement structures, speakers implicitly compare them to high-frequency forms involving *think* and *say*, which are the most familiar.

This idea is easily modeled as a processing effect, as it is usually described in the usage-based literature (Dąbrowska, 2004, 2008, 2013; Verhagen, 2006): Speakers create templates based on these high-frequency forms and use them for production and comprehension, and processing any other kind of structure necessarily requires modification and incurs a cost.⁶

⁶This is not to say that exemplar effects influence acceptability only through processing factors, such as production or comprehension, although it is certainly relatively straightforward to model these effects that way. For example, it is logically possible that the degree of well-formedness of long-distance A-bar movement exhibits exemplar effects.

4.3.7 A frequency-based reductionist account

In recent work, Gibson (2018)/Liu et al. (2019) put forward a reductionist argument, in which the differences in acceptability in A-bar movement associated with bridge effects simply reflect differences in the frequency of verbs appearing with clausal complements.

This account is built around the following observation: A-bar movement is the most acceptable when it occurs with bridge verbs and degraded when it appears with manner of speaking verbs, but this correlation happens to be confounded with frequency: bridge verbs appear frequently and often take finite clausal complements, while a prototypical non-bridge verb, such as a manner-of-speaking verb, is less frequent and can appear without clausal complements. Liu et al. (2019) provide experimental evidence for a set of 48 English verbs to support this argument. Featherston (2004) makes a similar observation for German, although with a much smaller set of verbs.

Conceptually, for English at least, this frequency-based analysis is not entirely unmotivated, since frequency is widely known to influence language processing, which in turn impacts acceptability. This idea manifests itself in several ways within psycholinguistics, in the form of priming and satiation, where exposure in the very short term leads to more frequent production and ease of processing, and/or greater acceptability. This idea can further be seen as a lexicalized version of Pearl and Sprouse’s account (2013a; 2013b), which models acceptability of long-distance A-bar movement as a function of frequency of observing long-distance A-bar move-

ment structures in one's linguistic experience.

That said, there are three sets of issues associated with this frequency-based treatment.

First, it ties the acceptability of a *wh*-dependency to two elements within it: a verb and its clausal complement. One obvious question is why these two elements should matter more than other elements for the same dependency. For example, why does the aspect of the verb, or the tense of the embedded clause, seem to not matter? Another question is why other kinds of dependencies do not seem to be sensitive to these elements. For example, the dependency between a pronoun and its antecedent does not seem to be sensitive to these elements (29a). The dependency between a reflexive and its antecedent, on the other hand, is sensitive to the mere presence of a clausal complement; the frequency of the verb that takes the clause as a complement does not matter (29b).

- (29) a. Every girl₁ {thought/said/whispered/yelled/regretted} that John liked her₁.
b. *Every girl₁ {thought/said/whispered/yelled/regretted} that John liked herself₁.

Second, to rephrase an argument of Featherston's (2004), correlation is not causation. There might be some other linguistic property that is simultaneously responsible for the acceptability of long-distance A-bar movement and frequency. Featherston considers two candidates: phonological weight (as measured in number of syllables) and semantic weight (although he does not provide a definition of it). For the sake of discussion, suppose that being semantically light (or phonologically light) might mean that a verb can be used in more contexts than a "heavier" verb,

which contributes to the frequency of use. That said, Featherston is also careful to note that proving a causal relation between weight and frequency is difficult.

4.4 Acceptability judgments for 100 attitude verbs

The proposals make distinct predictions that one can test empirically. To do so, I ran an acceptability judgment experiment on Amazon Mechanical Turk to collect ratings for 100 verbs. I recruited a total of 83 participants, all self-identified native speakers of American English based in the United States.

There were two main goals in conducting this study.

The first goal is to remedy an empirical gap in our understanding of bridge verbs and bridge effects. Although the field has long recognized that long-distance A-bar movement is not equally acceptable across all clause-embedding verbs, we know relatively little about the actual range of variation in acceptability.

Second, as reviewed above, there are a number of existing claims about the nature of bridge effects that are made on the basis of relatively few verbs. The large number of attitude verbs in a language like English means that it is not feasible to test these claims through informal introspection, one verb at a time. A larger scale formal study, as described here, allows a more comprehensive evaluation of these claims.

More specifically, to the extent that one of these claims is a better account of bridge effects, a statistical model of acceptability judgments that is built around this claim should outperform statistical models based on alternative claims. Adopting

this quantitative approach thus allows us to adjudicate between various claims and to identify the dimension(s) that truly have an impact on the acceptability of long-distance A-bar movement. Doing so will help clarify the kind of learning a native speaker might have to do (or not have to do) regarding the syntax of long-distance A-bar movement.

4.4.1 Methods

4.4.1.1 Verb selection

First, I identified a set of verbs that take declarative complement clauses in naturally occurring contexts; this was so that there would be some assurance that the relevant verb–clause frame would not be completely unfamiliar to participants. To do so, I wrote a Python script that identified declarative finite clausal sisters (annotated with the label SBAR) of (phrasal) verbs in the Penn Treebank (approximately 251,000 tokens).

To minimize the likelihood of false positives in the identification of complement clauses in the Penn Treebank, I manually checked verb lemmas that appeared with a declarative finite sister nine times or fewer and corrected the annotation if necessary. I assume that all verb lemmas that appeared at a higher frequency take a complement clause.

The semi-automated process yielded 20,756 instances of (phrasal) verbs appearing with a complement clause-like frame, distributed across 279 unique verb lemmas. These verbs have a power law-like distribution. The most common 20

verbs, listed in (30), appear a total of 16,817 times (81%), while 87 verbs appear only once.

- (30) Most common 20 verbs appearing with finite declarative clausal complements
say, think, guess, know, believe, tell, feel, find, hope, note, mean, add, show, suggest, wish, realize, see, indicate, seem, report

One of the goals of this study is to replicate claims about frequency and bridge effects made by Gibson (2018)/Liu et al. (2019). To that end, I selected 40 of their 48 verbs; this set includes some of the most frequent verbs, such as *say* and *think*, as well as most of their manner of speaking verbs. These 40 verbs also appeared in the Penn Treebank sample.

The remaining 60 verbs were selected from the Penn Treebank sample in a pseudo-random fashion, to exclude raising verbs like *seem*.

Finally, I checked to make sure that the 100 verbs chosen also occur with a complement clause in the British National Corpus, a corpus that is 24 times the size of the Penn Treebank (see below for rationale).

The full set of 100 verbs is listed in (31).

- (31) accept, admit, advise, affirm, alert, allow, argue, assert, assume, attest, believe, boast, brag, claim, comment, communicate, complain, concede, concur, confide, confirm, counter, declare, decree, deny, disagree, disclose, discover, doubt, ensure, expect, expound, fear, feel, figure, forecast, foresee, forget, fret, grumble, guarantee, guess, hate, hear, hint, hope, hypothesize, indicate, infer, inform, insinuate, insist, intimate, know, laugh, learn, like, maintain, mean, muse, mutter, notice, notify, observe, pledge, presume, proclaim, promise, propose, protest, prove, read, realize, regret, remark, remember, repeat, report, respond, reveal, say, scream, shout, sigh, snap, specify, state, suspect, swear, testify, theorize, think, urge, venture, verify, vow, warn, whisper, worry, write

4.4.1.2 Obtaining better frequency estimates

As mentioned above, a frequency-based reductionist account posits that acceptability varies directly with how frequently a verb occurs with a complement clause — for ease of reference, I will also call this the frequency of the “verb-S frame.” To obtain better estimates of this frequency, I used the freely downloadable British National Corpus (BNC, BNC Consortium, 2007) to obtain frequencies for the verbs that were found to occur with at least one finite complement clause in the Penn Treebank (PTB). Although verb-S frequencies can be computed easily from the PTB, it is a relatively small corpus, raising concerns that estimates for low-frequency items might be too coarse. Using the BNC, which consists of about 6 million sentence units and is thus about 24 times the size of the PTB (about 251,000 sentence units) reduces the analytical problem posed by coarse estimates.

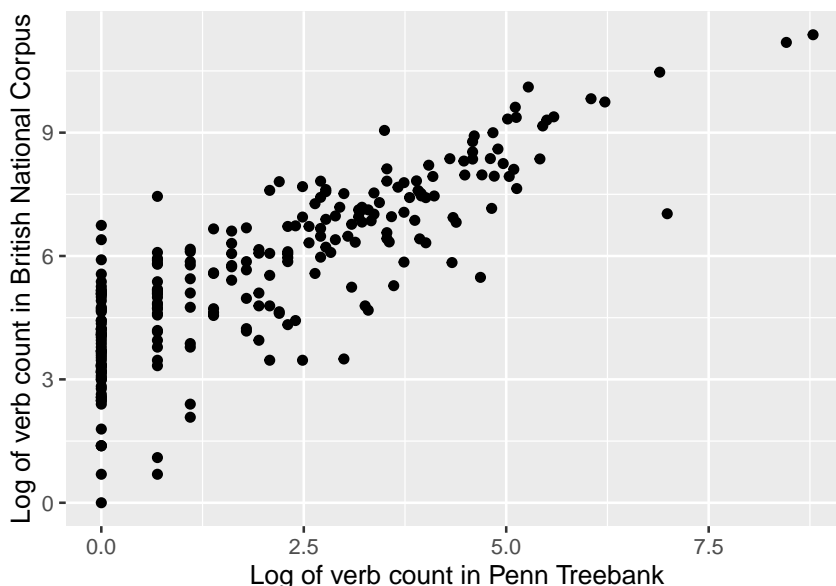
The BNC was chosen over other large, free-to-use corpora like the Corpus of Contemporary American English and the Google Books corpus for two reasons (note: Liu et al. (2019) used the Google Books corpus to obtain frequency estimates). First, the BNC is available for download and hence is available for customized analysis; the other two datasets must be accessed via online interfaces. Because all three corpora are collections of sentences with lemma and part of speech information but no other structural information, there is no easy way to use the online interface to obtain good estimates of a verb taking a complement clause. The second reason is that the BNC contains both spoken and written registers (10% and 90% of all words, respectively). This makes it more balanced than the Google Books corpus.

These two features were judged to outweigh one drawback of using the BNC: the fact that the BNC is a corpus of British English varieties, while the PTB data are based on American English. In my judgment, the syntax of clause-embedding verb in these varieties is likely to be very similar, and so dialectal differences are likely to be small.

To obtain estimates of frequency of complement clauses, for each attitude verb, I wrote a script to randomly extract a sample of sentences containing the verb. Each sentence was then automatically parsed using the Stanford Parser (Klein and Manning, 2003; Manning et al., 2014) into machine-readable syntax trees. A second script then analyzed each tree to identify the sisters of the verb, and if one of them was a clause, identify certain syntactic characteristics of the clause: whether it was a complement clause or an adjunct clause, whether it was finite or not, whether it was an embedded question or a declarative, and so on. Granted, the Stanford Parser is not perfectly accurate. I will, however, make the simplifying assumption that the estimates are reliable and broadly reflect how frequently these verbs appear with complement clauses.

To speed up the sampling, parsing, and analysis, I divided the set of verbs into four smaller sets based on their base frequencies in the BNC. Verbs whose lemmas are recorded to appear at least 100,000 times in the list created by Adam Kilgarriff (<https://www.kilgarriff.co.uk/bnc-readme.html>) were randomly sampled at a 5% rate, those whose lemmas appear 10,000–99,999 times at 10%, those whose lemmas appear 800–9,999 times at 25%, and verbs less than 800 times at 100% (i.e. there was no random sampling for these very low frequency verbs). The fre-

Figure 4.1: Frequencies of verbs with complement clauses in the Penn Treebank and the British National Corpus



quency figures obtained through this process were then scaled to obtain corpus-level estimates.

One might (rightly) be concerned that, because of dialectal differences, frequency estimates might diverge significantly for less frequent items in both datasets. An analysis finds no cause for concern: there is a high degree of correlation between both sets of estimates (Figure 4.1); log frequencies for one corpus is strongly correlated with log frequencies in the other (Spearman $\rho = 0.836$, $p < 0.001$).

4.4.1.3 Identifying the other independent variables

Factivity measures I used the diagnostics discussed in Section 4.3.1 to code a verb as factive, semifactive, veridical, or non-factive. Since the particular implementation discussed above excluded manner of speaking verbs, all manner of speaking verbs were treated as a separate “manner of speaking” class, instead of being coded as

non-factive.

Anand et al.’s classification system I maintained their binary factivity distinction, while making a few minor corrections. (Specifically, I reclassified *fret* as an emotive verb, and not a communicative verb, and treat *admit* and *hear* as non-factive.) Note that in this system, a verb can appear in multiple categories: *guarantee*, for instance, is treated as both an inferential verb and a communicative verb.

Indexical shift hierarchy Anand et al.’s system was also used to determine what categories a verb might belong to in the indexical shift hierarchy. First, I coded all factive verbs (emotive factives like *regret* and cognitive factives like *notice*) as verbs of knowledge. All non-factive doxastics were coded as verbs of thinking, and all non-manner of speaking communicative verbs were coded as verbs of saying. All other verbs — non-factive emotives, inferential, and manner of speaking verbs — were coded separately as “emotive,” “inferential,” and “manner of speaking” verbs.

Levin’s classification system I adapted the classification system in Levin, 1993 (organized as chapters and sections in the book) to produce the following verb classes (32); note that a verb can appear in multiple classes due to polysemy or by virtue of their subcategorization frames:

- (32) Verb classes based on Levin’s classification system
- a. Mental state verbs: Chapter 29 “Verbs with predicate complements”; these are verbs that can appear with small clause complements or non-finite complements.
 - b. Realize verbs: This refers to a set of mental state verbs that are distinguished by being able to appear with an embedded question, like *realize* and *know*. Levin does not use embedded questions as a criterion.

- c. Perception verbs: Chapter 30
- d. Emotive verbs: Chapter 31 “Psych-Verbs” and 32 “Verbs of desire”; these two chapters are combined due to their similar semantics
- e. Judgment verbs: Chapter 33
- f. Social interaction verbs: Chapter 36
- g. Various classes of communication verbs: Chapter 37
 - (i) Manner (37.3): This includes all manner of speaking verbs, as well as *write*, which describes an instrument of communication.
 - (ii) Chitchat verbs (37.6)
 - (iii) Say verbs (37.7)
 - (iv) Complain verbs (37.8)
 - (v) Advise verbs (37.9)
 - (vi) “Subjunctive” verbs: This refers to a set of communicative verbs that describe commands and orders, such as *insist*; syntactically they can occur with a subjunctive clause. Levin does not distinguish this class or use subjunctive clauses as a criterion.
- h. Non-verbal expression verbs: Chapter 38 “Verbs of sounds made by animals”
- i. Verbs of appearance: Chapter 48 “Verbs of appearance, disappearance, and occurrence”
- j. Other verbs: this includes a small set of miscellaneous verbs such as “Measure verbs” which are scattered across a relatively diverse set of verb classes. I consolidated these to avoid spuriously creating verb classes for the statistical analysis.

Backgroundedness measures I use an existing set of entailment metrics for measuring backgroundedness, as defined by Goldberg (2006) and colleagues. In a large scale study of the factive and veridical properties of over 300 English attitude verbs by White and Rawlins (2018), participants were presented with a set of sentences like (33a). 10 participants rated each sentence for acceptability on a 7-point Likert scale and answered a question that was based on the complement clause, as in (33b).

- (33) a. Someone {thought/didn’t think} that a particular thing happened.
 b. Did that thing happen? [Options: “Yes,” “Maybe or maybe not,” “No”]

Of interest are the sentences in which there was matrix negation — *Someone*

didn't think that a particular thing happened — and the responses to the associated question. To the extent that participants responded ‘No,’ we may conclude, following Ambridge and Goldberg (2008), that the verb foregrounds its complement clause. In the data that White and Rawlins make available, there are raw responses (“Yes,” “Maybe or maybe not,” and “No”) for each participant and each verb, as well as an average response for each verb that has been normalized to adjust for individual differences, such that the more likely participants gave a negative response, the more negative the normalized score is.

To estimate the backgroundedness of a verb, I did the following: First, I excluded participants that White and Rawlins indicated should be excluded from analysis based on their native languages. Next, I extracted only the test sentences like the one in (33a), where the matrix verb was in the active voice, was negated, and took a finite complement clause. For each verb, I calculated the percentage of ‘no’ responses and extracted the normalized responses. The greater the extent of backgrounding (and hence by hypothesis the lower the acceptability rating), the lower the rate of ‘no’ responses, and the higher the normalized score.

Verb similarity measures The exemplar effects hypothesis predicts that the acceptability of long-distance A-bar movement for a verb depends on how semantically similar the verb is to the most common bridge verbs. Following Ambridge and Goldberg (2008); Dąbrowska (2013), I operationalize this by measuring the similarity of a given verb to two high-frequency bridge verbs: *think* and *say*. There are many options on the market for measuring verb similarity, and I selected the

following three approaches for doing so.

The first approach is to use WordNet (Fellbaum, 1998; Miller, 1995). The Python Natural Language Toolkit (NLTK) (Bird et al., 2009) interface generates a suite of similarity measures for any given pair of verbs (or more specifically, verb readings, since most verbs are polysemous and so have multiple readings). To identify the appropriate reading for a given verb, I checked the definitions, examples, and sentence frames given by WordNet for each reading of a verb. I consider a sense relevant if (i) the sentence frames listed for that reading include one where the verb appears with a “that CLAUSE” (i.e. a complement clause), or (ii) if the examples listed for that reading include one with a complement clause, or (iii) if the definition was judged to be compatible with a complement clause. This process yielded between 1 to 5 readings for each verb.

From looking at the definitions given for *say* and *think*, I identified two relevant readings for each verb; call these four readings the baseline readings.

I then wrote a Python script to generate similarity scores for each reading of a verb and each of the baseline readings. From this set of similarity scores, I took the highest similarity score.

From the set of six similarity scores available in the NLTK WordNet package, I selected two: a path similarity score, which measures similarity in terms of WordNet’s hierarchy of concepts, and the Jiang-Conrath similarity score (Jiang and Conrath, 1997). The definition of the Jiang-Conrath score makes reference to the ‘information content’ of each reading relativized to a corpus (Resnik, 1995). For the purpose of calculating this score, I used the pre-compiled information content data

for the Penn Treebank provided in the WordNet package.

The second approach is to use word vectors (more precisely, lemma vectors) as a proxy for semantic representations; I calculate similarity using cosine similarity between these vectors. To do so, I used the Penn Treebank as a corpus; each sentence was converted to lower case, stripped of null syntactic elements (e.g. traces), punctuation, and stop words as defined by the NLTK package, and then lemmatized. I trained a Word2Vec model (Mikolov et al., 2013; Řehůřek and Sojka, 2010) on this lemmatized corpus. I included all lemmas in the training process, instead of dropping very low-frequency items, because doing so would have eliminated some attitude verbs of interest. The training process generates a word vector for every lemma in the lemmatized corpus.

For each of the verbs, I calculated cosine similarity values for that verb’s vector relative to the vectors of *say* and *think*. The higher cosine similarity value was taken to be the verb’s similarity score.

The third approach is to use syntactic frames as a proxy for semantic representations. Specifically, I used the MegaAttitude dataset (White and Rawlins, 2016), which consists of acceptability ratings assigned to 50 distinct syntactic frames for 1000 clause-embedding verb verbs. Adapting the normalization procedure described by White and Rawlins, I normalized the ratings for each participant using a Ridit transformation. Mean Ridit-transformed ratings were then calculated for each frame for each verb, yielding a vector of ratings for each verb.

Again, for each of verb of interest, a cosine similarity value was computed for that verb’s vector and the vector for *say* and *think*. The higher similarity value was

taken to be the verb’s similarity score.

4.4.1.4 Collecting acceptability ratings

Minimal pairs for each verb were constructed. To ensure that ratings are broadly comparable, the minimal pairs were all based on the following template:

- (34) a. Matrix A-bar movement (baseline): This is the NOUN that VERBed that {no one/someone/everyone} (AUX) VERB(ed/en) the ADJECTIVE NOUN.
b. Long-distance A-bar movement: This is the ADJECTIVE NOUN that the NOUN VERBed that {no one/someone/everyone} (AUX) VERB(ed/en).

I chose to construct sentences containing relative clauses rather than *wh*-questions to avoid confounds with the pragmatics of questions, following Gibson (2018)/Liu et al. (2019). Questions are usually posed to acquire information from one’s conversation partner, and in the absence of context, it might be odd to ask that person about a third individual’s attitudes or statements (see Gibson, 2018 for similar comments). The contents of a relative clause, in contrast, is usually perceived to be common knowledge.

Subjects of the attitude verbs were uniformly human: *the lawyer*, *the teacher*. The exception is *mean*, which had a non-human subject (*the outage*). The reason for making an exception for *mean* is because when it appears with a human subject, it triggers a presupposition that there is another proposition under discussion introduced by the referent of the subject. For example, *Mary meant that John is late* is felicitous only if Mary had made another statement previously. To avoid this complication, I decided to use a non-human subject, which does not trigger such a

presupposition.

To ensure that any low acceptability can be reasonably attributed to long-distance A-bar movement and not due to the choice of lexical items, stimuli sentences were constructed to maximize plausibility in the matrix A-bar movement condition. For example, since a verb like *testify* is typically used in legalistic situations, the relevant minimal pair for such a verb might feature lexical items like *lawyer* and *witness*. Similarly, since one usually whispers something that is not intended to be publicly known, the matrix A-bar movement sentence for *whisper* was deliberately constructed to suggest something conspiratorial: *This is the actor who whispered that everyone hated the arrogant director.*

Each participant rated 10 minimal pairs along a 7-point Likert scale, where 1 indicates lowest acceptability and 7 the greatest. In addition, they also rated 20 sentences that include preposition stranding in implausible contexts (35a), ungrammatical preposition stranding (35b), and A-bar movement from a complex NP island (35c), which served as fillers and control sentences.

- (35) a. This is the key witness the cook washed a meal for. [Preposition stranding in implausible context]
 b. This is the war for independence the writer wrote novels after. [Ungrammatical preposition stranding]
 c. This is the difficult client the manager regretted the fact that no one contacted. [Complex NP Island Constraint violation]

Before starting the experiment proper, each participant did 6 practice sentences for familiarization. Participants were paid \$4.

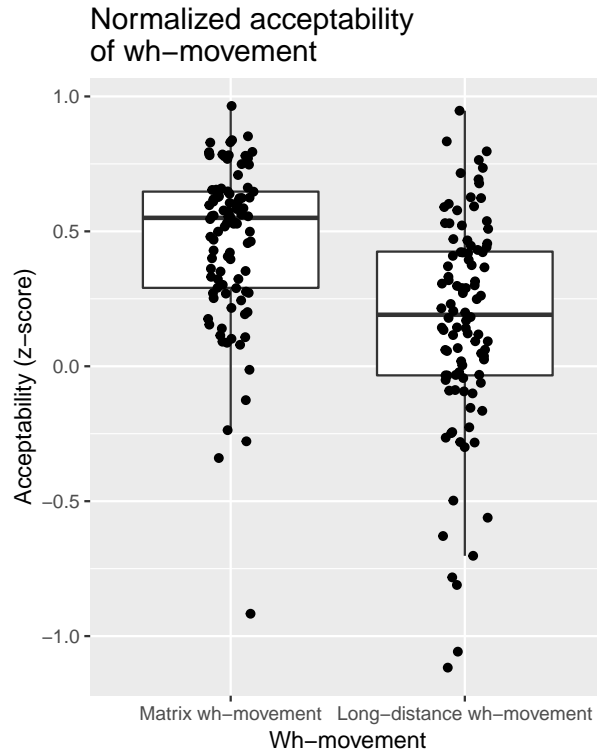
4.4.2 Data analysis

For graphing purposes, I normalized the acceptability ratings for each participant using a z-score transformation.

For statistical analysis, I also used z-scores. I used the ‘LME4’ package in R to fit linear mixed-effects models for the acceptability ratings, using a maximum likelihood estimation procedure (Bates et al., 2015; R Core Team, 2019). The fixed effects in these models were the factors outlined above: verb classes, frequency measures, verb similarity measures, and so on. I included random intercepts for participant and for verb. (I also tried more complex models with random intercepts and slopes for participant and for verb, but they were either too complex, failed to converge, or ran into boundary fit issues that suggest over-fitting problems.)

One important reason for using a linear mixed effects model is because one can use mixed effects models, but not other models, to calculate two useful values: a marginal R^2 and a conditional R^2 (Nakagawa and Schielzeth, 2013). The former value measures the variance that is explained by the fixed factors in the model, in this case, factors such as semantic class, frequency, verb similarity, and so on. The latter value measures the variance explained by both fixed and random factors, and so provides a sense of the overall quality of fit. For this analysis, I used the ‘MuMIn’ package in R (Barton, 2019).

Figure 4.2: Normalized acceptability of matrix A-bar movement vs. long-distance A-bar movement



4.4.3 Analysis 1: Absolute acceptability of long-distance A-bar movement for the fuller set of verbs

Figure 4.2 shows that normalized acceptability ratings for the baseline matrix A-bar movement condition is generally higher than the long-distance A-bar movement condition, and clustered more closely. Both properties suggest that the lexicalizations designed were largely successful at maximizing sentence plausibility and hence acceptability for this condition.

Average z-score acceptability judgments long-distance A-bar movement for all

100 verbs are given in (36):

(36) Verbs sorted by average absolute acceptability of long-distance A-bar movement (normalized by participant)

| Verb | z-score | Verb | z-score | Verb | z-score |
|----------|---------|-------------|---------|-----------|---------|
| mean | -1.12 | concede | 0.06 | guess | 0.37 |
| intimate | -1.06 | disclose | 0.06 | declare | 0.39 |
| snap | -0.81 | concur | 0.07 | propose | 0.41 |
| scream | -0.78 | reveal | 0.09 | know | 0.42 |
| allow | -0.76 | discover | 0.09 | advise | 0.42 |
| respond | -0.7 | alert | 0.1 | verify | 0.42 |
| counter | -0.56 | hear | 0.12 | ensure | 0.43 |
| sigh | -0.5 | promise | 0.12 | realize | 0.43 |
| attest | -0.3 | learn | 0.13 | affirm | 0.44 |
| shout | -0.28 | insinuate | 0.14 | argue | 0.45 |
| inform | -0.28 | accept | 0.14 | indicate | 0.45 |
| repeat | -0.26 | notice | 0.14 | figure | 0.47 |
| like | -0.25 | protest | 0.17 | confirm | 0.47 |
| hate | -0.24 | read | 0.17 | report | 0.51 |
| disagree | -0.23 | forecast | 0.18 | urge | 0.52 |
| venture | -0.17 | doubt | 0.18 | guarantee | 0.53 |
| testify | -0.1 | state | 0.2 | worry | 0.53 |
| brag | -0.1 | grumble | 0.2 | expect | 0.54 |
| whisper | -0.09 | proclaim | 0.21 | specify | 0.58 |
| laugh | -0.09 | communicate | 0.23 | forget | 0.59 |
| remember | -0.09 | write | 0.25 | suspect | 0.59 |
| observe | -0.05 | warn | 0.26 | think | 0.6 |
| confide | -0.04 | foresee | 0.27 | vow | 0.62 |
| pledge | -0.03 | fret | 0.29 | feel | 0.63 |
| admit | -0.03 | complain | 0.29 | remark | 0.68 |
| deny | -0.03 | mutter | 0.29 | decree | 0.69 |
| expound | -0.02 | muse | 0.3 | assume | 0.72 |
| regret | -0.01 | assert | 0.3 | believe | 0.74 |
| comment | 0.01 | theorize | 0.31 | fear | 0.76 |
| notify | 0.02 | hint | 0.32 | presume | 0.8 |
| maintain | 0.03 | hypothesize | 0.33 | insist | 0.83 |
| prove | 0.04 | say | 0.34 | hope | 0.95 |
| boast | 0.05 | swear | 0.37 | | |
| infer | 0.06 | claim | 0.37 | | |

Weighted mean z-score for all 100 verbs = 0.16

So that the models could be compared with each other, data for 15 verbs had

to be dropped from the ordinal regressions reported in (37): these 15 verbs were not analyzed by White and Rawlins (2016) in their MegaAttitude dataset.

(37) Comparisons of models of absolute acceptability of long-distance A-bar movement

| Model | AIC | logLik | Marginal R ² | Conditional R ² |
|--|------|--------|-------------------------|----------------------------|
| <i>Accounts based on linguistic distinctions</i> | | | | |
| Factivity | 1243 | -613 | 0.0602 | 0.3324 |
| Indexical shift hierarchy | 1240 | -610 | 0.0778 | 0.3326 |
| Anand et al. classification | 1236 | -606 | 0.0970 | 0.3324 |
| Levin, simplified | 1258 | -612 | 0.0685 | 0.3352 |
| <i>Backgroundedness</i> | | | | |
| Backgroundedness, percentage score | 1253 | -622 | 0.0092 | 0.3346 |
| Normalized backgroundedness | 1256 | -623 | 0.0001 | 0.3344 |
| <i>Verb similarity accounts</i> | | | | |
| Path similarity | 1253 | -621 | 0.0097 | 0.3340 |
| Jiang-Corvath/PTB similarity | 1251 | -621 | 0.0145 | 0.3331 |
| Cosine similarity, Word2Vec/PTB | 1251 | -621 | 0.0153 | 0.3358 |
| Cosine similarity, MegaAttitude | 1256 | -623 | 0.0002 | 0.3346 |
| <i>Non-linguistic account</i> | | | | |
| Frequency | 1239 | -614 | 0.0537 | 0.3305 |

Models were fit with this formula: raw acceptability \sim independent variable(s) + (1 | verb) + (1 | participant). Interaction effects were specified for the indexical shift hierarchy and Anand et al. models but not in the Levin model. A maximum likelihood procedure was used.

Several measures of quality are reported here. The first is the Akaike Information Criterion (AIC), which measures relative goodness of fit adjusted for model complexity, to facilitate the identification of more parsimonious models. The lower the AIC, the better the model. The second measure is the log likelihood (logLik): the closer the log likelihood to zero, the better the model. The third and fourth are marginal and conditional R² values, which respectively measure the contribution of the fixed factors and both fixed and random factors.

There are several interesting points to note about these results. First, the AIC

and log likelihood values favor the frequency, factivity, Anand et al., and indexical shift models: they account for much of variance in judgments while being relatively parsimonious.

Second, as measured with conditional R^2 s, all models capture about a third of the variance. However, the contribution of the fixed factors — the factors of interest — varies significantly depending on the model. The better-performing models are those listed above; in particular, the Anand et al. yields the highest marginal R^2 , about 0.097.

Overall, a frequency-based reductionist account does not fare too well under this analysis. The analysis reveals that frequency has a statistically significant effect ($\beta = 0.071, p < 0.001$), similar to what Gibson (2018) found. The frequency-only model is also one of the most parsimonious, as measured by the AIC. However, the marginal R^2 values suggest that frequency does not capture the range of effects as well as models that are based on semantic factors.

The results provide little support for backgroundedness and verb similarity accounts; their marginal R^2 s are even lower. This finding aligns with Gibson, 2018/Liu et al., 2019, which also report a lack of correlation between backgroundedness and acceptability.

I take a closer look at two models below. The first is the Anand et al. model, which has the best log likelihood and marginal R^2 values; the effect sizes for various dimensions are reported in (38). This model effectively shows that manner of speaking and emotive verbs have a negative effect on acceptability via what is essentially a statistical conspiracy: There is a negative effect on acceptability for “non-agentive

repository of information (ROI)” ($\beta = -0.397$), i.e. if a verb obligatorily takes a subject that is human and not an agentive repository of information. This set of verbs include manner of speaking, emotive, and doxastic verbs. However, there is a positive interaction effect of the same magnitude for doxastic verbs and non-agentive ROI ($\beta = 0.370$).

This model offers little evidence that factivity matters for acceptability. While non-factivity has a positive effect on acceptability ($\beta = 0.389$), this effect is not significant. This result is consistent with existing claims in the formal syntax literature that factive verbs are compatible with long-distance A-bar movement in English.⁷

(38) Results of Anand et al. (to appear) model for absolute acceptability of long-distance A-bar movement

| Variable | Estimate | Std. err. | t | p |
|-------------------------------|----------|-----------|--------|------------|
| (Intercept = Inference verbs) | -0.0604 | 0.2893 | -0.209 | 0.8352 |
| Doxastic verbs | 0.3077 | 0.3403 | 0.904 | 0.3685 |
| Communicative verbs | -0.1011 | 0.1667 | -0.606 | 0.5460 |
| Emotive verbs | 0.3273 | 0.2159 | 1.516 | 0.1335 |
| Non-factive | 0.3894 | 0.2364 | 1.647 | 0.1035 |
| Non-agentive ROI | -0.3966 | 0.0968 | -4.097 | <0.001 *** |
| Doxastic * Communicative | -0.1229 | 0.3426 | -0.359 | 0.7210 |
| Doxastic * Non-factive | -0.2222 | 0.2697 | -0.824 | 0.4126 |
| Doxastic * Non-agentive ROI | 0.3702 | 0.1835 | 2.018 | 0.0467 * |

The second model is the factivity model, in which verbs were sorted into five discrete categories, including one for manner of speaking verbs. In numerical terms, compared to non-factive verbs, veridical verbs have a slightly higher acceptability, while semifactive, factive, and manner of speaking verbs have a lower acceptability.

However, only the effect for manner of speaking verbs is significant. The effect for

⁷Running the same analysis on the full set of 100 verbs yields similar results: there is a significant negative effect associated with the non-agentive ROI property, and there is a positive but marginally significant effect associated with non-factivity ($p = 0.072$). The interaction effect between doxastic and non-agentive ROI verbs is now insignificant.

factive verbs is only marginally significant ($p = 0.0634$), suggesting that there might be no difference between non-factive and factive verbs.

(39) Results of factivity model for absolute acceptability of long-distance A-bar movement

| Variable | Estimate | Std. err. | t | p |
|---------------------------|----------|-----------|--------|-------------|
| (Intercept = non-factive) | 0.2864 | 0.0460 | 6.220 | <0.001 *** |
| Veridical | 0.0084 | 0.1448 | 0.058 | 0.9538 |
| Semifactive | -0.0740 | 0.1327 | -0.557 | 0.5787 |
| Factive | -0.2693 | 0.1430 | -1.883 | 0.0634 . |
| Manner of speaking | -0.5075 | 0.1173 | -4.327 | < 0.001 *** |

4.4.4 Analysis 2: Relative acceptability of long-distance A-bar movement for the full dataset

In this section, I consider the extent to which the various hypotheses can account for the *relative* acceptability long-distance A-bar movement: the difference in raw acceptability ratings compared to the acceptability of matrix A-bar movement.

Fitting the same regression models to relative acceptability shows that the quality of the fit declines substantially across the board. The fixed and random effects account for only about a quarter of the variance, and the contribution of the fixed effects, as approximated by marginal R^2 , is much lower, accounting for only up to about 5% of the variance. We might thus conclude that the various hypotheses are not particularly successful at modeling the variation in relative acceptability. Although we can still use the AIC and log likelihood to identify which models provide the best fit, it is unclear, given the R^2 values, to what extent doing so is a meaningful exercise in model selection.

This conclusion is somewhat unexpected: we might expect relative acceptabil-

ity to closely track absolute acceptability, and so to the extent that a model can account for variance in absolute acceptability, we expect it to be similarly successful for relative acceptability. One post hoc explanation is that there is actually variation in acceptability in the matrix A-bar movement condition that offsets or obscures the variation for the long-distance A-bar movement condition. Consequently, the effect size is much smaller and harder to detect with the current sample size.

As Dąbrowska (2013) points out, that strictly speaking, that the verb similarity accounts of Dąbrowska (2004, 2008, 2013) and Verhagen (2006) actually make no predictions about whether relative acceptability should be influenced by verb similarity. I show the results of verb similarity model here for the sake of comprehensiveness. Their lexical template hypothesis merely predicts that verb similarity affects the comprehension or production of long-distance A-bar movement (in fact, more specifically, long-distance *wh*-questions). A prediction that verb similarity affects relative acceptability requires the ancillary assumption that verb similarity has no effect on the processing of matrix A-bar movement.

- (40) Comparisons of models of relative acceptability of long-distance A-bar movement

| Model | AIC | logLik | Marginal R ² | Conditional R ² |
|--|------|--------|----------------------------|-------------------------------|
| <i>Accounts based on linguistic distinctions</i> | | | | |
| Factivity | 1488 | -737 | 0.0166 | 0.2203 |
| Indexical shift hierarchy | 1471 | -727 | 0.0396 | 0.2452 |
| Anand et al. classification | 1468 | -723 | 0.0479 | 0.2582 |
| Levin classification | 1491 | -730 | 0.0330 | 0.2486 |
| <i>Backgroundedness</i> | | | | |
| Backgroundedness, percentage score | 1493 | -743 | 0.0036 | 0.2038 |
| Normalized backgroundedness | 1495 | -743 | 0.0019 | 0.2082 |
| <i>Verb similarity</i> | | | | |
| Path similarity | 1492 | -742 | 0.0046 | 0.2068 |
| Jiang-Corvath/PTB similarity | 1494 | -743 | 0.0024 | 0.2015 |
| Cosine similarity, Word2Vec/PTB | 1484 | -738 | 0.0150 | 0.2324 |
| Cosine similarity, MegaAttitude | 1496 | -744 | 0.0000 | 0.2024 |
| <i>Non-linguistic account</i> | | | | |
| Frequency | 1477 | -734 | 0.0225 | 0.2251 |

4.4.5 General discussion

The statistical analysis described show that factors such as frequency and verb similarity explain relatively little of the variance in absolute acceptability of long-distance A-bar movement. Similarly, the results also provide little support for backgroundedness as an explanation of bridge effects.

These results also provide at best weak support for claims that bridge effects reflect sensitivity to certain verb classes or factivity. Although they perform relatively better, the fact is that they too explain only a small degree of the variance. For example, the Anand et al. model captures about a tenth of the total variance (marginal $R^2 = 0.09$).

To sum up, the results suggest that existing proposals on bridge effects have limited explanatory power. It appears that we have yet to fully identify the relevant dimensions that long-distance A-bar movement in English is sensitive to. This

might reflect limitations in our methods: perhaps there are issues or limitations in how example sentences are constructed or judged or the number of verbs that are investigated in a given study. I return to this issue in Section 4.5.4.

4.5 Just which dimensions matter for long-distance A-bar movement in English? A post-hoc analysis

In this section, I describe a post-hoc analysis of the acceptability judgments to try to identify the semantic properties that might matter for long-distance A-bar movement.

4.5.1 Methods

I calculate average z-score values of absolute acceptability of long-distance A-bar movement for each verb, and then sort the verbs from lowest acceptability to highest.⁸ I focus on the verbs with low acceptability ratings, and try to identify what properties (semantic, syntactic, discourse, etc.) they might have in common with each other. The verbs that appear in the bottom half are listed in (41).

- (41) Bottom 50 verbs, sorted by absolute acceptability of long-distance A-bar movement

⁸Using raw absolute acceptability produces more or less the same ordering.

| Verb | Average z-score | Verb | Average z-score |
|----------|-----------------|-----------|-----------------|
| mean | -1.12 | deny | -0.03 |
| intimate | -1.06 | expound | -0.02 |
| snap | -0.81 | regret | -0.01 |
| scream | -0.78 | comment | 0.01 |
| allow | -0.76 | notify | 0.02 |
| respond | -0.70 | maintain | 0.03 |
| counter | -0.56 | prove | 0.04 |
| sigh | -0.50 | boast | 0.05 |
| attest | -0.30 | infer | 0.06 |
| shout | -0.28 | concede | 0.06 |
| inform | -0.28 | disclose | 0.06 |
| repeat | -0.26 | concur | 0.07 |
| like | -0.25 | reveal | 0.09 |
| hate | -0.24 | discover | 0.09 |
| disagree | -0.23 | alert | 0.10 |
| venture | -0.17 | hear | 0.12 |
| testify | -0.10 | promise | 0.12 |
| brag | -0.10 | learn | 0.13 |
| whisper | -0.09 | insinuate | 0.14 |
| laugh | -0.09 | accept | 0.14 |
| remember | -0.09 | notice | 0.14 |
| observe | -0.05 | protest | 0.17 |
| confide | -0.04 | read | 0.17 |
| pledge | -0.03 | forecast | 0.18 |
| admit | -0.03 | doubt | 0.18 |

4.5.2 Verb classes

I was able to sort many of these verbs into the following classes based on semantic content. These classes might also include verbs for which long-distance A-bar movement is relatively acceptable; I have listed such verbs in parentheses.

- (42) a. “Complain” verbs (cf. Levin, 1993)
- (i) Examples: *brag*, *boast*
 - (ii) Characteristics: Semantically, these verbs convey some kind of subjective judgment on the part of the attitude holder (i.e. the “bragger” or the “boaster”) with respect to the embedded proposition. These verbs can appear intransitively, with a finite clause, but not with a nominal object, e.g. **Mary bragged her achieve-*

ments.

- b. “Disclose” verbs
 - (i) Examples: *disclose, reveal*
 - (ii) Characteristics: Semantically, these verbs describe the announcement of some secret or little-known material.
- c. Emotive verbs
 - (i) Examples: *like, hate, regret* (also *fear*)
 - (ii) Characteristics: These describe emotions the attitude holder has towards a proposition. The ones that are least acceptable are factive, like *Mary {regrets/hates} that John is always late.*
- d. “Hint” verbs
 - (i) Examples: *confide, hint, insinuate, intimate*
 - (ii) Characteristics: These verbs all describe the communication of a matter in a non-open fashion: either the contents are deliberately obscured, as in *hint* or *insinuate* or the communication is done in a low-key, private fashion, as *confide* or *intimate* suggest.
- e. “Inform” verbs
 - (i) Examples: *inform, notify, alert*
 - (ii) Characteristics: These verbs can appear only with a recipient object, e.g. *Mary informed John.* If they take recipient and propositional arguments, both arguments must appear in a double object frame, e.g. *Mary informed *(John) that he was going to be late.*
- f. “Legalistic” verbs (cf. Levin, 1993)
 - (i) Examples: *testify, affirm, attest*
 - (ii) Characteristics: These verbs have a performative quality and are often used in legal contexts. These verbs appear with a finite complement clause, but not with a non-finite one, e.g. *Mary affirmed that she will go* but not **Mary affirmed to go*, and therefore can be distinguished from similarly performative “pledge” verbs like *swear* or *vow*, which are also more acceptable in the context of long-distance A-bar movement.
- g. “Manner of speaking” (cf. Levin, 1993; Zwicky, 1971)
 - (i) Examples: *snap, scream, sigh, shout, laugh*
 - (ii) Characteristics: Semantically, these verbs describe the physical manner of utterance. As defined here, this class consists of several distinct subclasses, corresponding in large part to Levin’s “manner of speaking” and “non-verbal expression” verbs.
- h. “Pledge” verbs
 - (i) Examples: *pledge, promise, swear, vow*
 - (ii) Characteristics: These verbs have a performative quality and can be used to express future commitments. Syntactically, they can appear with both finite and non-finite clauses, in contrast to performative verbs like *attest* or *testify*.
- i. “Reactive” verbs (cf. “response stance” verbs (Cattell, 1978; Honcoop, 1998))

- (i) Examples: *allow, respond, counter, deny, maintain, concede, accept*
 - (ii) Characteristics: These verbs describe how the attitude holder reacts to a particular proposition that present in the discourse. They have fairly diverse syntactic properties: some of these verbs can take nominal complements, others must appear with certain prepositions. The diversity in the syntax of these verbs suggests that this class consists of several smaller classes of verbs.
- j. “Learn” verbs
- (i) Examples: *discover, hear, learn, notice, observe*
 - (ii) Characteristics: These verbs describe the acquisition of certain beliefs or knowledge from external sources; the source can be linguistically expressed with the preposition *from*, e.g. *Mary discovered (from the newspaper) that John won the lottery*. Most members of this class are factive; the exception is *hear*.

Another property that appears to be relevant is whether the verb in an affirmative frame entails the truth of the declarative complement: this includes the veridical, semifactive, and factive verbs. For ease of reference, I will call these the “veridical+” verbs. Note that this property is orthogonal to the verb classes described above.

The relevance of veridicality is in a way surprising, since the best-performing model from the previous analysis, the Anand et al. model, found no statistically significant effect for the closely-related property of factivity.

- (43) “Veridical+” verbs
- a. Examples: *mean* (with a non-human subject), *like, hate, remember, discover, hear, learn* (also *know, indicate, confirm, forget*)
 - b. Characteristics: These verbs all display the following entailment: Subject Verb $p \rightarrow p$. This set of verbs consists of several distinct subclasses, such as emotive factives like *hate* and *like*, cognitive factives like *realize know, discover*, and *notice*.

4.5.3 A statistical analysis

I test the validity of this classification scheme by applying it to the same kind of mixed effects model. The reason for doing so is not so much as to confirm the validity of the classification, but to assess the relative improvement of using this classification system over existing proposals. Compared to other proposed verb classification systems (except for the Levin system), this particular classification system makes more fine-grained distinctions, at the risk of overfitting the data. The Akaike Information Criterion is particularly well-suited for this assessment task. It is defined in a way that balances empirical coverage with model complexity, so that all else being equal, a more parsimonious model has a lower AIC value.

The results of the statistical analysis are shown in (44), with results from previous analyses included below for ease of comparison. Excluding the slight decrease in overall model fit, as measured by the conditional R^2 , this post hoc classification scheme accounts for about 14% of the variance, half again as much as the Anand et al. model and almost three times as much as the frequency-only model. The AIC value is also the lowest compared to all previous models, suggesting that this model does not overfit.

(44) Statistical assessment of post-hoc classification system

| Model | AIC | logLik | Marginal R ² | Conditional R ² |
|--|------|--------|----------------------------|-------------------------------|
| Post hoc classification | 1226 | -596 | 0.1411 | 0.3289 |
| <i>Accounts based on linguistic distinctions</i> | | | | |
| Factivity | 1243 | -613 | 0.0602 | 0.3324 |
| Indexical shift hierarchy | 1240 | -610 | 0.0778 | 0.3326 |
| Anand et al. classification | 1236 | -606 | 0.0970 | 0.3324 |
| Levin, simplified | 1258 | -612 | 0.0685 | 0.3352 |
| <i>Backgroundedness</i> | | | | |
| Backgroundedness, percentage score | 1253 | -622 | 0.0092 | 0.3346 |
| Normalized backgroundedness | 1256 | -623 | 0.0001 | 0.3344 |
| <i>Verb similarity account</i> | | | | |
| Path similarity | 1253 | -621 | 0.0097 | 0.3340 |
| Jiang-Corvath/PTB similarity | 1251 | -621 | 0.0145 | 0.3331 |
| Cosine similarity, Word2Vec/PTB | 1251 | -621 | 0.0153 | 0.3358 |
| Cosine similarity, MegaAttitude | 1256 | -623 | 0.0002 | 0.3346 |
| <i>Non-linguistic account</i> | | | | |
| Frequency | 1239 | -614 | 0.0537 | 0.3305 |

Models were fit with this formula: raw acceptability \sim independent variable(s) + (1 | verb) + (1 | participant). Interaction effects were specified for the indexical shift hierarchy and Anand et al. models but not in the Levin model. A maximum likelihood procedure was used.

I present estimates of the effects for each verb class in (45). This analysis shows that most of effects are negative, as predicted, although not every effect size is statistically significant. Significant effects were observed for “complain” verbs, legalistic verbs, manner of speaking verbs, reactive verbs, and emotive “veridical+” (for all intents and purposes, emotive factive) verbs. A marginally significant effect was observed for “hint” verbs. The significance of effect sizes for manner of speaking verbs and emotive factive verbs corroborates previous analyses, giving us more reason to think that these particular verb classes are incompatible with A-bar movement.

The analysis also shows again that there is no statistically significant main effect for “veridicality+”: veridicality, semifactivity, and factivity. This is perhaps

not surprising since there is overlap between this class and the emotive factive verbs.⁹

In other words, the post-hoc analysis seems to be consistent with claims in the literature that factivity per se has little impact on A-bar movement in English. How might we reconcile this finding with reports by Ambridge and Goldberg (2008) and Truswell (2011), in which factivity appears to degrade A-bar movement? While I do not have a definitive answer, it strikes me that the structures that are reported to be unacceptable typically involve *wh*-questions. The A-bar dependencies of interest in the experiment are instances of relativization, not instances of movement of a *wh*-phrase to form *wh*-questions. One plausible account is that the unacceptability in this instance is related to the pragmatics of *wh*-questions (Abrusán, 2011; Gibson, 2018; Liu et al., 2019; Müller, 2015b; Oshima, 2006; Schwarz and Simonenko, 2018; Simonenko, 2013, 2015). This would then explain why little or no negative effect was found for factive verbs in this study and also in Liu et al., 2019, who also used a mix of relative clause and *wh*-question stimuli.

(45) Results of model for post hoc classification

⁹Running the same analysis on the full set of 100 verbs yielded similar results.

| Variable | Estimate | Std. err. | t | p |
|-----------------------------|----------|-----------|---------|-------------|
| (Intercept = non-veridical) | 0.3915 | 0.0469 | 8.352 | <0.0001 *** |
| “Complain” verbs | -0.2741 | 0.1321 | -2.076 | 0.0412 * |
| “Disclose” verbs | -0.3002 | 0.2410 | -1.246 | 0.2175 |
| Emotive verbs | 0.3302 | 0.2602 | 1.269 | 0.2078 |
| “Hint” verbs | -0.2788 | 0.1532 | -1.819 | 0.0724 . |
| “Learn” verbs | -0.2552 | 0.2597 | -0.982 | 0.3287 |
| Legalistic verbs | -0.3788 | 0.1563 | -2.424 | 0.0173 * |
| Manner of speaking verbs | -0.7616 | 0.1117 | -6.819 | <0.0001 *** |
| “Pledge” verbs | -0.0666 | 0.1540 | -0.432 | 0.6667 |
| Reactive verbs | -0.3997 | 0.1003 | -3.984 | 0.0001 *** |
| Veridical+ | -0.0322 | 0.0985 | -0.3270 | 0.7449 |
| Disclose * Veridical+ | 0.0167 | 0.3650 | 0.046 | 0.9636 |
| Emotive * Veridical+ | -0.8242 | 0.3096 | -2.662 | 0.0093 ** |
| Learn * Veridical+ | -0.0284 | 0.3005 | -0.094 | 0.9250 |

4.5.4 Interim summary

There are a number of points that one can take away from this quantitative evaluation of bridge effects.

The first is a negative point: the initial set of analyses show that existing proposals do not fully capture the range of acceptability of long-distance A-bar movement, especially once we test these proposals with a much larger set of verbs that better captures the diversity of clause-embedding verb in English. In some cases, e.g. factivity, the relevant effect turns out to be very small, or is statistically insignificant. In other cases, such as verb frequency, the factor has a statistically significant effect on acceptability. However, the factor only accounts for a relatively small amount of the variance in acceptability — in other words, some unknown factor(s) might more effectively explain the overall acceptability patterns.

The second is a more positive point: The relative success of the post-hoc analysis suggests that the semantic distinctions that affect the acceptability of long-

distance A-bar movement are very fine-grained; these distinctions are unlikely to be fully captured by existing claims about bridge effects. Of course, this is not to claim that the post hoc classification system sketched above is a definitive description of bridge verbs and non-bridge verbs in American English or even generally across languages.

More generally, I take these analyses to make a more important methodological point: a full description of bridge effects requires a more careful and systematic study of attitude verbs. While it is certainly scientifically desirable to give as simple an analysis as possible, given the large number of verbs involved, one has to be careful when making claims about the empirical coverage of a particular analysis. A quantitative approach can be helpful in this regard, as it makes it possible to compare ratings across different verb classes, and to adjudicate between competing proposals. However, informal introspection still has an important role to play: it can help us formulate novel hypotheses, as the post hoc analysis demonstrates.

While the data reported are based on American English speaker judgments, they also bear on how we should evaluate descriptions or proposals about bridge verbs in other languages. A-bar movement in English is relatively well-studied compared to many other languages. For example, I mentioned that there is an argument/adjunct asymmetry in overt A-bar movement; most work on this topic is built around English data.¹⁰ Similarly, research on A-bar movement from an experimental syntax perspective is also often based on English or explicit comparisons with

¹⁰This is not to deny the fact that other non-English languages, such as East Asian languages like Chinese, Japanese, Korean, etc., have also played significant roles in advancing our knowledge of argument/adjunct asymmetries in covert A-bar movement.

English; some exceptions include e.g. Featherston, 2004 and Fanselow et al., 2005 for German, Almeida, 2014 for Brazilian Portuguese, Sprouse et al., 2016 and Kush et al., 2018 for Norwegian. The fact that existing proposals do not fully capture the richness of bridge effects in English then suggests that they are likely to also understate the richness of bridge effects in other languages. Again, this should not be understood as dismissing the value of existing descriptions or proposals; rather, it is a reminder that we need to be careful about how we construct examples and use acceptability judgments to support a proposal.

4.6 The source of bridge effects

4.6.1 Three hypotheses

We saw in the above section that there are a number of fine-grained semantic dimensions that seem to reduce the acceptability of long-distance A-bar movement. Logically, there are (at least) three distinct positions compatible with this evidence that one could take about the nature of these effects and the syntactic well-formedness of long-distance A-bar movement.

First, one could treat these effects as purely pragmatic in nature, and take long-distance A-bar movement to be syntactically well-formed, regardless of the choice of clause-embedding verb. For illustration, consider the restriction on long-distance A-bar movement imposed by manner of speaking verbs. Given how prominently the mode of speaking is featured, it is not difficult to imagine that there could be general pragmatic or discourse principles that restrict the circumstances in which

they can be used (Ambridge and Goldberg, 2008; Erteschik-Shir and Lappin, 1979; Müller, 2015b). For instance, consider the following sentence, which is based on an example discussed by Müller (2015b) and Erteschik-Shir and Lappin (1979).

- (46) What₁ did he lisp that they'd do t₁?
- a. Degraded if *he* refers to some generic person.
 - b. More acceptable if *he* refers to Truman Capote, known for lisping.

The Gricean-based approach advocated by (Müller, 2015b, pp. 43-44) goes roughly as follows: The point of asking the question (46) is to find out about the contents of a speech act, and a general communication verb that is relatively neutral about the manner of speech, like *say*, should suffice. Using *lisp* is “too informative,” which reduces the sentence’s acceptability. However, if the context is about Truman Capote, for whom lisping is a distinctive way of speaking, then the choice of using *lisp* becomes clearer to a listener (or reader), and the sentence becomes more acceptable, which reflects its syntactic well-formedness.

It seems reasonable to also apply a pragmatic explanation to the other classes identified in the post-hoc analysis, such as “reactive” verbs like *deny*. As mentioned, these verbs presuppose a proposition that the attitude holder reacts to. However, in a formal experiment where sentences are presented with little or no context, such a presupposition might not readily available, which might explain the lower acceptability.

Alternatively, one might take these effects to show that syntactically, long-distance A-bar movement is restricted to certain verb classes. There are several ways of formally implementing this idea: one could simply stipulate representa-

tional / derivational constraints that rule out long-distance A-bar movement from complement clauses of certain classes of verbs. Alternatively, assuming that A-bar movement takes place successive cyclically through the left periphery of embedded clauses, one could also do so via subcategorization: certain verbs might take complement clauses that block A-bar movement through their left periphery; I review these possibilities more thoroughly in Chapter 5.

All else being equal, this account predicts that long-distance A-bar movement should always be unacceptable with certain verb classes, which seems contrary to existing reports about the ameliorative effect of context. One possibility is to explain this as a repair effect. For the sake of illustration, I will return to the lisp example. Here, when the context makes clear that the lisp is done by Capote, the listener/reader might draw upon their knowledge of Capote's distinctive way of speaking, observing that the verb *lisp* is a fair characterization of a regular speech act by Capote, just like how *say* is used to describe a regular speech act by the average person. This observation enables them to repair the representation of (46), by replacing *lisp* with *say*. Successful repair would yield a well-formed representation, which explains why (46) is relatively acceptable.

A third approach is a hybrid one: there is no single source of bridge effects. For some verbs, the reduced acceptability is due to pragmatics, but for other verbs, the reduced acceptability reflects the violation of some syntactic constraint.

4.6.2 Evaluating these hypotheses from a conceptual perspective

From a theoretical perspective, the first approach — treating bridge effects as having a pragmatic origin — is conceptually perhaps the most parsimonious. It fits in neatly with a simple theory of long-distance A-bar movement: long-distance A-bar movement from complement clauses of verbs is always syntactically well-formed. From the perspective of learning syntax, this scenario is also not unwelcome. It means that what learners need to do is to learn that their language allows A-bar movement from complement clauses of verbs, and we know independently that evidence for this conclusion exists: see Pearl and Sprouse, 2013a,b for data on naturally occurring instances of long-distance A-bar movement in English, and Verhagen, 2006, Schippers, 2012, Broekhuis and Corver, 2018 for Dutch data.

In contrast, the other two approaches seem to be more stipulative, even though they are also logically coherent. For instance, one might wonder whether there is any insight to be gained by claiming that there is some constraint referring to certain verb classes that block long-distance A-bar movement; it appears to be simply restating the facts. The hybrid approach, by claiming that both pragmatic and syntactic approaches are necessary, also comes across as encoding a certain amount of redundancy.

Having said all these, the fact is that far more work is needed to determine the exact role of context in affecting acceptability of long-distance A-bar movement. While there is no doubt that context influences acceptability judgments, the fact is that there is no widely accepted theory about the mechanism(s) by which it affects

acceptability or about the size of the effect.

More specifically, I have pointed out that accounts in which bridge effects are syntactic will also require an account of amelioration. The repair scenario that I sketched above, while perhaps plausible, obviously requires more work, as there are still open questions about what factors trigger repair and affect the likelihood of repair.¹¹

As for pragmatic accounts of bridge effects, as mentioned, there are worked out accounts about how pragmatic or discourse principles can affect acceptability for certain verb classes, such as manner of speaking verbs. It is less clear whether these accounts can be reasonably extended in a way that explains the range of acceptability judgments for a more representative set of verbs, such as those reported by Gibson (2018)/Liu et al. (2019) or in the acceptability judgment experiment in Section 4.4. Although it seems feasible, I am not aware of any specific theory on the market that achieves this kind of empirical coverage, in large part because the acceptability profiles of many of these verbs are poorly understood. The experimental results discussed above thus present new challenges — although perhaps not unsurmountable ones — for pragmatic accounts of bridge effects.

4.6.3 Evaluating these hypotheses from an empirical perspective

Empirically, one prediction that the first (pragmatics) approach might make is cross-linguistic uniformity in the acceptability profiles of long-distance A-bar move-

¹¹Put differently, we do not want a general theory in which repair applies too easily, such that it predicts that speakers readily accept ungrammatical structure.

ment. This prediction follows from two ancillary assumptions: (i) verbs with similar lexical semantics and syntax should have similar pragmatics, (ii) pragmatic principles are likely to be universal, especially considering the fact that they are attested cross-linguistically and are difficult to learn directly. As an example, consider the fact that clause-embedding verbs like English *shout* and Dutch *schreeuwen* ‘yell, shout’ have very similar lexical semantics and syntax. From assumption (i), it follows that they have similar pragmatics. If so, by assumption (ii), long-distance A-bar movement for *shout* and *schreeuwen* (and other “pairs” in English and Dutch, or in other languages) is subject to the same pragmatic restrictions, and therefore should be similar in acceptability.

In contrast, the other two accounts, in which (some) bridge effects have a syntactic origin, do not automatically make this prediction. One could imagine a scenario where languages vary in terms of which verb classes block long-distance A-bar movement, although this raises questions about how these distinctions might be learned.

Factive verbs appear to bear on this particular issue. In English, factivity *per se* (or the closely-related property of veridicality) seems to have little or no significant effect on the acceptability of long-distance A-bar movement, as suggested by the models reviewed in preceding sections — the Anand et al. model and the post-hoc classification model.¹²

¹²As noted previously, this outcome is inconsistent with certain claims in the literature, e.g. Ambridge and Goldberg, 2008; Truswell, 2011. Of course, factivity might give rise to an interaction effect with other semantic properties, as in the case of emotive factives. It is also not unreasonable that certain types of A-bar dependencies, such as *wh*-movement in the context of *wh*-questions, might interact with factivity to lower acceptability.

For the sake of exposition, suppose that these results do show that in English, long-distance A-bar movement itself is not sensitive to factivity. In that case, English provides an interesting contrast with certain varieties of Dutch. As mentioned in the introduction of this chapter, Broekhuis and Corver (2016) report that in Dutch a factive verb like *weten* ‘know’ typically blocks A-bar movement of a bare *wh*-phrase like *wat* ‘what,’ while a verb like *denken* ‘think’ does not. Making the *wh*-phrase D-linked improves acceptability, but not uniformly — there are speakers who reject the D-linked sentence (47).

- (47) Dutch (a and b examples from Broekhuis and Corver, 2016, p. 1397, ex. 214).
- a. Wat {dacht/*weet} Jan dat Marie t₁ gekocht had]?
 what thought/knew Jan that Marie bought had
 ‘What did Jan think/know that Marie had bought?’
 - b. Welk boek₁ {dacht/%wist} Marie [dat Marie t₁ gekocht had]?
 which book thought/knew Jan that Marie bought had
 ‘What did Jan think/know that Marie had bought?’ (% = some speakers only)
 - c. Welke film {*herinnerde/*realiseerde} Marie zich dat Jan zag?
 which movie remembered/realized Marie self that Jan saw
 Intended: ‘Which movie did Marie remember/realize that Jan saw?’
 (Annemarie van Dooren, p.c.)

It is tricky to explain away the low acceptability as an idiosyncratic fact about *wh*-questions, as a similar unacceptability can be observed with relativization (48).

- (48) a. Dit is de film die Marie dacht dat Jan heeft gezien.
 this is the movie that Marie thought that Jan has seen
 Intended: ‘This is the movie that Marie thought that Jan has seen.’
 (Annemarie van Dooren, p.c.)
- b. ??Dit is de film die Marie zich {herinnerde/realiseerde} dat Jan
 this is the movie that Marie self remembered/realized that Jan
 heeft gezien.
 has seen
 Intended: ‘This is the movie that Marie remembered/realized that Jan

has seen. (ibid.)

However, the reports of interspeaker variation in Dutch might cause one to wonder to what extent this cross-linguistic variation reflects a data quality issue. More specifically, for the sake of argument, perhaps some Dutch speakers were rejecting long-distance A-bar movement with factive verbs, not because long-distance A-bar movement in these environments is necessarily worse than it is in English, but because the sentences in question were constructed in a way that required a specific context that was not as salient. If an appropriate context had been supplied, these Dutch speakers would find long-distance A-bar movement with (cognitive) factive verbs as acceptable as their English-speaking counterparts did. Such a scenario would allow one to claim that there are no systematic differences between English and Dutch, consistent with the position that bridge effects are pragmatic and not syntactic.

Finally, it is also important to make two points: First, this discussion is not intended to cast doubt on how existing data points were collected or how the data were interpreted. Rather, the goal is to reconsider the factors that might be driving differences in judgments. Second, the issue of cross-linguistic variation is not necessarily an issue that is restricted to factivity or to English and Dutch. It is logically possible that other languages and/or other verb classes might show similar kinds of variation. This discussion is centered on factive verbs in these languages in large part because these issues are relatively well-studied and we have some evidence to believe that cross-linguistic variation in this dimension exists.

4.7 A survey of English and Dutch speakers

To investigate this question on pragmatics and long-distance A-bar movement, I designed a short survey for native speakers of English and Dutch. The main goal was to determine whether long-distance A-bar movement improves in acceptability, perhaps to the extent of becoming perfectly acceptable, when a suitable context is present; a secondary goal was to validate existing claims about interspeaker variation regarding cognitive factive verbs in Dutch.

Practical constraints meant that this survey could not be run as a formal experiment with suitable controls: doing so would entail creating additional control sentences in Dutch and recruiting enough Dutch speakers to participate. The task of reading sentences with context also called for a certain amount of attention and processing that might be difficult to guarantee in a formal experiment setting where participants were anonymous. Consequently, I opted to conduct a more informal survey over email, which also allowed me to get judgments and any comments that native speaker consultants might have about the sentences. It also allowed me to follow up with them to clarify what their intuitions were.

4.7.1 Survey materials

This survey had a 3x2 design. There are three types of clause-embedding verbs (or adverb-verb combinations): manner of speaking verbs, “say” or “claim” modified with a manner-like adverb, and cognitive factive verbs. Manner of speaking and cognitive factive verbs were chosen in part because there are explicit discussion and

examples in the literature of whether A-bar movement from their complements is acceptable or not (Ambridge and Goldberg, 2008; Dąbrowska, 2008, 2013; Müller, 2015b; Oshima, 2006). The adverb–“say” condition was added as a control for manner of speaking verbs, to see if the presence of an adverbial-like element that provided additional information about the event denoted by a bridge-like clause-embedding verb would reduce acceptability.

Sentences were intended to be presented without and with an appropriate context, but were constructed in a way so that they should be the most acceptable when presented with a suitable context. This goal also determined the choice of verbs; it was easier to create sentences and contexts for certain verbs. For the manner of speaking verbs, sentences took the form of *wh*-questions, although some of them formally feature relativization, and not movement of a *wh*-phrase. This was consciously modeled after observations by Ambridge and Goldberg (2008), Müller (2015b), and Erteschik-Shir and Lappin (1979), that such questions become acceptable when the event denoted by the verb is contextually salient.¹³

For cognitive factive verbs, the A-bar dependencies in question took the form of relativization. These sentences were modeled after naturally-occurring examples in the Penn Treebank that I judged to be the most acceptable.

The full set of contexts and sentences in English are presented in (49). Annemarie van Dooren kindly provided the Dutch translations (50), which also featured long-distance A-bar movement (instead of, for instance, resumptive pronouns). For

¹³Special thanks to Alexander Williams, Omer Preminger, Valentine Hacquard, Annemarie van Dooren, and Aaron Doliana for discussion and comments on these contexts.

ease of presentation here, the verbs are bolded and the complement clauses put between square brackets.

(49) English sentences

a. Manner of speaking verbs

- (i) Context: You remember how Mary was whispering to us during the movie that John liked some girl?
Critical sentence: Who's the girl that Mary **whispered** [that John liked]?
- (ii) Context: You know how Mary shouted during the protest that the police had shot a teenager?
Critical sentence: Who's the teenager that Mary **shouted** [that the police shot]?
- (iii) Context: You know how Marie mumbled to the client that the CEO wanted to buy some company?
Critical sentence: Which company did Marie **mumble** [that the CEO wanted to buy]?
- (iv) Context: You know how the suspect stammered that the terrorists were going to attack an airport?
Critical sentence: Which airport did the suspect **stammer** [the terrorists were going to attack]?

b. (Manner) adverb–“say” combination

- (i) Context: You remember how Mary was quietly saying to us during the movie that John met some actor?
Critical sentence: Who's the actor that Mary **quietly said** [that John met]?
- (ii) Context: You know how Mary was loudly claiming during the protest that the police had shot a teenager?
Critical sentence: Who's the teenager that Mary **loudly claimed** [that the police shot]?
- (iii) Context: You know how Mary secretly told the client that the CEO wanted to buy some company?
Critical sentence: Which company did Mary **secretly say** [the CEO wanted to buy]?
- (iv) Context: You know how the suspect reluctantly said that the terrorists were going to attack an airport?
Critical sentence: Which airport did the suspect **reluctantly say** [the terrorists were going to attack]?

c. Cognitive factive verbs

- (i) Context: As a smart sales manager, Mary goes to meals with her clients and quickly learns what they like.
Critical sentence: Last week, she gave a client a kind of wine that she had **noticed** [he often ordered at dinner].

- (ii) Context: Sally is an art student who is planning a trip to New York. She has told John about all the museums that she plans to visit.
Critical sentence: These are the museums that she **found out** [that students can visit for free].
- (iii) Context: John lost his job recently.
Critical sentence: Mary went to visit him to give him \$300, which she **knew** [he needed for rent].
- (iv) Context: When you invest in a business, it is important to understand the risks.
Critical sentence: People always lose money on investments that they don't **realize** [are risky].

(50) Dutch sentences

a. Manner of speaking verbs

- (i) Context: Je herinnert je toch hoe Marie tijdens de film ons in-fluisterde dat Jan een bepaald meisje leuk vindt?
Critical sentence: Wie is het meisje dat Marie ons **influisterde** [dat Jan leuk vindt]?
- (ii) Context: Je weet toch hoe Marie tijdens het protest schreeuwde dat de politie een tiener had neergeschoten?
Critical sentence: Wie is de tiener die Marie **schreeuwde** [dat de politie had neergeschoten]?
- (iii) Context: Je weet toch hoe Marie tegen de klant mompelde dat de directeur een bepaald bedrijf wilde overnemen?
Critical sentence: Welk bedrijf **mompelde** Marie [dat de directeur over wilde nemen]?
- (iv) Context: Je weet toch hoe de verdachte tijdens de ondervraging stamelde dat de terroristen een bepaald vliegveld zouden gaan aanvallen?
Critical sentence: Welk vliegveld **stamelde** de verdachte [dat de terroristen zouden gaan aanvallen]?

b. Adverb-“say” combination

- (i) Context: Je herinnert je toch hoe Marie tijdens de film ons stil-letjes zei dat Jan een bepaalde acteur heeft ontmoet?
Critical sentence: Wie is de acteur die Marie **stilletjes zei** [dat Jan heeft ontmoet]?
- (ii) Context: Je weet toch hoe Marie tijdens het protest luidkeels claimde dat de politie een tiener had neergeschoten?
Critical sentence: Wie is de tiener die Marie **luidkeels claimde** [dat de politie had neergeschoten]?
- (iii) Context: Je weet toch hoe Marie de klant in het geheim vertelde dat de directeur een bepaald bedrijf wilde overnemen?

- Critical sentence: Welk bedrijf **vertelde** Marie de klant **in het geheim** [dat de directeur over wilde nemen]?
- (iv) Context: Je weet toch hoe de verdachte aarzelend zei dat de terroristen een bepaald vliegveld zouden gaan aanvallen?
Critical sentence: Welk vliegveld **zei** de verdachte **aarzelend** [dat de terroristen zouden gaan aanvallen]?
- c. Cognitive factive verbs
- (i) Context: Een slimme verkoper zoals Marie gaat uit eten met haar klanten om er snel achter te komen wat ze lekker vinden.
Critical sentence: Vorige week gaf ze een klant een wijn die ze had **opgemerkt** [dat hij vaak bestelde tijdens het eten].
- (ii) Context: Marie studeert aan de kunstacademie en is bezig een reis naar New York voor te bereiden.
Critical sentence: Ze heeft Jan verteld over alle musea die ze van plan is te bezoeken. Dit zijn de musea die ze heeft **ontdekt** [dat studenten gratis kunnen bezoeken].
- (iii) Context: Jan is onlangs ontslagen.
Critical sentence: Marie ging bij hem op bezoek om hem 300 euro te geven, die ze **wist** [dat hij nodig had om de huur te betalen].
- (iv) Context: Als je in zaken investeert is het belangrijk om de risico's te kennen.
Critical sentence: Mensen draaien altijd verlies op investeringen die ze **zich** niet hadden **gerealiseerd** [dat riskant waren].¹⁴

4.7.2 Collecting and evaluating native speaker judgments

I surveyed 7 native speakers of English and 7 Dutch speakers. The Dutch speakers were all speakers of Netherlands dialects.¹⁵

Native speakers first read and rated the critical sentences without context.

They were then presented with a suitable context preceding each sentence, and told

¹⁴In this particular example, the extracted element corresponds to the subject of the embedded clause that is marked with the complementizer *dat*, i.e. the subject of *riskant waren*. In English, the same configuration is unacceptable, due to a violation of the *that*-trace effect: *... *investments that they don't realize [that are risky]*. In standard Dutch at least, there is no *that(dat)*-trace constraint (see Broekhuis and Corver, 2016, p. 1386 and references therein). However, a Dutch native speaker consultant commented that this sentence could become even more acceptable if there were a subject pronoun *ze* “they” after *dat*.

¹⁵My sincere thanks to Maxime Tulling and Anne Giskes for putting me in touch with native speakers of Dutch.

to rate them taking the context into consideration. Most native speakers did not have a syntax background, and therefore were not familiar with the issues being investigated. To help native speakers unfamiliar with this kind of judgment task, I explicitly asked all of them to rate sentences along a 7-point Likert scale, with 1 being the least acceptable, and 7 the most acceptable. Doing so also made it easier to measure the effect of context.

4.7.3 Summary of ratings

For ease of comparison, for each speaker, I report median ratings for each of the three verb conditions, without and with contexts.

- (51) Median ratings for English native speakers (1 = completely unacceptable, 7 = completely acceptable)

| Speaker | #1 | #2 | #3 | #4 | #5 | #6 | #7 |
|--|----|-----|-----|-----|-----|-----|-----|
| Manner of speaking verbs, no context | 3 | 2.5 | 5.5 | 6 | 4 | 4 | 4.5 |
| Manner of speaking verbs, with context | 7 | 4 | 6.5 | 6.5 | 5 | 6 | 4 |
| Adverb-“say”, no context | 5 | 3.5 | 5.5 | 6 | 5.5 | 5.5 | 5 |
| Adverb-“say”, with context | 7 | 4 | 6.5 | 5 | 6 | 6 | 3.5 |
| Cognitive factive verbs, no context | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Cognitive factive verbs, with context | 7 | 7 | 7 | 7 | 6.5 | 7 | 7 |

- (52) Median ratings for Dutch native speakers (1 = completely unacceptable, 7 = completely acceptable)

| Speaker | #1 | #2 | #3 | #4 | #5 | #6 | #7 |
|--|-----|-----|-----|-----|-----|-----|-----|
| Manner of speaking verbs, no context | 3.5 | 2 | 4 | 2.5 | 3 | 2 | 5.5 |
| Manner of speaking verbs, with context | 4 | 5 | 6 | 6.5 | 4 | 2 | 2 |
| Adverb-“say”, no context | 4.5 | 3 | 5.5 | 3 | 3.5 | 2 | 5 |
| Adverb-“say”, with context | 4.5 | 3.5 | 6.5 | 4 | 5 | 2.5 | 2 |
| Cognitive factive verbs, no context | 6 | 1.5 | 6 | 4 | 4 | 2 | 2.5 |
| Cognitive factive verbs, with context | 7 | 3.5 | 6.5 | 4.5 | 6 | 3 | 4.5 |

Separately, I sought to verify with Dutch speakers whether they allowed long-distance A-bar movement — specifically, to form *wh*-questions and relative clauses — without a context, across the prototypical verb *denken* ‘think,’ in effect using *denken* as a baseline. For transparency, some speakers found relativization to be of intermediate acceptability. Others, however, found relativization perfectly acceptable. Some speakers also mentioned a preference for paraphrases with resumptive pronouns, even if they found the baseline sentences to be fairly acceptable. Overall, speaker ratings for these baseline sentences did not seem to correlate with their ratings for the critical sentences, except for Speaker #6, who consistently assigned low ratings.

This informal survey yields a few preliminary generalizations.

First, for a majority of English speakers, long-distance A-bar movement from the complements of manner speaking verbs and adverb-“say” combinations is relatively degraded without context. In such environments, most speakers assigned low to intermediate ratings on a 7-point scale. With context — in these cases, an introductory sentence that made salient the event denoted by these verbs (and adverbs) — the same sentences generally became more acceptable. However, the degree of

improvement varied by speaker; an inspection of ratings also shows that there is variation at the verb level. Similar observations apply for Dutch.

A linguistically-trained Dutch speaker (but naive to the issues studied here) volunteered the observation that with context, the improvement was striking for some of the verbs;¹⁶ a linguistically-naïve English speaker independently echoed the same sentiment.

For one English speaker (#7) and one Dutch speaker (#7), however, the presence of context actually caused long-distance A-bar movement to become less acceptable. In these examples, the verb was first presented in the context sentence and then repeated in the critical sentence featuring long-distance A-bar movement. Comments from the English speaker seem to suggest that the repetition of the verb actually made the critical sentence less acceptable.

An interesting case of variation surfaced with the cognitive factive verbs. For English speakers, these examples were consistently highly acceptable, even without an introductory sentence providing context. This outcome is unsurprising, since the sentences were deliberately modeled upon naturally-occurring examples in an English corpus that were chosen for their naturalness.

However, the equivalent sentences for Dutch did not show the same uniformity in ratings, even though these sentences express the same sentiments as their English counterparts. While there were Dutch speakers who found these to be acceptable (#1, #3), others assigned what appeared to be much lower ratings, e.g. Dutch

¹⁶However, an inspection of that speaker's ratings showed that the improvement does not apply across the board, which means it is unlikely that there is a general satiation effect.

speakers #2, #6, #7. Setting aside speaker #6, I note that speakers #2 and #7 accepted A-bar movement across the baseline *denken* ‘think,’ so their low ratings do not reflect some general bias against long-distance A-bar movement.

In fact, for these sentences, some speakers suggested that the sentences could be improved by changing the relative clauses from instances of long-distance A-bar movement (with the relative pronoun *die* as the head of the dependency, and a gap in the tail) to a related construction featuring *waarvan* (lit. “where of”) and a resumptive pronoun (or a demonstrative); the suggested revisions are indicated in (53b) and (54b). Another native speaker suggested that the equivalent sentences can be expressed using what appears to be a *wh*-copying construction, where a *wh*-element appears in the left periphery of the complement clause of the factive verb (54c).

- (53) a. Marie ging bij Jan op bezoek om hem 300 euro te geven,
 Marie went to Jan on visit COMP him 300 euro to give
*die*₁ ze wist dat hij *t*₁ nodig had om de huur te
 REL.PRN she knew that he need had COMP the rent to
 betalen.
 pay
 ‘Marie went to visit Jan to give him 300 euros, which she knew he
 needed to pay rent.’ (original sentence)
- b. ... 300 euro te geven, **waarvan** ze wist dat hij **ze/die** nodig
 300 euros to give where.of she knew that he it/that need
 had om de huur te betalen.
 have to the rent to pay.
 ‘... to give [him] 300 euros, which she knew that he needed to pay
 rent.’ (suggested change by native speaker consultants)
- (54) a. Dit zijn de musea *die*₁ Marie heeft ontdekt dat
 this are the museums REL.PRN Marie has discovered that
 studenten *t*₁ gratis kunnen bezoeken.
 students free can visit

- ‘These are the museums that Marie discovered that students can visit for free.’ (original sentence)
- b. Dit zijn de musea **waarvan** Marie heeft ontdekt dat
 this are the museums where.of Marie has discovered that
 studenten **ze** gratis kunnen bezoeken.
 students them free can visit
 ‘These are the museums that Marie discovered that students can visit for free.’ (suggested change by native speaker consultant)
- c. Dit zijn de musea die Marie heeft ontdekt **waar**
 this are the museums REL.PRN Marie has discovered where
 studenten gratis op bezoek kunnen
 students free on visit can
 ‘These are the museums that Marie discovered that students can visit for free.’ (suggested change by native speaker consultant)

4.7.4 Discussion

There are a few takeaways from the data collected from this survey.

First, with a suitable context, A-bar movement from complement clauses of manner of speaking verbs can become fairly acceptable, although the improvement is not consistent across all verbs or all speakers. This variation might simply be due to interspeaker differences in perceiving how appropriate the context is for a given verb. If so, this amelioration effect is consistent with the claim that the canonical low acceptability associated with these constructions is pragmatic in nature (Ambridge and Goldberg, 2008; Erteschik-Shir and Lappin, 1979; Müller, 2015b), as well as being consistent with a scenario in which these structures are ungrammatical but repairable if a suitable context is available.

Second, the results reveal different acceptability profiles for long-distance A-bar movement with cognitive factive verbs for English and Dutch, suggesting deeper differences between these two languages and interspeaker variation within Dutch.

Specifically, some Dutch speakers were willing to accept long-distance A-bar movement across a verb like *denken* ‘think’ but not across cognitive factive verbs. The interspeaker variation observed here is consistent with existing reports in the Dutch syntax literature that not all speakers find A-bar movement from complement clauses of (cognitive) factive verbs to be acceptable (Broekhuis and Corver, 2016 and references therein, also comments by Annemarie van Dooren, p.c.). It is unlikely that this variation can be blamed on the absence of an appropriate linguistic context, since the equivalent English sentences, which are at least syntactically and semantically/contextually identical, receive much higher ratings by English native speakers.

Comments from Dutch native speakers also validate existing reports in the literature that in such instances, speakers might prefer alternative constructions, such as the *waarvan*-resumptive pronoun construction. An alternative construction described by Broekhuis and Corver (2016) and Salzmann (2017) is the syntactically similar resumptive prolepsis construction, where the head of the *wh*-dependency is a preposition (like *van*) followed by a *wh*-phrase, and the tail of the dependency a resumptive pronoun (55).

- (55) Van welk boek wist Jan niet dat Els het gekocht had?
 of which book knew Jan not that Else it bought had
 ‘Of which book didn’t Jan know that Els had bought [it]?’ (Resumptive
 prolepsis, Broekhuis and Corver, 2016, p. 1404 ex. 232b)

Third, the English data collected in informal survey echoed the findings of the formal acceptability judgment experiment reported in Section 4.4: compared to manner of speaking verbs, there is little evidence to suggest that cognitive factive verbs block A-bar movement from their complement clauses.

These results, if they are on the right track, have implications for our understanding of bridge effects. Recall that a primary goal for this survey was to evaluate the hypothesis in which bridge effects are pragmatic in nature. The specific hypothesis tested was that long-distance A-bar movement can become acceptable when a suitable context is present, on the linking hypothesis that verbs with similar lexical semantics should have similar pragmatics. The data for cognitive factive verbs appear to pose a problem for this hypothesis, as the acceptability profiles for these verbs turn out to be different between English and Dutch, when context is controlled for.

To maintain this general hypothesis in light of the survey findings, one might posit a more nuanced view of these verbs, namely, that their pragmatics or semantics vary subtly in English and Dutch. Consequently, the contexts that justify the use of English *know* vs. Dutch *weten* are different, contrary to how this particular survey was set up. In fact, interspeaker variation in Dutch would suggest that the pragmatics and semantics of these verbs vary across Dutch speakers (or varieties), and correspondingly so do the contexts that justify their use.

4.8 Directly learning about the acceptability of long-distance A-bar movement with cognitive factive verbs / Corpus study 5

How might this cross-linguistic difference for cognitive factive verbs arise? One straightforward hypothesis is that English speakers get to observe more reliable direct evidence that cognitive factive verbs are compatible with long-distance A-bar

movement, compared to Dutch speakers. Observing these tokens then leads English learners to learn either (i) the pragmatics (or semantics) of these verbs are such that they are compatible with long-distance A-bar movement, even when relatively little context is available, or (ii) that long-distance A-bar movement from the complements of these verbs is syntactically well-formed in English.

As I see it, there are two requirements for this direct learning scenario to work: English speakers must be able to (i) identify a class of cognitive factive verbs and (ii) observe A-bar movement from the complements of factive verbs in their linguistic experience, at least a rate higher than Dutch speakers. I address these in turn.

As a class, cognitive factive verbs are distinctive in their syntax and semantics. As verbs of cognition, these verbs are subject to animacy restrictions: when these verbs appear in an active voice frame, the subject cannot be non-human, since non-human entities are not capable of thinking; Anand et al. (to appear) further observe that the subject cannot even be an agentive repository of information, the product of some human entity (56); this fact sets it apart from other clause-embedding verbs that can appear with non-human subjects, such as communicative verbs.

- (56) { *The table/*The report/Mary } { knew/realized/forgot/found out } that John was responsible.

Further, a number of these verbs are distinguished from non-factive verbs like *think* in that they can take embedded questions as complements (57a) (see also Spector and Egré, 2015; White and Rawlins, 2018) or, at least in some cases, omit them entirely (57b) if the verb and context allows it.¹⁷ These subcategorization

¹⁷In other words, some of these verbs allow null complement anaphora. This is not a distinguishing characteristic for cognitive factive verbs, as there are some cognitive factive verbs that

properties set the cognitive factive verbs apart from the emotive factive verbs (57c), (57d).

- (57) a. Mary {knew/realized/forgot/found out} who was late.
 b. Mary {knew/realized/forgot/found out}.
 c. *Mary {regretted/hated} who was late.
 d. *Mary {regretted/hated}.

Semantically, these verbs are distinct in presupposing the truth of their complements, if the complements are declarative clauses. This property might correspond with relatively easy-to-observe cues: to the extent that there is a correlation between presupposed propositions and discourse-old propositions (i.e. propositions that are previously mentioned and present in the common ground) and learners are able to track propositions in the discourse, these verbs might be more likely than non-factive attitude verbs like *think* to take complements whose propositions are discourse old (that said, Dudley et al. (2017) did not find a clear difference in a corpus study of child-directed speech).

The second requirement is also not as far-fetched as it might first appear to be. Impressionistically, there are factive verbs that are relatively high frequency in English: for example, *know*, *remember*, *forget*. Although these verbs appear in a variety of frames, given their frequency, it is not implausible that these verbs might appear naturally in bridge contexts.¹⁸

require overt clausal complements, such as *discover* (cf. *find out*, which allows null complement anaphora).

¹⁸I note that there are actually two versions of this hypothesis. In the weak version of this hypothesis, English speakers observe A-bar movement from complements of some cognitive factive verbs, and learn that these verbs — and only these verbs — are compatible with A-bar movement. In the strong version, English speakers observe these tokens and generalize across the set of cognitive factive verbs. I return to this point later in Section 4.8.3.

In contrast, given what we know about interspeaker variation about long-distance A-bar movement and (cognitive) factive verbs in Dutch, it is possible that the equivalent evidence is less robust for learners. Some speakers of Dutch do not allow long-distance A-bar movement with cognitive factive verbs and presumably do not produce these structures. All else being equal, these structures are less likely to occur naturally in Dutch.

To preview the rest of this section: I assess this hypothesis with an analysis of an English corpus, the Penn Treebank. I show that there is limited direct evidence that cognitive factive verbs can appear in long-distance A-bar movement configurations: most cognitive factive verbs appear infrequently in such configurations, if at all. However, as data from the previous sections show, native speakers of English seem to possess intuitions that long-distance A-bar movement from the complements of these verbs are (relatively) acceptable.

I argue that one solution that might let us reconcile the sparsity of direct evidence with native speaker intuitions is that speakers form generalizations about long-distance A-bar movement from cognitive factive verbs. I discuss two generalization accounts, testing them with the Penn Treebank data.

4.8.1 Methods

Ideally, evaluating this hypothesis would require looking at the linguistic experience of Dutch and English speakers, for instance, through the lens of corpora. While it is not feasible for me to look at Dutch data, since I do not have access to

such a dataset nor the Dutch skills to analyze such data adequately, such an analysis is possible for English. Specifically, I turned to the Penn Treebank again. In Section 4.4.1.1, I described extracting all instances of a verb occurring with a declarative complement clause from the Penn Treebank.

I wrote a Python script that analyzed this set of complement clauses. The script counted the number of traces within each complement clause, and for each trace, determined whether its antecedent was outside of the clause. If the antecedent was, then one concludes that A-bar movement has taken place from the embedded clause, and the verb appears in a bridge context. The script also automatically flagged for exclusion instances of direct quotation (e.g. *John said “Mary is a genius.”*) and S-lifting (e.g. *Mary is a genius, John said.*).

To minimize the likelihood of false positives in the identification of complement clauses, I manually checked verb lemmas that appeared with a declarative finite sister nine times or fewer and corrected the annotation if necessary. I assume that all verb lemmas that appeared at a higher frequency take a complement clause. Within this set of complement clauses, the script flagged about 640 tokens of potential long-distance A-bar movement. To rule out false positives in this process, I manually checked each token.

4.8.2 Results

I identified 593 instances of long-distance A-bar movement, associated with 57 unique attitude verb lemmas. Crucially, there are seven factive verbs in this set,

appearing a total of 44 times: *know*, which appears the most frequently at 34 times, *remember*, *see*, *learn*, *realize* (two times each), *find out*, and *understand* (1 time each).

For transparency, I further note that these 57 verbs were distributed according to what looks like a power law distribution. The top 10 verbs appeared a total of 516 times (87% of 593). The remaining 47 verbs appeared a total of 77 times, with 31 verbs appearing only once.

| (58) Clause-embedding verbs appearing in long-distance A-bar movement contexts in the Penn Treebank dataset | | |
|---|---|---------------------------|
| Frequency of bridge contexts | Verbs | Number of unique verbs |
| More than 100x | think (260x), say (117x) | 2 |
| Between 10x and 99x | know (34x), feel (33x), believe (25x), guess (17x), hope (11x) | 5 |
| Between 2x and 9x | seem (7x), claim, find, wish (6x each), estimate, fear (4x each), agree, doubt, figure, imagine, suspect, tell (3x each), contend, decide, learn, realize, remember, see, suppose (2x each) | 19 |
| Only 1x | allege, announce, anticipate, argue, ask, assert, assume, bet, calculate, concede, confess, confirm, consider, deem, expect, fancy, find out, gather, hear, imply, indicate, pretend, promise, propose, read, recognize, recommend, suggest, swear, take it, understand | 31 |
| Total | n/a | 57 |

4.8.3 Discussion

There are two takeaways from the Penn Treebank analysis: first, factive verbs occur naturally in bridge contexts, even though it is sometimes remarked that A-bar movement from the complement clauses of these verbs is unacceptable.

Second, overall, the rate of occurrence is relatively high. The Penn Treebank contains about a quarter million tokens. Assuming that learners are exposed to 915k–2.5m utterances a year (Hart and Risley, 2003, 1995), this works out to about 168–464 tokens, or from about one token every other day to just over one token a day. To the extent that the range of sentences in the Penn Treebank is representative of the linguistic experience for older speakers and learners of English, the results suggest that learners have access to evidence that at least some factive verbs are compatible with long-distance A-bar movement.

As I see it, the main issue that this study reveals concerns the robustness of the evidence. Most of the tokens that English learners observe likely involve *know*, and it is presumably easy for them to conclude that *know* is compatible with long-distance A-bar movement. The other verbs occur much less frequently, if they appear at all.

This result sits somewhat uneasily with the data collected in the formal acceptability judgment experiment and the informal survey. For example, the informal survey showed that English native speakers can accept long-distance A-bar movement with cognitive factive verbs like *discover* and *notice*, which do not occur with long-distance A-bar movement in the Penn Treebank dataset.

One hypothesis that might explain how native speakers have these intuitions despite sparse direct evidence is that they form generalizations about cognitive factive verbs as a class, namely, that long-distance A-bar movement is compatible with this class of verbs. This particular claim awaits further empirical confirmation, as the acceptability judgment study in Section 4.4 and the informal survey in Section

4.7 tested a relatively small number of these verbs. But it is consistent with the data obtained so far, and also consistent with a number of descriptions of English that claim that long-distance A-bar movement is compatible with these verbs (e.g. Kastner, 2015, Kiparsky and Kiparsky, 1970, Abrusán, 2014), and for the sake of discussion in the following sections, I will tentatively adopt it.

4.8.4 Generalizing despite sparse input

In this section, I review two different approaches about how learners might form generalizations from sparse input. I will first consider the Sufficiency Principle proposed by Yang (2016, 2017), which has the advantage of making very clear quantitative predictions about the evidence needed for forming generalizations. I will show that the cognitive factive data in the Penn Treebank poses a problem for this particular proposal. I then sketch an alternative Bayesian proposal.

4.8.4.1 The Sufficiency Principle

Yang presents a theory of computational efficiency that explains how learners might learn generalizations and exceptions. The core intuition underlying Yang’s proposal is this: for a rule to generalize, or for a particular morphological form to become the default form, it needs to first be observed to have applied in sufficiently many instances; a mathematical formula, which he calls the Sufficiency Principle (59), determines whether generalization occurs or not. When a generalization could in principle apply either a superset or a subset of items, learners always attempt

to generalize to the superset. Only when generalization at the superset level is impossible does the learner consider the possibility of generalization at the subset level.

- (59) Sufficiency Principle: Let R be a generalization over a set S with N candidates, of which M items are attested to follow R . R can be extended to all N items in S iff: $M \geq N - \frac{N}{\ln(N)}$; otherwise, assume that R only applies for the subset of M items. (adapted from Yang, 2017 ex. 12)

Yang discusses the limited productivity of the dative alternation in English: the double object construction is only applicable to some, but not all, ditransitive verbs (Ambridge et al., 2014; Baker, 1979; Bowerman, 1988; Perfors et al., 2010; Pinker, 1984, 1989, etc.). But it is clearly intended to be applied to other kinds of phenomena, and here I would like to evaluate it using the Penn Treebank dataset. In the previous section, I reported that there were 57 attitude verbs that appeared in long-distance A-bar movement contexts; in the context of this proposal, $M = 57$. To determine what N is, I used the script described in Section 4.8.1 to estimate the number of attitude verbs that appear with a complement clause. This yielded an estimate of $N = 279$, after excluding idiomatic expressions like *keep in mind* or *have it (that)* and the neologism *grok*.

Yang's formula yields a threshold of $279 - \frac{279}{\ln(279)} = 229.4$: long-distance A-bar movement must be attested with at least 230 verbs before it generalizes to the broader set of attitude verbs. This threshold is clearly not met. This predicts correctly that long-distance A-bar movement is not compatible with all attitude verbs.

If long-distance A-bar movement from complement clauses of cognitive factive

verbs is generally acceptable to English speakers, and if Yang’s proposal is correct and the Penn Treebank is representative of an English speaker’s linguistic experience, then one expects that enough cognitive factive verbs appear with long-distance A-bar movement in the Penn Treebank to satisfy the Sufficiency Principle.

Reviewing the set of 230 attitude verbs in the Penn Treebank, I was able to identify 17 cognitive factive verbs (60), i.e. $N = 17$, which appear with complement clauses for a total of 1,706 times. Applying the Sufficiency Principle formula yields a threshold of 11, i.e. 11 verbs must appear in long-distance A-bar movement before a learner generalizes long-distance A-bar movement to all cognitive factive verbs. However, $M = 7$: only 7 verbs do so in the Penn Treebank dataset. According to the Sufficiency Principle, there should be no generalization for the class of cognitive factive verbs.

- (60) Cognitive factive verbs appearing with complement clauses in Penn Treebank dataset:
*know** (988 times), *realize** (154), *see** (151), *remember** (74), *understand** (60), *learn** (52), *notice* (52), *acknowledge* (42), *discover* (42), *find out** (30), *forget* (25), *observe* (15), *recall* (15), *figure out* (3), *ascertain* (1), *recollect* (1), *grasp* (1)
 * = verb also occurs naturally with long-distance A-bar movement in the Penn Treebank

While this outcome is clearly not ideal for the Sufficiency Principle, technically speaking, this is a null result. One might therefore interpret this outcome as an indicator that at least some linking assumption is faulty: perhaps the Penn Treebank is not perfectly representative of the linguistic experience of the participants of the acceptability judgment experiment or the informal survey, or if it is, perhaps the dataset is too small a sample to yield useful counts for the purposes of the Sufficiency

Principle. Future research could, for example, apply the same counting methodology to a larger dataset that might be a better approximation of the linguistic experience of English speakers.

4.8.4.2 An alternative Bayesian-inspired approach

That said, just because long-distance A-bar movement fails to naturally occur with a large set of verbs does not mean that all these verbs are incompatible with long-distance A-bar movement. Because many of these verbs appear infrequently with complement clauses in the first place, it is perhaps not surprising to the learner that she fails to observe long-distance A-bar movement co-occurring with these verbs.

I would like to suggest an alternative Bayesian-inspired perspective on the data that allows us to reconcile the idea that cognitive factives can generally appear in long-distance A-bar movement contexts, even though only a very small number of cognitive factive verbs naturally appear these contexts. In this approach, the learner considers two hypotheses: the first is the null hypothesis that long-distance A-bar movement is not fully productive for a given class of verbs, while the second is the alternative hypothesis that it is productive but infrequent. The learner then considers the extent to which these hypotheses can explain the actual instances of long-distance A-bar movement observed in her linguistic experience. It is in this respect that this account is Bayesian (for a sample of applications of Bayesian models on various domains of language acquisition, see, among others, Dillon et al., 2013;

Feldman et al., 2013; Pearl, 2007; Perfors et al., 2011a,b; Perkins et al., 2017; Xu and Tenenbaum, 2007; Yang, 2016, 2017.).¹⁹

More specifically, suppose that the learner generates a prediction about how often long-distance A-bar movement occurs with each verb. The learner then compares whether the actual attested frequency of long-distance A-bar movement for that verb is comparable to the predicted value. We may say that long-distance A-bar movement is “conspicuously absent” for this verb if it does not appear in long-distance A-bar movement, contrary to the learner’s predictions. The absence of long-distance A-bar movement for this verb then serves as indirect negative evidence against the alternative hypothesis that long-distance A-bar movement is productive.

To give an example: suppose a verb occurs with a complement clause 1,000 times, but of these 1,000 tokens there are no instances of long-distance A-bar movement. Suppose further that the learner predicts that there should be 30 tokens of long-distance A-bar movement. Because the observed number of long-distance A-bar movement is 0, which is less than the predicted value, long-distance A-bar movement is said to be “conspicuously absent” for this verb.

Following Yang’s proposal, I assume that, if generalization is not possible for a given class, learners will check whether generalization is possible for each of its subclasses. Learners apply this process recursively until there are no subclasses left.

In broad terms, this analysis is similar to Yang’s proposal in at least three ways:

¹⁹Note that as stated, the null hypothesis will always offer a perfect fit for the data. In a Bayesian framework, this means that the likelihood $P(data|H_{null}) = 1$. Even if the alternative hypothesis also offers a perfect fit for the data, all else being equal, the learner should not be able to decide in favor of one hypothesis over the other. To the extent that learners do decide in favor of the alternative hypothesis on productivity (i.e. $P(H_{alt}|data) > P(H_{null}|data)$), one would need to posit a prior bias for the alternative (i.e. $P(H_{alt}) > P(H_{null})$).

(i) it frames the learning problem as a matter of choosing between two (implicit) hypotheses about whether the phenomenon in question is productive or not, (ii) it assumes that the learner is sensitive to verb syntax and semantics, which is necessary for identifying which verb classes to formulate a generalization for, (iii) it assumes that learners proceed from superset to subset when formulating generalizations. Importantly, it differs in terms of what learners are tracking. In the case of the Sufficiency Principle, the learner is sensitive to the number of distinct verbs that appear in long-distance A-bar movement; how frequently a verb appears with long-distance A-bar movement does not matter at all. In contrast, this analysis assumes that the learner can track a number of frequencies: how frequently a verb appears with complement clauses and long-distance A-bar movement, which enables her to make predictions about how frequently a verb should appear with long-distance A-bar movement if that were a productive process.

4.8.4.3 Methods

The above learning scenario can be implemented as a simple Monte Carlo simulation.

For concreteness, suppose that N distinct attitude verbs naturally occur p times with complement clauses; call this set S . Within the set S , there are M distinct verbs that naturally occur q times with long-distance A-bar movement. From S , one can generate a random sample (with replacement) of q items. The attitude verbs in this random sample can be understood as the attitude verbs that

appear with long-distance A-bar movement if long-distance A-bar movement were fully productive (but infrequent) for this class of attitude verbs. How frequently each of the N attitude verbs appears in the random sample can be calculated.

This random sampling process can then be repeated a fairly large number of times in order to produce a range of how often a given verb should appear in a long-distance A-bar movement context. Specifically, I calculate a 95% confidence interval. I consider long-distance A-bar movement “conspicuously absent” for a verb if the verb appears zero times in bridge contexts in the original Penn Treebank sample and if the confidence interval is above zero.

I apply this method on two sets of verbs: the first is the full set of 279 attitude verbs; for this set, $N = 279$, $p = 20,756$, $M = 58$, $q = 596$. The second set are the cognitive factives: $N = 17$, $p = 1,706$, $M = 7$, $q = 44$.

4.8.4.4 Results and discussion

For the full set of attitude verbs, there were four verbs for which long-distance A-bar movement was “conspicuously absent.” For space reasons, I will only report the data for these four verbs (61).

(61) Verbs for which long-distance A-bar movement is “conspicuously absent”

| Verb | Tokens with complement clause | Predicted number of long-distance A-bar movement instances (95% conf. int.) |
|-------------|-------------------------------|---|
| <i>note</i> | 225 | 2–6 |
| <i>mean</i> | 195 | 2–5 |
| <i>add</i> | 169 | 1–5 |
| <i>show</i> | 168 | 1–5 |

Although four out of 279 verbs might not seem to be a lot, these four verbs

are relatively frequent. *Show*, for example, is the 13th most common verb that appears with a finite declarative complement clause. It is precisely this frequency that makes the absence of long-distance A-bar movement conspicuous in the first place. An English learner who takes seriously the existence of such verbs might thus conclude that long-distance A-bar movement is not compatible with all attitude verbs.

As for the cognitive factive verbs, there were no verbs for which long-distance A-bar movement was conspicuously absent, an outcome which is consistent with the hypothesis that long-distance A-bar movement is productive for this class of verbs and the results of the acceptability judgment experiment. Certainly, as mentioned previously, there were ten verbs in the Penn Treebank for which there was no long-distance A-bar movement attested: *acknowledge, ascertain, discover, figure out, forget, grasp, notice, observe, recall, recollect*. However, these verbs are part of a subset of cognitive factive verbs that are so low-frequency in the first place that a non-occurrence of long-distance A-bar movement was expected (62).

- (62) Predicted instances of long-distance A-bar movement for cognitive factive verbs in the Penn Treebank

| Verb | Tokens with complement clause | Predicted number of long-distance A-bar movement instances (95% conf. int.) |
|--------------------|-------------------------------|---|
| <i>know</i> | 988 | 20–34 |
| <i>realize</i> | 154 | 1–9 |
| <i>see</i> | 151 | 1–8 |
| <i>remember</i> | 74 | 0–5 |
| <i>understand</i> | 60 | 0–5 |
| <i>learn</i> | 52 | 0–4 |
| <i>notice</i> | 52 | 0–4 |
| <i>acknowledge</i> | 42 | 0–4 |
| <i>discover</i> | 42 | 0–4 |
| <i>find out</i> | 30 | 0–3 |
| <i>forget</i> | 25 | 0–3 |
| <i>observe</i> | 15 | 0–2 |
| <i>recall</i> | 15 | 0–2 |
| <i>figure out</i> | 3 | 0–1 |
| <i>ascertain</i> | 1 | 0–1 |
| <i>grasp</i> | 1 | 0–1 |
| <i>recollect</i> | 1 | 0–1 |

4.8.5 Prospects of applying these learning accounts to other instances of bridge effects

One might wonder how effective this generalization mechanism (or the Sufficiency Principle) might be when applied to other verbs or verb classes with similar distributional and acceptability profiles. For example, there are other English verbs outside the class of cognitive factives for which long-distance A-bar movement is relatively acceptable but occur infrequently in a corpus like the Penn Treebank. For the sake of illustration, consider the verbs *specify* and *vow*, for which long-distance A-bar movement is relatively acceptable: the z-score of long-distance A-bar movement for *specify* is 0.58, while that for *vow* is 0.62 (36). However, both verbs do not

appear in long-distance A-bar movement configurations in the Penn Treebank, so one might argue that learners lack direct evidence that these verbs are compatible with long-distance A-bar movement.

I see two main challenges in applying these proposals to other instances. The first challenge is that we do not know for certain whether there is any learning with respect to bridge effects for other verbs. The reason for applying these proposals to the class of cognitive factive verbs is because we had good evidence (from English and Dutch) to think that there might some learning that takes place for these verbs. We lack the same kind of evidence for verbs like *vow* and *specify*: for all we know, there is some innate discourse or pragmatic principle which ensures that long-distance A-bar movement is cross-linguistic variation acceptable for verbs with “vow” or “specify” semantics. If so, applying the Sufficiency Principle or the Bayesian-style generalization proposal to these verbs would be beside the point.

Even if we had good reason to think that there is some learning implicated for *vow* and *specify* (e.g. clear evidence of cross-linguistic variation), we might still need to overcome another challenge, namely, identifying the relevant verb classes for these verbs. Both the Sufficiency Principle and the above Bayesian-style approach presuppose that learners try to generalize over verb classes. Sometimes, it is easy to determine what the verb classes are: the discussion above looked at attitude verbs and cognitive factive verbs, both of which are verb classes that are relatively easy to describe and well-studied in the literature.

But sometimes identifying verb classes is not as straightforward, as is the case for *specify* and *vow*: they are quite clearly non-manner of speaking communication

verbs, for sure, but what subclasses do they belong to? What other verbs are in the same subclass? These questions might be answered through further cross-linguistic investigation in bridge effects: perhaps we will see clearly which other verbs pattern like *specify* or *vow*, which will let us identify the appropriate verb class(es). But for now, the lack of a consensus on verb classes or a fine-grained typology of attitude verbs constitute another challenge for empirically testing these generalization proposals.

4.8.6 Additional comments on the results of the corpus analysis

Finally, the results show that a relatively large variety of clause-embedding verbs can appear in bridge contexts. I would like to point out here that this finding contrasts with what Dąbrowska and Verhagen reports. For example, Dąbrowska (2004) looked at *wh*-questions involving long-distance A-bar movement in the Manchester child language corpus (Theakston et al., 2001). Of the 325 questions identified, she reports that *think* and *say* appear in 96% of the questions (280 and 33 respectively); the verbs in the remaining 4% of questions are *tell* (6), *pretend* (3), *see* (1), *hope* (1), *reckon* (1), *suppose* (1) (p. 197).²⁰

This difference is almost certainly attributable to the differences in the size of corpora used, the registers (child-ambient speech have simpler lexicons and syntax), and the fact that this corpus study considered a wider range of long-distance A-bar movement constructions. That said, the results replicate their finding that the vast

²⁰For reasons unknown to me, the subtotals add up to 326 and not the 325 total reported by Dąbrowska (2004).

majority of tokens are centered around a very small number of verbs.

4.9 Conclusion

This chapter was divided into three distinct parts. First, I started with a review of cross-linguistic variation in bridge verbs, including existing generalizations about bridge effects. Second, I presented an acceptability judgment experiment that was designed to address gaps in our empirical understanding of bridge effects in English and to test existing claims. Analyses showed that current claims are likely too coarse-grained to model the range of bridge effects. Subsequently, on the basis of a post hoc analysis, I proposed a more fine-grained classification of verbs that offers better empirical coverage. Third, I discussed whether the fine-grained semantic distinctions that affect the acceptability of long-distance A-bar movement might be more simply captured by general pragmatic principles, contrasting that with a hypothesis where long-distance A-bar movement as a syntactic operation / dependency is sensitive to the presence of certain verb classes. An informal survey of native speakers of English and Dutch showed that the low acceptability of long-distance A-bar movement with manner of speaking verbs can be ameliorated with context, although the degree of amelioration varies. Survey results also provide some evidence that cognitive factive verbs have different acceptability judgment profiles in English and Dutch.

To the extent there is a case of cross-linguistic difference in cognitive factive verbs, it suggests that, even if bridge effects are generally pragmatic in nature, there

are still some aspects that can be learned from one's linguistic experience. Taking these verbs as a case study, I suggested that English speakers might have more access to direct evidence that long-distance A-bar movement is compatible with cognitive factive verbs, drawing evidence from an English corpus (the Penn Treebank). The study also shows that the direct evidence might be sparse for many of these verbs, which implies the existence of generalization. I discussed how learners might form generalizations on the basis of sparse evidence, contrasting a Sufficiency Principle approach with a Bayesian-inspired approach.

Chapter 5: Cross-linguistic variation and consequences for formal theories of A-bar movement constraints

In previous chapters, I observed that cross-linguistic variation in A-bar movement constraints poses challenges for the language learner. In this chapter, I turn my attention to discussing the challenges and implications cross-linguistic variation has for how we model these constraints formally, by reviewing existing proposals about these constraints. To preview the discussion: much theorizing in the literature about these constraints is based on careful descriptive work on a small number of languages and the reasonable null hypothesis that the same generalizations hold cross-linguistically. This process yields very elegant descriptions of constraints, at least for certain languages.

However, these theories tend to struggle to accommodate cross-linguistic variation. I would like to suggest that we should instead be comfortable with less elegant descriptions that have better cross-linguistic coverage, on the condition that we can give plausible (or better yet, elegant) learning accounts that can explain the range of cross-linguistic variation. Let me be clear that I am not advocating that our theories of syntax should just restate cross-linguistic differences. Rather, what I am proposing is that to the extent that cross-linguistic variation obliges us to forgo

elegant descriptions of the knowledge that adults have about their languages, we should instead seek principled descriptions of the *process* by which they come to possess that knowledge.

5.1 A critique of “unified” analyses of A-bar movement from relative clauses and complement clauses

Since the two case studies reviewed in this dissertation both involve constraints on A-bar movement from embedded clauses, it is not implausible to think that they are amenable to a unified analysis. In this section, I review several such proposals that have been put forward recently, showing that they do not adequately capture the range of variation in constraints on A-bar movement from embedded clauses within and across languages. I then consider how these proposals can be adapted to improve their empirical coverage.

5.1.1 An event semantic approach: Truswell 2007, 2011

The core of Truswell’s proposal is that A-bar movement is subject to an event semantic condition, the Single Event Grouping Condition (among other conditions). Empirically, Truswell intends for this event semantic condition to cover A-bar movement from a set of adjuncts in which the verb is morphologically not finite (including purposive clauses) and extends it to complement clauses for a select set of clause-embedding verbs.

Truswell proposes that in configurations where A-bar movement is acceptable,

the event denoted by the predicate in the adjunct forms a single “event grouping” with the event denoted by the matrix predicate. As an example, consider (1). The matrix predicate denotes an event of going to the store, while the adjunct predicate denotes an event of buying chocolate. Since it is a necessary condition for the adjunct event, the matrix event is said to enable the adjunct event. In Truswell’s theory of event structure, both events then form an event grouping.

- (1) a. John went to the store to buy chocolate.
- b. What_{t₁} did John go to the store to buy t₁?
- c. That’s the chocolate_{t₁} that John went to the store to buy t₁.

Although Truswell treats tensed (finite) adjuncts to be uniformly islands (Truswell, 2011, pp. 175–177), his account might work to a certain extent with A-bar movement from finite porous relative clauses, a phenomenon not covered in his dissertation or book. For example, in some contexts, the matrix predicate might be understood as denoting an event that is an enablement relation with the event in the finite relative clause. A-bar movement from the relative clause thus does not violate the Single Event Grouping Condition. For instance, to the extent that (2) is acceptable, one might argue that the president’s desire to appoint someone enables that person to lead the department in question. To the extent that an enablement relation exists, A-bar movement satisfies the Single Event Grouping Condition.

- (2) a. The president wants to appoint someone who can lead this department.
- b. That’s the department_{t₁} that the president wants to appoint someone who can lead t₁.

However, there are other acceptable examples where the matrix and adjunct events might not stand in such a relation. Consider an example in the literature on

porous relative clauses, (3). In this event, the event denoted by matrix predicate *know[ing] a lot of people ...* is not a necessary condition for the event in the relative clause, which is a state of being taken in by some trick: it is hard to see how such an acquaintance relation is related to getting deceived. To the extent that they do not form a single extended event, the event structure of this sentence in this context fails to satisfy the Single Event Grouping Condition. We therefore predict that A-bar movement out of the relative clause should be unacceptable, contrary to fact (3b).

- (3) a. I've known a lot of people who've been taken in by this trick.
 b. That's the trick₁ that I've known a lot of people who've been taken in
 by t₁. (Chung and McCloskey, 1983, p. 708, ex. 9a)

The porous relative clause datapoints thus suggest that the Single Event Grouping Condition does not fully handle all restrictions on A-bar movement from adjuncts, *pace* Truswell. That said, this does not necessarily mean that the Single Event Grouping Condition (more precisely, the intuition underlying the condition) is invalid; it could well be the case that there are other conditions that determine when A-bar movement from adjuncts is possible.

Truswell also extends his Single Event Grouping Condition to A-bar movement from factive complements, e.g. the complement of a verb like *regret*. Although Truswell acknowledges that there are conflicting judgments about A-bar movement from factive complements in English, he makes the assumption that these structures are ungrammatical and attempts to derive the ill-formedness from the condition. The intuition pursued is that in factive complements, the speaker presupposes the existence of the event denoted by the embedded predicate. Consequently, this event

does not form a single event grouping with the event denoted by the matrix predicate. In contrast, for non-factive complements (e.g. the complement of *think*), no such presupposition exists; the event denoted by the embedded clause is an argument of the event described by the non-factive verb, and therefore forms a single event grouping with it.

While ambitious in scope and offering many interesting observations, Truswell's proposal seems to struggle more with A-bar movement from factive complements. For one, it does not predict the fact that A-bar movement from factive predicates like *know* and *realize* occurs naturally and is relatively acceptable to English speakers. In addition, it appears to predict that A-bar movement from the complement of manner of speaking verbs should be acceptable, since these verbs are non-factive and so the events denoted in their complement clauses are not presupposed to exist. (To be fair, Truswell explicitly says in his book that he will not discuss A-bar movement from the complements of manner of speaking verbs (p. 179 fn. 4).)

Even if we set aside these concerns with the Single Event Grouping Condition, there is still a cross-linguistic problem that it presents. To the extent that the Single Event Grouping Condition is universal, it predicts that all languages will behave more or less like English, allowing A-bar movement from clausal adjuncts, gerundival adjuncts, and even PPs. As Truswell himself recognized in his book, this prediction is not borne out.

5.1.2 A discourse-based approach: Goldberg 2006 and Ambridge and Goldberg 2008

As mentioned previously in Chapters 3 and 4, Goldberg (and colleagues) provides a discourse-based analysis for A-bar movement from relative clauses and purposive clauses, centered around the notion of backgroundedness. In Goldberg, 2006, she argues that rationale clauses and “presentational relative clauses” (i.e. porous relative clauses) and complement clauses of certain non-factive verbs are all not backgrounded. The evidence provided in the book on islands is almost all taken from English. To the extent that this backgroundedness condition, motivated using English examples, is intended to be universal, it overgenerates, as it predicts incorrectly that all languages should behave like English. (To be fair, Ambridge and Goldberg (2008) also acknowledge that the backgroundedness proposal does not fully address cross-linguistic variation, at least in the case of bridge verbs. They observe, for example, that “say” is compatible with long-distance A-bar movement in English, but not in Polish, although they do not say exactly how this difference can be derived (p. 384).)

Setting aside issues related to cross-linguistic variation, one limitation of this proposal is the absence of a formal definition for backgroundedness. Instead, sentential negation is presented as a diagnostic: a subordinate clause is taken to be backgrounded if sentential negation “impl[ies] a negation of the proposition expressed by the subordinate clause” (Goldberg, 2006 p. 143). The absence of formal definitions or a thorough discussion of how sentential negation works, or why sentential nega-

tion (and not some other kind of negation or sentence-level operation) is particularly relevant to backgroundedness, makes it sometimes difficult to see how island effects can be attributed to backgroundedness.

The backgrounded island proposal runs into empirical difficulties with complex NPs modified by relative clauses, as Goldberg acknowledges. I discussed this in greater detail in Chapter 3 (Section 3.2.1). To summarize the issue, Goldberg (2006) considers the sentence in (4), and concludes that sentential negation can imply the negation of the contents of the relative clause. The relative clause is therefore considered as not backgrounded. A-bar movement from this relative clause is thus predicted to be possible.

- (4) She met a boy [who resembled her father]. (ibid. p. 147, ex. 63)
- a. Sentential negation: She didn't meet a boy who resembled her father.
 - b. Content of relative clause: "A boy resembled her father"
 - c. Negation of contents of relative clause: "A boy did not resemble her father"¹
 - d. Sentential negation implies negation of relative clause, so the relative clause is not backgrounded: She didn't meet a boy [who resembled her father]. → A boy did not resemble her father

Goldberg correctly observes that this prediction is not borne out, presenting (5) as an example. Recognizing that this is a problem, she notes that "an explanation of this fact remains elusive" (p. 148).

- (5) *Who₁ did she meet a boy [who resembled t₁]?

Ambridge and Goldberg (2008) extend the backgroundedness hypothesis to

¹Technically, the content of the relative clause could also be "Some person *x* does not resemble her father." In addition, negation could also scope high, yielding "no boy resembled her father" or "no person *x* resembles her father." Goldberg does not discuss these issues, and I will not do so either.

bridge effects. Once again, they employ a negation test to measure backgroundedness, where “the degree to which a clause C is considered backgrounded varies inversely with the extent to which main clause negation implies that C itself is negated” (p. 360).

- (6) a. She didn’t think that he left. \rightarrow He didn’t leave.
 b. She didn’t shout that he left. \nrightarrow He didn’t leave / He left.
 (adapted from *ibid.* p. 360 exx. 26-27)

Used in this context, the test is especially problematic, as it seems to equate non-backgroundedness with neg-raising. For illustration, consider a verb like *think*. In Ambridge and Goldberg’s framework, the negation test implies that the complement of *think* is not backgrounded. However, it is unclear whether this is a valid conclusion to draw. One could imagine a scenario in which the complement of *think* is actually backgrounded, and the entailment facts only obtain because *think* is a neg-raising verb.

A further problem for this backgroundedness proposal is that it predicts that A-bar movement from complements of factive verbs should be unacceptable. While Goldberg and colleagues have provided support for this hypothesis, I note that this prediction is not always borne out. For one, A-bar movement from factive verb complements occur naturally in English. Second, Gibson (2018)/Liu et al. (2019) were unsuccessful at reproducing these effects, and the acceptability judgment experiment reported in Chapter 4 also failed to elicit the same effects. Statistical analysis of the acceptability judgments also showed that backgroundedness explained only a small portion of the variance in acceptability in long-distance A-bar movement.

5.1.3 A distributional learning approach: Pearl and Sprouse 2013a, 2013b

Pearl and Sprouse (2013a,b) model island effects as a consequence of distributional learning: learners use certain statistical facts about A-bar movement to deduce what the relevant constraints might be for their language. Pearl and Sprouse assume that learners can parse all *wh*-dependencies in an adult-like fashion. In particular, they assume that learners represent each *wh*-dependency as a sequence of “container nodes”: the maximal projections that dominate the gap but not the *wh*-phrase, with the addition of “start” and “end” symbols. The learner then analyzes these sequences as trigrams of container nodes, whose frequencies are tracked in the course of language acquisition.

- (7) a. $[_{CP} \text{Who}_1 \text{ did } [_{IP} \text{she } [_{VP} \text{like } t_1]]]$?
 b. Container nodes sequence: start-IP-VP-end
 c. Container node trigrams: start-IP-VP, IP-VP-end
 (Pearl and Sprouse, 2013b p. 36 ex. 12)

The acceptability judgment native speakers assign to a *wh*-dependency is further modeled as the probability of observing the container node sequence that represents that dependency, which they define as the product of trigram probabilities. In other words, the acceptability associated with the *wh*-dependency in a novel expression like *What spaceship₁ did the nurse paint t₁*, which has an identical set of container node trigrams as (7a), is estimated by the product of the frequencies of “start-IP-VP” and “IP-VP-end.”

Based on a study of *wh*-dependencies in naturally occurring contexts and com-

putational modeling, Pearl and Sprouse show that the container node sequence and trigrams associated with island-violating A-bar dependencies – like those that involve A-bar movement from a relative clause – are of very low probability, even after applying a smoothing constant to raise the frequencies of these trigrams to just above zero. This fact correctly predicts the low acceptability associated with these dependencies. In contrast, because A-bar movement from finite complement clauses is attested in the input (although rare), the container node approach is able to obtain non-zero frequencies for the relevant trigrams, which explains why long-distance A-bar movement is relatively more acceptable.

The container node trigram approach is elegant, in that it ideally requires the learner to track only syntactic information in the form of container nodes and the frequencies of these trigrams. This simplicity poses a problem for the modeling of the acceptability of A-bar movement from clausal adjuncts and bridge effects. The argument goes as follows. Underlying Pearl and Sprouse’s model is the intuition that the acceptability of an A-bar dependency varies directly with two factors: the length of the dependency and the frequency of each container node trigram associated with the dependency.

For illustration purposes, consider the following minimal pair.

- (8) a. This is the paper₁ we need to find some person [who understands t₁].
 b. *This is the paper₁ we need to find the person [who understands t₁].

I first argue that the length of the dependency in (8a) (a porous relative clause) is as long as the one in (8b) (a regular relative clause), if not longer. All else being equal, the acceptability of (8a) should be lower than that of (8b).

Suppose that there is some kind of covert movement of the complex NP in (8b) and A-bar movement applies after covert movement, as proposed in Sichel, 2018 and in the movement/height-based analysis in Chapter 2. The LF position of the complex NP in (8b) is thus higher than the LF position of the complex NP in (8a), and therefore A-bar movement passes through fewer projections in (8b). Alternatively, suppose that there is no covert movement of the complex NP, *pace* Sichel. In that case, A-bar movement passes through the same number of projections.

Next, for the sake of argument, suppose that the length of the dependencies are identical. In that case, the relative acceptability of (8a) requires at least some of the container node trigrams in (8a) to be more frequent than that in (8b). Pearl and Sprouse appear to assume that the learner tracks coarse-grained, “relatively universal” syntactic categories (e.g. IP, VP, but not whether the IP is finite or not, nor whether the VP is passive or not; p. 35). This assumption means that there is no difference in terms of the frequencies of the container node trigrams. (The only exception they make is for material in the CP layer, in order to model *wh*-island effects and the *that*-trace effect. Specifically, they assume that learners track whether there is a *wh*-phrase in the specifier position or whether it is headed by an overt complementizer, such as *that*.)

As I see it, for the container nodes proposal to plausibly model the difference in acceptability, one could assume that learners are tracking more abstract, fine-grained information. To see why this is so, for the sake of argument, suppose that both dependencies are equally long, and that the distinction separating the examples

is ultimately due to the relative clause in (8a) containing defective tense, while the relative clause in (8b) contains independent tense. Under these assumptions, we might be able to derive the difference in acceptability by supposing that there are more instances of A-bar movement that cross the projection of a defective tense head than the projection of an independent tense head. To do so, though, one would have to assume that learners make a distinction between defective tense (both finite and non-finite forms, which are both dependent) and non-defective (independent) tenses, and encode defectiveness in their representation of container nodes.

A similar issue occurs for bridge effects, if these are to be modeled syntactically: in container node terms, A-bar movement from the clausal complement of a bridge verb is identical to A-bar movement from the clausal complement of a non-bridge verb. To the extent that bridge effects have a syntactic explanation, one must either introduce additional conditions on A-bar movement, or assume that learners are sensitive to and track what verbs subcategorize for a clause, or deny the premise that the complements of bridge verbs and non-bridge verbs are identical, contrary to appearances.

More specifically, to model bridge effects, one could stipulate that the learner lexicalizes a trigram if it involves a verb and its finite complement. Learners then track the frequency of these lexicalized trigrams and generalize accordingly. This analysis would be a straightforward extension of Pearl and Sprouse's proposal. As mentioned, they already assume that learners can track lexical items in a CP, for example, whether there is an overt complementizer like *that*. While easily implemented, this solution might strike one as contrary to the spirit of Pearl and Sprouse's

proposal, which at its heart assumes that learners use simple, coarse-grained syntactic categories (which do not contain lexical information) to learn about island constraints.

5.2 A-bar movement from relative clauses

In this section, I discuss consequences specific to the observation that A-bar movement from relative clauses is possible under exceptional circumstances. I organize my discussion to start with broader architectural issues.

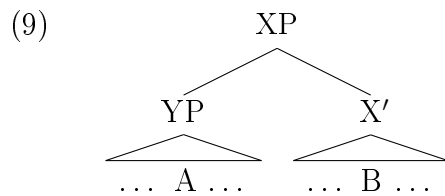
5.2.1 Implications for “derivational” approaches to adjunct islandhood

As Truswell (2007, 2011) points out, the proposal that A-bar movement from adjuncts is possible in limited has consequences on a set of approaches found in the syntax literature on adjunct islandhood, such as Hunter, 2015; Stepanov, 2007; Uriagereka, 1999. These approaches elegantly attribute island properties of adjuncts to some basic property of the derivational system.

Abstracting away from technical details, these “derivational” approaches claim that some basic requirement of the grammar causes an adjunction operation to become incompatible with A-bar movement from inside the adjunct. For example, for Uriagereka (1999), this requirement is related to linearization, which forces an adjunct to be Spelled-out and become opaque to A-bar movement; for Stepanov (2007), the requirement is a “Least Tampering Condition” that causes adjuncts to be merged postcyclically, after A-bar movement operations have applied.

In general, these proposals, to quote Boeckx (2012), are not “modifiable enough” for the linguist. But importantly, they are also unlikely to be modifiable enough for the learner. To accommodate the fact that A-bar movement from an adjunct is possible, the basic grammatical requirement needs to be waived in certain contexts. While such an assumption would capture the facts, it is an ad hoc solution to the problem. This solution implies that learners can alter basic properties of the derivational system, which is conceptually unappealing.

For illustration, consider the influential Multiple Spell-out proposal of Uriagereka, 1999. In this proposal, the linear ordering of any two lexical items A and B is entirely dependent on whether A asymmetrically c-commands B or not. This linearization algorithm runs into a problem when dealing with adjuncts and specifiers of a constituent XP (9). A lexical item inside the adjunct YP, A, cannot be ordered with a lexical item outside of the adjunct, B, as neither asymmetrically c-commands the other.



Uriagereka thus proposes that when two complex structures are to be merged together, one must be Spelled-out, so that it is no longer syntactically complex but is instead linearized and behaves “like a lexical compound” (p. 115). He assumes that Spell-out applies to adjuncts and specifiers, and so these constituents become inaccessible to further syntactic operations like A-bar movement. The asymmetric c-command requirement of the linearization algorithm thus derives the desired

generalization that adjuncts (and specifiers) are islands.

This analysis however needs to be reconciled with the fact that adult native speakers of languages like English allow A-bar movement from certain adjuncts. Technically speaking, the most direct way is to claim that this linearization algorithm is relaxed for these adjuncts. However, such a solution seems ad hoc: asymmetric c-command is a fundamental property of the (universal) linearization algorithm, and is therefore not something that we want to be able to relax or waive under language-specific circumstances. The same ad hoc problem exists from a learnability perspective: it is difficult to imagine that a learner can learn to make changes to the linearization algorithm to accommodate counter-examples in the input.

5.2.2 Remarks on syntactic parameters and restricted hypothesis spaces

In Section 3.6, I argued that there are (presumably innate) restrictions on a learner's hypothesis space that ensure that learners end up drawing conclusions about A-bar movement from porous relative clauses from their observations of A-bar movement from purposive clauses, even though these two adjuncts are superficially very different. This argument goes as follows: In principle, there are many logically coherent conclusions one might be able to draw about one's grammar from observing A-bar movement from purposive clauses; for instance, one might take these observations to mean that A-bar movement from all adjuncts is possible. However, in the case of English and Mandarin Chinese at least, learners seem to converge

on a more conservative conclusion: A-bar movement from porous relative clauses is also possible. Convergence can either be attributed to learners successfully ruling out alternative hypotheses on observing tokens that are inconsistent with these hypotheses, or to some innate bias that prevents learners from even considering these hypotheses in the first place. Since A-bar movement from purposive clauses is infrequent in languages like English and Mandarin Chinese, the first scenario is unlikely.

This kind of restriction on hypothesis space is core to the notion of syntactic parameters, and so it is useful to consider this argument in light of current views on syntactic parameters. Parameters have been criticized on conceptual and empirical grounds. Depending on how they are implemented, they can be stipulative, which is inconsistent with the goals of Minimalist theories. Some proposals are too powerful, predicting (incorrectly) that certain phenomena should be absent (e.g. Gilligan's (1989) typological work on Rizzi's proposals about null subjects). At the same time, languages appear to vary along too many morphosyntactic dimensions to be easily captured with a small number of parameters.

While innate parameters/restrictions on hypothesis spaces are perhaps not effective for capturing the full range of cross-linguistic variation, I concur with Chacón (2015) that this limitation does not constitute an argument for eliminating them from our theories of syntax. They are especially crucial in accounts in which learners use indirect evidence, in which the evidence is always (by definition) different in some way from the phenomenon to be learned. Consequently, if there is no restriction, there would be no way to guarantee that learners will draw the appropriate

inference about the target phenomenon. From a theoretical perspective, what this limitation means is that we ought to be much more judicious about when we invoke notions such as parameters/restrictions on hypothesis spaces to account for cross-linguistic variation.

5.2.3 A critique of two recent approaches on A-bar movement from relative clauses

In this section, I summarize two recent proposals that attempt to explain A-bar movement from relative clauses and related clausal adjuncts, comparing their ideas and predictions with the ones presented in Chapters 2 and 3.

5.2.3.1 A syntactic approach: Sichel 2018

Sichel's goal is to account for A-bar movement from finite relative clauses in Hebrew. Adapting her proposal to account for the English facts is straightforward, and I have done so in Chapter 2. Here, I describe her account in greater detail.

There are two components to her account. First, she assumes that the relevant finite relative clauses are derived via a “raising” analysis, adapting proposals of Bianchi, 2000; Brame, 1968; Kayne, 1994; Preminger, 2010; Schachter, 1973; Vergnaud, 1974, etc. Specifically, she assumes that there are (at least) three potential landing sites for a *wh*-phrase in the left periphery of the clause: the specifiers of CP, FP, and Foc(us)P.

The raising analysis she proposes is illustrated in (10). The complement of

the indefinite determiner *a* is a CP; the relative clause does not adjoin to a nominal projection, contrary to more conventional analyses of relative clauses. The highest *wh*-phrase in the CP raises to only Spec,FocP, and the NP inside this *wh*-phrase moves to the specifier of a higher FP. Importantly, nothing occupies the edge of CP.

- (10) $[_{DP} a [_{CP} \dots [_{FP} \text{person}_2 \dots [_{FocP} [\text{which } t_2]_1 \dots t_1 \text{ can understand this paper}]]]]$
 (adapted from Sichel, 2018, pp 353–354, ex. 34)²

In the case of A-bar movement from a complex NP like (10), the other *wh*-phrase moves directly to the Spec,CP of the complex NP. It is then free to move from this position to a higher position (11).

- (11) $[\text{Which paper}]_3 \text{ do we need to find } [_{DP} a [_{CP} t'_3 [_{FP} \text{person}_2 \dots [_{FocP} [\text{which } t_2]_1 \dots t_1 \text{ can understand } t_3]]]]?$

On its own, this first assumption overgenerates, as it predicts, incorrectly, all kinds of (raising) relative clauses permit A-bar movement from within. Sichel thus supplements this assumption with a freezing condition (in the spirit of the one proposed in Wexler and Culicover, 1980): “constituents in derived A-positions are opaque to subextraction” (her ex. 38, p. 356).

This part of Sichel’s analysis is adopted in Chapter 2, and I will present it again, here, for ease of reference. The freezing condition is connected directly to Sichel’s observation that A-bar movement is only possible from relative clauses that are part of complex NPs that are not “presuppositional,” which includes NPs that

²The raising analysis itself does not account for the fact that the *wh*-element in such an example surfaces as *who* and not *which*, i.e. the relative clause is realized as *... a person {who/*which} can understand this paper*. Presumably the *who* / *which* alternation takes place at a post-syntactic level.

receive a non de re reading or NPs in an existential construction.

Sichel's movement-based analysis is elegant, and reduces the nuances in the island constraint associated with relative clauses to an independently-motivated constraint on A-bar movement, namely, freezing. That said, there are several limitations with this proposal.

The first relates to why NPs move, which determines whether it freezes and thus whether A-bar movement is possible. As far as I can tell, Sichel does not present a full theory of A-movement, only observing that her proposed "[movement of NPs] is closer to movement in the domain of Differential Object Marking," although she rules out QR and/or type conflict resolution as possible explanations of A-movement (her footnote 20, p. 355). In the absence of a more specific theory of NP movement, this component of the proposal is difficult to evaluate.

The second kind of limitation relates to empirical coverage. Sichel's paper is concerned with A-bar movement from Hebrew relative clauses, is therefore mostly silent about cross-linguistic variation and cross-linguistic predictions. For this reason, it would be unfair to hold issues related to cross-linguistic variation against Sichel's proposal, since there is no intent on her part to make claims about A-bar movement from relative clauses across languages, even though, as mentioned in Section 2.3.2.3, Sichel is aware of cross-linguistic variation.

With this all said, I would like to point out a few issues related to cross-linguistic variation that Sichel's paper does not address. These happen to also be issues that I address in this dissertation.

Because Sichel's paper is silent about cross-linguistic variation, the paper is

also silent about how speakers might come to acquire the relevant constraint for their language. In contrast, in Chapters 2 and 3, I consider cross-linguistic differences, observe that the relevant direct experience is very sparse in English and Mandarin Chinese, and develop a learning account based on indirect positive evidence.

Second, to the extent that subjects are in derived A-positions (i.e. subjects move from some VP-internal position and freeze), relative clauses that are part of subjects should not allow A-bar movement. As pointed out in Chapter 2, this prediction turns out to be too strong for Mandarin Chinese. It is in response to datapoints like this that I also consider a defective tense analysis in Chapters 2 and 3.

5.2.3.2 A processing approach: Kush et al., 2013

Kush et al. (2013), building on observations by Allwood (1982) and Engdahl (1997) for Scandinavian languages, observe that A-bar movement from relative clauses in English is sensitive to the type of verb that selects the complex NP. In this paper, they consider the hypothesis that the verbs that allow A-bar movement from a relative clause are those that select small clause complements, i.e. verbs like *see*, *find*, and *know*. With a series of formal experiments, they show that A-bar movement from relative clauses is significantly more acceptable with main verbs that select small clauses than with main verbs that do not, providing support for their hypothesis. To restate their ideas in term of porousness, a porous relative clause (in English) is one modifying the nominal complement of a verb that can also take a

small clause.

However, in absolute terms, A-bar movement from their relative clauses was rated as “marginal at best” (p. 254), not unlike the experimental results reported in Section 5.3. To explain this marginal acceptability, Kush et al. propose the idea of “partial amelioration.” Consider the following example (12).

- (12) That is the bill that he saw many senators who supported at the congress.
(ibid. p. 257, ex. 20a)

The parser first encounters a filler, *the bill*, and the complementizer *that*, and concludes that there is a A-bar movement gap in the sentence. Upon encountering *see*, the parser realizes that *see* can take either a noun phrase or a small clause complement. Encountering *many senators* causes the parser to favor a clausal analysis where *many senators* is the subject; this is because English allows a A-bar movement gap in the predicate of a small clause (cf. *This is the bill₁ that he saw [_{SC} many senators support t₁]*). English also allows gaps inside a noun phrase, but the noun phrase has to be headed by a picture noun or the nominalized form of a verb (e.g. Davies and Dubinsky, 2003), and *many senators* is not such a noun phrase.

However, the sentence as presented is incompatible with the small clause analysis. Assuming that A-bar movement from relative clauses is actually ungrammatical in English, Kush et al. argue that at this point, the parser starts to repair the representation, converting it from a subject relative clause to a small clause, so that it would be well-formed for the representation to contain a gap. Although they do not provide an example of the repaired representation, it is presumably something like (13); note that the tense of the verb in the relative clause must change for the

small clause analysis to be well-formed. Kush et al. suggest that using a discarded analysis to repair the representation is costly, which degrades the acceptability of the sentence.

- (13) After repair: That is the bill that he saw many senators support at the congress.

This can be contrasted with (14), which is less acceptable. Observing that *meet* does not take a small clause complement, they argue that there is no discarded small clause analysis that the parser can use. As a result, it is not possible for the parser to repair the representation to get a well-formed one with a gap.

- (14) *That is the bill that he met many senators who support at the congress.
(ibid. p. 257 ex. 20b)

Kush et al.'s proposal is notable in that it is the first published empirical study of the acceptability of A-bar movement from relative clauses in English, and also the first to present a concrete proposal about the marginal acceptability of A-bar movement from porous relative clauses. However, this proposal has several weaknesses.

The first is that the repair hypothesis over-generates. For example, consider a sharply unacceptable sentence like (15a) where A-bar movement has taken place from a definite complex NP. All else being equal, the parser should be able to use a small clause analysis to repair the representation, yielding a structure like (15b). As far as I can tell, the repair steps needed are identical to the ones for (12). However, there appears to be no partial amelioration for (15a).

- (15) a. *That was the bill₁ that he saw [_{NP} the senators who supported t₁ at

- the congress].
- b. After repair: That was the bill₁ that he saw [_{SC} the senators support t₁ at the congress].

A second problem is that it does not generalize easily to other languages. Consider Mandarin Chinese. For one, the main predicates in the Mandarin examples reviewed above do not take small clauses. For example, *zhao* “to find” in (16a) is the main verb of a sentence that allows A-bar movement from a relative clause. However, *zhao* does not take a small clause complement; it does not have the “to perceive” reading associated with English *to find*. In fact, it only has the sense of *to locate (something/someone)* (16b). If the parser repairs (16a), it does not do so by using a discarded small clause analysis.

- (16) a. [Zheme wanpi de haizi]₁, wo zhao-bu-dao [yuanyi shouyang t₁
so naughty MOD child I -can’t-find willing adopt
de] ren.
MOD person
‘Such a naughty child, I cannot find someone who is willing to adopt him/her.’ (Zhang, 2002 ex. 5c))
- b. *Lisi zhao
- dao [ta shagua].
Lisi find 3sg fool
Intended: ‘Lisi finds him/her a fool.’ (compare with *dang* “to treat,”
Lisi dang ta shagua “Lisi treats him/her as a fool”)

Further, even if *zhao* did take a small clause complement, it is difficult to see how the parser might repair the representation in a way that minimizes cost. Mandarin subject relative clauses precede the noun they modify, producing predicate–subject word order: in (16a), the predicate *yuanyi shouyang* ... “willing to adopt ...” precedes the noun that serves as its subject, *ren* “person.” However, for all other clauses (setting aside right dislocation constructions where the subject appears at the end of the sentence), the word order is reversed: the subject precedes

the predicate. If (16a) is acceptable because of repair, one needs to assume that the repair process here involves a drastic revision of the word order so that *zhao dao* would have a small clause complement. Such a change should be extremely costly. However, there is no sharp degradation in acceptability.

5.3 Comments on the acceptability of A-bar movement from porous relative clauses and purposive clauses

As mentioned, Kush et al. (2013) report a formal acceptability judgment experiment where A-bar movement from porous relative clauses in existential and evidential existential environments in English were judged to be of marginal acceptability. In this section, I describe an acceptability judgment experiment that evaluates the acceptability of A-bar movement from two types of adjuncts in English: porous relative clauses in non de re environments and from purposive clauses.

To preview the results, the judgment data show quite clearly that A-bar movement from purposive clauses is acceptable, validating existing reports (e.g. Truswell, 2007, 2011). They also confirm the finding by Kush et al. (2013) that A-bar movement from porous relative clauses (in this case, the non de re construction) is more acceptable compared to canonical A-bar movement from relative clauses, although in absolute terms, A-bar movement from porous relative clauses is not perfectly acceptable. *Pace* Kush et al., I argue that the intermediate acceptability does not necessarily show that A-bar movement from porous relative clauses is ill-formed, pointing to similar lowered acceptability of dependencies involving non-island finite

clauses and reported cross-linguistic variation. In addition, the reduced acceptability of A-bar movement from porous relative clauses can be plausibly connected to parsing difficulty.

5.3.1 Methods

5.3.1.1 Participants

34 adults based in the United States who passed an American English native speaker proficiency test were recruited via Amazon Mechanical Turk. They received \$3 in monetary compensation.

5.3.1.2 Materials

The experiment had a 2x2 factorial design, combining adjunct type (relative clause and purposive clause) and whether A-bar movement had taken place from the adjunct. In these contexts, the sentences with purposive clauses are near-paraphrases of the sentences with relative clauses. Any difference in acceptability is thus most likely attributable to syntactic differences between these two constructions.

- (17) Porous relative clauses: relative clauses in a non de re construction
- a. This is the CEO who really has to hire a senior executive who can oversee the troubled business. [A-bar movement from outside relative clause]
 - b. This is the troubled business that the CEO really has to hire a senior executive who can oversee. [A-bar movement from relative clause]

- (18) Purposive clauses

- a. This is the CEO who really has to hire a senior executive to oversee the troubled business. [A-bar movement from outside purposive clause]
- b. This is the troubled business that the CEO really has to hire a senior executive to oversee. [A-bar movement from purposive clause]

16 test sentences were created with different lexicalizations. The test sentences were then distributed across four lists in a Latin Square fashion, so that each participant read four test sentences per condition and saw each lexicalization only once. The test sentences were then combined with 12 acceptable fillers and 20 unacceptable fillers; assuming the four sentences with A-bar movement from relative clauses to be relatively unacceptable, this distribution of fillers and sentences ensured that participants saw 24 acceptable sentences and an equivalent number of unacceptable sentences. Among the fillers were four sentences with A-bar movement from a relative clause adjoined to a definite complex noun phrase; an example is given in (19).

- (19) The spokesperson confirmed that these were the children that the mayor rewarded the firefighters who rescued. [A-bar movement from regular relative clause modifying definite NP]

5.3.1.3 Instructions

Participants were instructed to rate each sentence along a 7-point Likert scale based on how natural they sounded or if they would say such a sentence, with 1 being the least natural, and 7 being the most natural. Before starting the experiment proper, participants were presented with six practice sentences. Participants were free to take as much as time as they needed to give a judgment.

5.3.2 Results

To control for individual biases and variability in assigning ratings, acceptability ratings were normalized at the participant level by calculating z-scores: after calculating a mean and a standard deviation for each participant, the mean value was then subtracted from each rating and the result divided by the standard deviation to obtain the z-score.

Data from one participant were excluded. Across all items, this participant took only an average of 1.3 seconds to give a rating, when the median participant took about 10 seconds to do so. This participant's fast response suggests that he/she might not have completed the task as instructed.

The results show a three-way split in acceptability: A-bar movement from a purposive clause is significantly more acceptable than A-bar movement from a porous relative clause (mean z-score: 0.30 vs. -0.40 , $p < 0.01$), which is in turn also significantly more acceptable than A-bar movement from a relative clause that is part of a definite complex noun phrase (19) (mean z-score: -0.91 , $p < 0.01$) (Figure 5.1).

The difference between porous relative clauses and purposive clauses cannot be entirely attributed to the adjunct type alone. An ANOVA analysis shows that there are significant effects for gap position, adjunct type, and the interaction of the two factors (all three p -values < 0.001). In other words, there is a superadditivity effect for A-bar movement from porous relative clauses relative to A-bar movement from purposive clauses (Figure 5.2).

Figure 5.1: A-bar movement from adjuncts

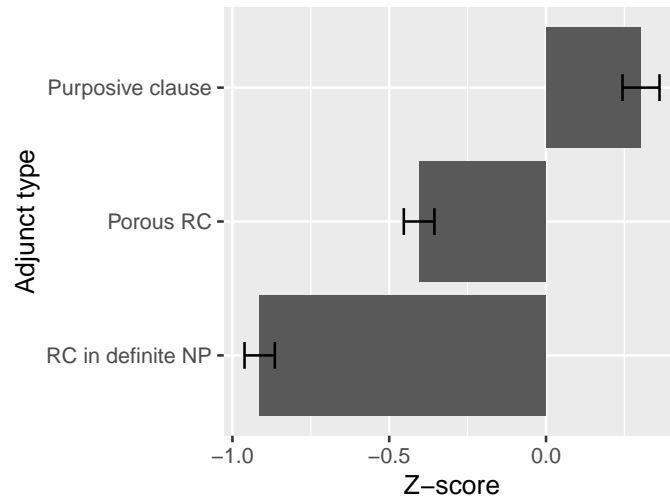


Figure 5.2: Superadditivity in A-bar movement from porous relative clauses

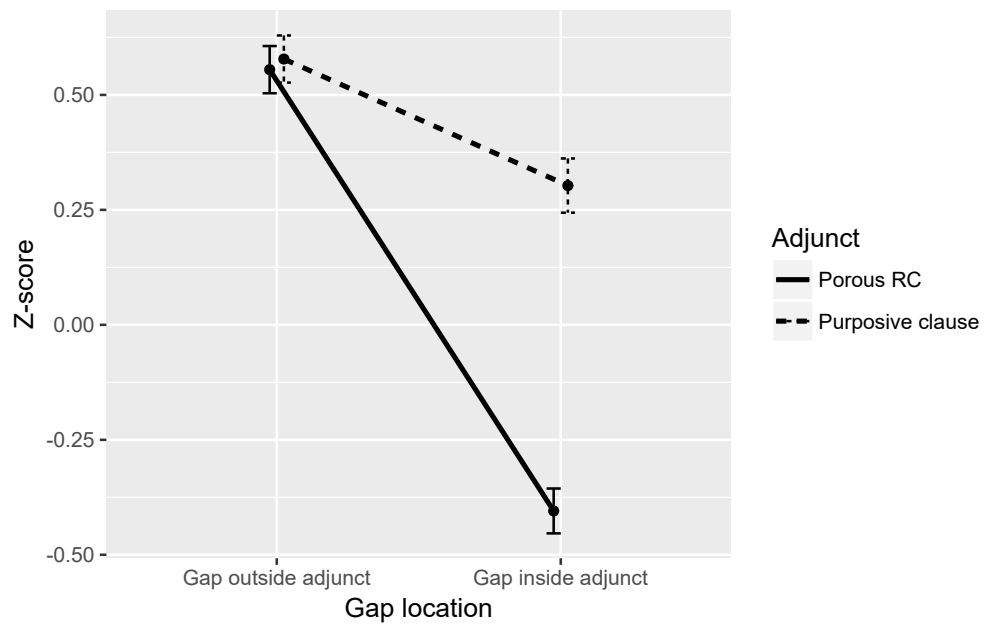
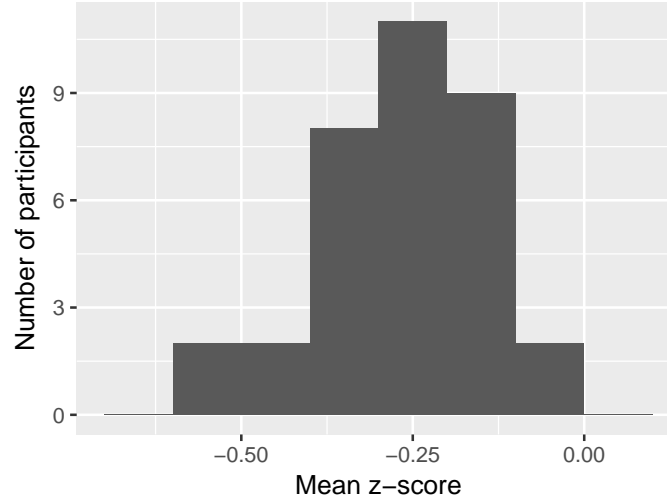


Figure 5.3: Distribution of z-scores for A-bar movement from porous relative clauses



An analysis of the judgments for A-bar movement from porous relative clauses also shows that the lower acceptability is not a statistical effect due to the presence of two distinct groups of participants, one that judges these sentences to be perfectly acceptable and one that does not. Figure 5.3 shows that participants' z-scores for these sentences have a unimodal distribution.

5.3.3 Discussion

The two-way contrast for A-bar movement from relative clauses corroborates claims in the literature, which present examples like (17) as exceptions to the relative clause constraint. The acceptability of purposive clauses is also consistent with existing claims in the literature (Truswell, 2007, 2011), even though this acceptability is, perhaps, unexpected, given that purposive clauses are adjuncts and the hypothesis that adjuncts are islands.

Complicating the picture, however, is the fact that A-bar movement from

porous relative clauses is not fully acceptable, especially when compared to A-bar movement from purposive clauses. This split is perhaps unexpected: informal judgments in the literature have tended to present these examples in a way that gives the impression that they are both completely acceptable; example sentences are often presented without asterisks or question marks that indicate degradedness. That said, for some researchers, the absence of these diacritics might merely indicate acceptability relative to some baseline that is salient in the context, e.g. A-bar movement from regular relative clauses, which is much less acceptable.

Nevertheless, to the extent that the intended claim is that A-bar movement from porous relative clauses and purposive clauses is perfectly acceptable, the judgment data presented above are inconsistent with these reports. However, it might be hasty to expect the purposive clause examples to be directly comparable to the porous relative clause examples in acceptability. After all, these constructions are not perfect minimal pairs, and their differences might contribute to the acceptability difference.

First, they differ in finiteness. There is independent experimental evidence that all else being equal, dependencies are more acceptable when they cross the boundary of a non-finite clause than that of a finite clause. For example, Michel and Goodall (2013) demonstrate this contrast for A-bar movement from various islands in English. Another study is reported in Grano and Lasnik, 2018, pp. 474–480. As mentioned above, Grano and Lasnik looked at how certain clause-bound dependencies can exceptionally cross into finite clauses when the clauses contain bound pronoun subjects (20). They measured the acceptability of these constructions with

a formal experiment. They found that relative to their non-finite counterparts (20a), the finite clause examples (20c) were less acceptable.

- (20) *Too/enough construction* (ibid.) (= (44) in Chapter 2)
- a. This book is too valuable for James to lend to Bill.
 - b. *This book is too valuable for James to claim [that Mark lent to Bill].
 - c. ?This book is too valuable for James₁ to claim [that he₁ lent to Bill].

The contrast they observed thus parallels the finiteness contrast found above for porous relative clauses and purposive clauses. Further, to the extent that the porous relative clause examples are the tense analogues of the bound pronoun subject phenomena, as set out in the defective tense account (Section 2.1.4.2), the intermediate acceptability of A-bar movement from porous relative clauses and the bound pronoun subject phenomena is not unexpected.

I will have to leave for future research the questions of why finiteness has such an effect on acceptability, and to what extent this effect holds true cross-linguistically. Researchers like Kluender (2004) and Hofmeister (2007) have attempted to cast this difference as a processing effect, although the specifics of such an account appears to be unclear to me. One conclusion that we can draw from these two sets of results is that we cannot use this finite/non-finite contrast to exclusively diagnose islandhood, even though it is tempting to do so on the basis of the results in Michel and Goodall, 2013. The three dependencies experimentally tested by Grano and Lasnik (2018) cross the finite and non-finite clausal complements of verbs like *claim* and *promise*, which are not islands in English by any conventional definition.

Another difference between the purposive clause and porous relative clause examples, which we might more easily connect with the acceptability difference, is that relative clauses are characterized by A-bar movement, and so A-bar movement from a relative clause involves the structural configuration in (21).

$$(21) \quad \dots \textit{wh}_1 \dots [_{RC} \textit{wh}_2 \dots \textit{t}_2 \dots \textit{t}_1]$$

In Chapter 2, I suggested that the configuration might be unacceptable because it is relatively difficult to process, and not because it is ill-formed *per se*. At the point *wh*₂ is processed, the parser has to resolve two A-bar dependencies within the same relative clause. This task might give rise to similarity-based interference (Lewis, 1996; see also Hofmeister, 2007 and Kluender and Kutas, 1993 for similar comments), thus reducing acceptability.

In contrast, there is no independent evidence that the purposive clauses (more precisely, rationale clauses) are characterized by A-bar movement. Consequently, A-bar movement from a purposive clause does not involve the same structural configuration. There is thus no equivalent similarity-based interference, which explains the greater acceptability.

Of course, one might argue that A-bar movement from relative clauses is actually ill-formed (ungrammatical). More specifically, one might see this configuration as violating the principle of Relativized Minimality (Rizzi, 1990), since the A-bar movement of *wh*₁ skips an A-bar position (the one occupied by *wh*₂, the relative pronoun or operator that characterizes the relative clause). In contrast, to the extent that rationale clauses are not characterized by A-bar movement, there is no

violation of Relativized Minimality.

In a framework where grammaticality is binary, i.e. representations are either well-formed (grammatical) or ill-formed (ungrammatical), this analysis means that there is no grammaticality distinction between A-bar movement from porous relative clauses and A-bar movement from regular relative clauses. To accommodate the fact that there is an acceptability difference, one could posit some kind of repair mechanism that succeeds with porous relative clauses but not with regular relative clauses, as Kush et al. (2013) do. Alternatively, one might claim that grammaticality is actually gradient (see work as early as Chomsky, 1965; for the notion of gradient well-formedness in the context of A-bar movement, see e.g. Chomsky, 1986): in contrast to A-bar movement from regular relative clauses, A-bar movement from porous relative clauses is more acceptable because these relative clauses do not freeze / are structurally low enough (under the movement/height-based analysis) or are not phases (under the defective tense analysis). A-bar movement from porous relative clauses in this regard is thus relatively well-formed.

Clearly, it is not a trivial matter to tease apart these different accounts. All things considered, though, the first account, in which A-bar movement from porous relative clauses is ill-formed but more acceptable because of processing effects, seems to me to be the most attractive: it allows us to maintain a simpler binary model of grammaticality, while deriving the marginal acceptability as an instance of similarity-based interference, a relatively well-motivated psycholinguistic effect. In contrast, developing a plausible repair account is not as straightforward, as pointed out in the above section on Kush et al.'s proposal (Section 5.2.3.2), while

the gradient grammaticality account requires us to posit a more complex theory of grammaticality.

5.4 Bridge effects

To recap, the main issue, inherited from Ross’s dissertation, is the basic assumption that long-distance A-bar movement from the complement clauses of verbs is well-formed. This assumption is largely inherited in the subjacency, CED, *Barriers*, and phase frameworks that have dominated generative discussions on long-distance A-bar movement (Chomsky, 1973, 1977, 1986, 2000, 2001; Huang, 1982) (although Chomsky, 1977 mentions briefly the effect of bridge verbs, as Charles Yang (quoting Julie Legate) points out to me). In the subjacency and phase frameworks, VPs do not block A-bar movement, while the CED and *Barriers* frameworks do not ban A-bar movement from complement clauses. Consequently, they all predict that the sentences in (22) should be uniformly acceptable, contrary to fact.

- (22) a. *Who does John {shout/quip} that Mary likes?
 b. *Co₁ Janek myśli [że studenci czytają t₁]?
 what Jan thought that students read
 ‘What did Jan think that students read?’ (Polish, Witkoś, 1995, p. 229
 ex. 39, his judgment)
 c. Who does John think that Mary likes?

The results from the acceptability judgment experiment and post hoc analysis in Chapter 4 suggest that long-distance A-bar movement is sensitive to relatively fine-grained semantic distinctions, rather than broad, coarse-grained categories. This sensitivity poses an interesting challenge from the perspective of formal

description: how should these fine-grained effects be modeled?

To the extent that the effects are ultimately pragmatic or discourse in nature (Ambridge and Goldberg, 2008; Erteschik-Shir and Lappin, 1979; Müller, 1995; Oshima, 2006), positing some kind of syntactic constraint would be irrelevant. In Chapter 4, I observed that from a syntactic theory perspective, this analysis means that we can maintain a relatively simple syntactic account of long-distance A-bar movement: A-bar movement from the complement clauses of verbs is always syntactically well-formed.

The existence of cross-linguistic variation presents complications for this approach. In Chapter 4, I discussed the case of (cognitive) factives in English and Dutch: English appears to allow long-distance A-bar movement from the complement clauses of these verbs more freely than Dutch. To maintain the position that bridge effects reflect pragmatic or discourse constraints, one would have to claim that the pragmatic or discourse properties of verbs with similar lexical semantics differ cross-linguistically, which raises questions about what these differences might be and how they might be learned. In contrast, cross-linguistic variation can be more easily accommodated in an analysis where there are language-specific syntactic constraints on A-bar movement that make reference to specific verbs or verb classes.

In fact, there are various technical options that can be easily used to implement this latter idea. One option is to implement the constraint via subcategorization and successive cyclic movement, assuming that long-distance A-bar movement must take place successive cyclically. Suppose that complement clauses are headed by

C, and C in principle comes in two different types: one with a *wh*-feature that facilitates successive cyclic movement, and one without. What learners need to do is to determine (from linguistic experience) which verbs can take CP complements headed by a C with a *wh*-feature; these verbs allow long-distance A-bar movement.

Another solution would be to invoke a classical “generate-and-filter” approach.

We might state a bridge verb constraint as follows:

- (23) a. Constraint: $*wh_1 \dots V [_{CP} \dots t_1 \dots,$
 b. such that $V \notin \text{BRV}$, where BRV is the set of bridge verbs

We might imagine this constraint applying throughout a derivation, whenever A-bar movement takes place, or, assuming a Y-model, this constraint might apply at the end of a syntactic derivation, as a constraint on syntactic representations. To the extent that there is evidence from ellipsis showing that A-bar movement constraints can be violated as long as the resulting *wh*-dependency is not overtly realized (see Merchant, 2001, Lasnik, 2001, and others on rescue of island violations by ellipsis), the latter implementation is empirically more desirable.

One additional implication of this filter account is that it requires one to assume that learners begin with knowledge of an abstract category of bridge verbs, even though they do not necessarily know which verbs belong to that category.

5.5 Evaluation of existing proposals about bridge effects

In the following sections, I review and evaluate formal analyses of bridge effects presented in the literature. Because of the breadth of the literature, I cannot present

every single proposal in detail. Instead, I seek to provide a high-level overview of the key ideas, discussing specific proposals only when necessary. For the most part, I will restrict my discussion to English bridge effects, which have received the most attention. Readers should keep in mind that cross-linguistic variation means that a theory that works well for English does not necessarily extend naturally to other languages.

5.5.1 Syntactic approaches

Most syntactic proposals focus on accounting for acceptability contrasts between selected classes of clause-embedding verbs, typically within a single language. While these are often elegant, they do not necessarily extend easily to other contrasts within the same language. As a result, they do not always come close to capturing the range of variation within a language (i.e. between various verb classes) and across languages.

To account for differences between bridge and non-bridge verbs within a language, an intuition frequently pursued is that bridge verbs take clausal complements, while non-bridge verbs do not, contrary to appearances.

For example, Snyder (1992) and de Cuba (2018) claim that the embedded clauses that appear with manner of speaking verbs are not complements, but are appositives or adjuncts. This appositive / adjunct analysis explains why the clauses are optional, i.e. why manner-of-speaking verbs can appear in intransitive frames. The restriction on A-bar movement from embedded clauses associated with these

verbs follows from this analysis as a violation of an adjunct island condition.

A close variant of this structural approach suggests that factive verbs actually contain nominal structure, so A-bar movement from the clauses effectively violate the Complex NP Island Constraint. This idea can be partially traced to Kiparsky and Kiparsky, 1970, who claim that factive verbs take a complex NP complement; however, they are careful to point out that A-bar movement from factive complements is acceptable, suggesting that A-bar movement takes after an operation that deletes nominal structure (p. 162, fn. 9). More recently, Kastner (2015) argues that these verbs subcategorize for DPs, where the D head takes a clausal complement. The same idea has been extended to manner-of speaking verbs by Berrebi and Bassel (2017). Their proposal also bears a strong resemblance to the proposals of Snyder (1992) and de Cuba (2018). In addition to arguing that embedded clauses with manner of-speaking verbs are appositive, they also hypothesize that manner-of-speaking VPs contain nominal structure, which reflects the fact that these verbs have zero-derived nominal forms (also Zwicky, 1971, Levin, 1993).

- (24) a. *regret* [_{NP} [_{CP} _____]] [Kiparsky and Kiparsky, 1970]
 b. *regret* [_{DP} [_{CP} _____]] [Kastner, 2015]
 c. [_{VP} MAKE [_{NP} A GRUNT] CP] → *grunt* CP [adapted from Snyder, 1992, p. 3 ex. 8]
 d. [_{VP} WHISPER [_{NP} (A WHISPER)] CP] → *whisper* CP [adapted from de Cuba, 2018, p. 8 ex. 30]

The above proposals attribute restrictions on long-distance A-bar movement to the presence of additional structure intervening between a clause and a verb. In a series of papers, de Cuba (2007, et seq.) reverses this intuition, suggesting that non-factive verbs like *think* take clausal complements that have an extra functional

projection, cP, that causes the clause to receive a non-factive interpretation. In de Cuba's analysis, the extra functional projection, combined with the independently motivated Adjunction Prohibition (25a) (McCloskey, 2006), exceptionally makes available an escape hatch in an embedded clause, so that *wh*-phrases may move out of it.

- (25) a. Adjunction Prohibition (McCloskey, 2006, p. 93, ex. 30): Adjunction to a phrase which is s-selected by a lexical (open class) head is ungrammatical (cf. Chomsky, 1986, which assumes that adjunction is only possible “only to a maximal projection . . . that is a nonargument” (p. 6 ex. 6)).
- b. think [_{cP} [_{CP} [A-bar movement to adjoin to CP possible]
- c. regret [_{CP} [A-bar movement to adjoin to CP impossible]

Finally, a third approach claims that verbs take clausal complements of the same size: there is no additional functional projection that blocks or facilitates long-distance A-bar movement. To explain differences between the complements of different verb classes, one posits differences within these CPs. For example, Hegarty (1992) argues that complement CPs of factive and non-factive verbs have different kinds of C heads: factive Cs “[discharge] the event position of the clause at IP” while non-factive (“propositional”) ones do not (pp. 32–33). Haegeman and Ürögdi (2010) suggests that factive CPs are referential due to the presence of a null operator on their left periphery. These hypothesized structural differences are then linked directly to the availability of long-distance A-bar movement.

5.5.2 Non-syntactic approaches

Non-syntactic approaches, as the name suggests, “strip out” the syntactic middleman, by restricting A-bar movement to contexts that bear a particular semantic or discourse property. This property has been labeled in various ways: “dominant” in Erteschik-Shir, 1973, Erteschik-Shir and Lappin, 1979, and Erteschik-Shir, 2006, “non-backgrounded” in Goldberg, 2006 and Ambridge and Goldberg, 2008. In this tradition, bridge verbs are compatible with long-distance A-bar movement because their clausal complements have this property, while this is not the case for other verbs.

Looking at long-distance A-bar movement of *wh*-adjuncts (a phenomenon that is not discussed in this dissertation), Cattell (1978) suggests that long-distance A-bar movement of *wh*-adjuncts is possible only from the complements of “volunteer stance” verbs, which introduce to the common ground the proposition denoted by the complement clause (Cattell does not specify whether these verbs vary in terms of A-bar movement of *wh*-arguments, nor discuss manner-of-speaking verbs.) Cattell’s typology has been influential, although most adopters (Hegarty, de Cuba and colleagues, Kastner, etc.) have chosen to implement his intuition in syntactic terms.

5.5.3 Evaluation of these approaches

Syntactic approaches tend to capture within-language variation with a widely-accepted and independently-motivated mechanism: subcategorization / c-selection. The weakness, however, is that independent morphosyntactic evidence in favor of

the proposed subcategorization differences is at best mixed. For example, consider de Cuba's proposal that non-factive verbs take a cP complement. The arguments for cP are entirely semantic in nature, as far as I can tell. Likewise, while it is the case that a factive verb like *regret* and *remember* can take nominal complements, it does not follow that when it appears with an embedded clause, the clause must be found inside a nominal complement, *pace* Kiparsky and Kiparsky, 1970 and Kastner, 2015.

There is also empirical evidence against the hypothesis that embedded clauses appearing with non-bridge verbs are embedded in some silent nominal projection. I present three arguments from English.

The first argument is from conjunction. Two conjoined nominals can be optionally modified with the adverb *both*, but it seems worse to conjoin an embedded clause and a(n overt) nominal in the context of a factive verb (26a) and a manner-of-speaking verb (26b).

- (26) a. Factive verb
 (i) The organizers regret both [the fact that some panellists were unprepared] and [the fact that the panel started late].
 (ii) ??The organizers regret both [that some panellists were unprepared] and [the fact that the panel started late].
 b. Manner-of-speaking verb
 (i) The child whispered (to Mary) both [the news that it was snowing] and [the rumor that schools would be closed the next day].
 (ii) ??The child whispered (to Mary) both [that it was snowing] and [the rumor that schools would be closed the next day].

The second argument is based on whether these clauses can appear in subject and object positions (A-positions). Nominal complements of the vast majority of verbs can appear in the subject position when the verb is in the passive voice (27a). To the extent that embedded clauses in the context of manner-of-speaking

and factive verbs are contained in silent nominal projections, they should appear felicitously in subject positions. This prediction is borne out for factive verbs (27b) but not for manner-of-speaking verbs (27c) (see also Baltin, 1982, p. 11).

- (27) a. [The fact that there is so much socioeconomic inequality] is regretted by many.
 b. [That there is so much socioeconomic inequality] is regretted by many.
 c. *[That John is an idiot] was shouted by Mary.

However, the fact that clauses can appear in subject positions for passivized factive verbs is not a watertight argument that these clauses are contained within “covert” DPs or NPs. There is no a priori requirement for subjects to be nominal. Another distributional test is to embed a passivized factive construction as the complement of an Exceptional Case Marking (ECM) verb like *expect* or *believe* (28a). If the passivized clausal subject is contained within a nominal expression, then this nominal expression should be able to appear in a position that gets accusative case, along the lines of (28a). This prediction is not borne out (28b).

- (28) a. I expect [the fact that there is so much socioeconomic inequality] to be regretted by many.
 b. *I expect [that there is so much socioeconomic inequality] to be regretted by many.

The third argument is specific to a recent proposal by Kastner (2015). Kastner assumes explicitly that verbs like *regret* or *deny*, which have a “presuppositional” lexical semantics, “subcategorize for a definite DP ...” (p. 161).

- (29) $[_{VP} \text{regret } [_{DP} \Delta [_{CP} \dots]]]$ (*regret* takes a DP complement headed by Δ , which is a covert definite determiner) (Kastner, 2015, p. 161, exx. 17 and 18)

This assumption seems too strong, since these verbs *can* take indefinite com-

plex NPs as complements (30).

- (30) Mary {regretted / denied / remembered} a statement that her employees made. [Indefinite nominal complement]

Setting this subcategorization fact aside, if the embedded clauses appearing with these verbs are part of a definite DP, then they should topicalize easily in the same way that definite DPs topicalize. This fact is not borne out, as observed by Baltin (1982).

- (31) a. John remembered {that Mary liked apples / the story}.
b. {*That Mary liked apples/The story}, John remembered.
c. John whined that he was hungry. (Baltin, 1982, p. 11, ex. 44a)
d. *That he was hungry, John whined. (ibid. ex. 44b)

Non-syntactic definitions of bridge verbs sidestep the above problems by obviating the need for morphosyntactic evidence. Broadly speaking, there are two issues with these proposals.

First, even though the intuitions behind these proposals are quite plausible, it can be challenging to identify independent evidence for these proposals. For example, Erteschik-Shir, Goldberg, and colleagues rely heavily on negation tests. Erteschik-Shir (1973) uses a “lie” test: bridge verbs introduce propositions whose truth can be challenged with a “That’s a lie!” or, less accusatorily, “That’s not true.” This test works well for many high-frequency non-factive verbs (32), factive verbs (33), and some manner-of-speaking verbs (34a), but seems to predict that a manner-of-speaking verb like *whisper* should allow long-distance A-bar movement when the context is right (35a).

- (32) A: John {said/thinks} that the earth is flat.

- B: That's a lie. We have photos of the earth from the International Space Station.
- (33) A: John regrets that he missed the party yesterday.
 B: That's not true. #He was there at the party. (OK: ... *He is not sorry that he missed it.*)
- (34) a. A: John mumbled that the earth rotated around the moon.
 B: That's not true. #We have photos of the earth and the moon from space.
- (35) a. A: John whispered (to me) that Mary killed Sam.
 B: That's a lie. It's John who killed Sam! (cf. ??*It was Sam who John whispered that Mary killed.*)

Cattell's typology of stance verbs is more fine-grained, but suffers from similar weaknesses. For one, he does not offer clear tests for determining what kind of stance a verb conveys, nor how it relates to other kinds of A-bar movement. Nor does his discussion extend immediately or easily to manner-of-speaking verbs, as Erteschik-Shir (2006) points out.

A second issue is in terms of data coverage. One attractive property of these proposals is that in principle, they can describe and capture relatively many classes of verbs with a single abstract property. However, it is unclear to what extent there is a property that can characterize the range of acceptability of long-distance A-bar movement; existing proposals are often built on a small number of case studies, such as long-distance A-bar movement from the complement clauses of manner of speaking verbs and factive verbs. The formal acceptability judgment study in Chapter 4 (Section 4.4), however, suggests that there are more verb classes for which long-distance A-bar movement is not fully acceptable. As far as I can tell, there is no

existing discourse-based or pragmatics-based account that claims to cover all these different verb classes, nor, as far as I can tell, is there an account that can be easily extended to do so.

5.5.4 Modelling variation within and across languages

Even supposing that a parsimonious syntactic or semantic characterization of bridge verbs or bridge effects in English is available, this characterization will still be inadequate as a general theory of bridge verbs and bridge effects, because not all languages behave like English in allowing long-distance A-bar movement across verbs like “say” and “think,” and “realize.”

Cross-linguistic variation thus poses a serious challenge for accounts that define bridge effects in purely semantic and/or discourse terms, a point that Ambridge and Goldberg acknowledge, citing again the case of Polish as an example (p. 376). As mentioned previously, the only way these accounts can accommodate cross-linguistic differences is by positing that the semantics or discourse properties of these verbs vary across languages. Consequently, one implicit assumption that these accounts make is that learners can deduce very subtle facts about the semantics and discourse properties of these verbs. This is by no means a trivial assumption, as many of these verbs describe highly abstract mental states, the specifics of which are difficult to deduce from physical context alone (Hacquard and Lidz, 2019; Harrigan et al., 2016; Huang et al., 2018).

Syntactic accounts in principle could fare better, especially if they explain

bridge effects as a product of lexically idiosyncratic subcategorization differences. More specifically, we might imagine that there are different types of complement clauses, of which only some allow long-distance A-bar movement, e.g. because they contain the right features and/or an escape hatch in the left periphery. Only some verbs subcategorize for these complement clauses that allow long-distance A-bar movement; others take complements that do not.

The idea being exploited here is that subcategorization requirements vary across languages, even when we control for lexical semantics (to the extent that it is possible to do so). For example, French *croire* ‘believe’ can take a non-finite complement without an overt subject (i.e. it has control syntax) while English ‘believe’ does not (e.g. Bošković, 1996).

- (36) Pierre croit [PRO avoir convaincu son auditoire].
 Pierre believes to.have convinced his audience
 ‘Pierre believes that he has convinced his audience.’ (cf. **Pierre believes to have convinced his audience.*; Bošković, 1996, p. 286, ex. 20a)

Taking this subcategorization idea seriously requires providing a theory of clausal syntax that provides a typology of complement clauses that attitude verbs can take in principle and a theory of acquisition that explains the process by which learners determine which verbs take what kind of complements; one such account is presented above in Section 5.4.

Another not-unpopular subcategorization-based approach derives bridge effects by assuming that non-bridge verbs only appear with adjunct clauses, not complement clauses, thus reducing bridge effects to a classic adjunct/complement distinction. This approach assumes that adjuncts are islands, a generalization that I

have claimed is problematic, as much as it is elegant. Setting that concern aside, using this approach to model cross-linguistic variation presents a problem in that it requires assuming that subcategorization properties vary in much deeper ways cross-linguistically. For example, long-distance A-bar movement across cognitive factive verbs is possible in English but not for certain Dutch varieties. In this particular subcategorization approach, one would need to postulate that in these Dutch varieties, cognitive factive verbs are obligatorily intransitive, so any subordinate clauses that appear with them are adjuncts, not complements. This strikes me as an odd position to take: while subcategorization requirements do vary for a given lexical item (and their “counterparts”) across languages (cf. French *croire* and English *believe*), it seems unlikely that these requirements would vary at the level of a verb class.

Alternatively, one could maintain that complement clauses have the same internal syntax cross-linguistically, and derive the facts by stipulating that complement clauses undergo certain structural operations in some languages that render them opaque for long-distance A-bar movement. An example is found in Witkoś, 1995, section 7, which deals with the problem of why Polish does not seem to allow long-distance A-bar movement. Witkoś rightly observes that this fact is “not in line with” a *Barriers* framework (p. 252), which allows long-distance A-bar movement from complement clauses. (In fact, the core assumptions in *Barriers* allow long-distance A-bar movement from complement clauses of nouns, obliging Chomsky to stipulate that nouns “assign oblique Case and that this imposes an inherent barrier to government” (Chomsky, 1986 p. 36).) Witkoś, following Cinque (1990), stip-

ulates that clause-embedding verbs in Polish take complement clauses, but these clauses extrapose, presumably obligatorily, so these clauses are not L-marked. An adjunct undergoing A-bar movement will fail to adjoin to these clauses and cannot move out of them. As for arguments, Witkoś attributes their failure to move to the presence of tense in the embedded clause, following proposals by Manzini (1992).³

As far as I can tell, there are two challenges for this “extraposition and tense analysis.” First, there is no independent evidence that clauses extrapose, not least because such an extraposition operation is string vacuous: Polish is head-initial, so a complement and an extraposed complement both appear on the right of a head. Second, it is difficult to see how that kind of distinction might be learned: to derive the differences between Polish and English, one must assume that the Polish learner figures out that complement clauses always extrapose, while the English learner figures out that extraposition is not always obligatory. Since complement clauses superficially appear in the same post-verbal position in both languages, it is unclear how learners might draw these conclusions.

³As far as I can tell, Witkoś could have also derived the desired blocking effects by simply appealing to the Freezing Condition (Wexler and Culicover, 1980), which blocks A-bar movement from extraposed elements. But this option is technically not available under the *Barriers* framework that he is operating in.

Chapter 6: Future directions and conclusion

6.1 Future work

In previous chapters, I surveyed existing work on A-bar movement from relative clauses and complement clauses, clarifying generalizations as well as contributing new descriptions to the literature. I also observed that cross-linguistic variation in these phenomena raise learning problems, and offered proposals on how learners might overcome them with evidence in their linguistic experience and learning mechanisms and biases. However, there are still many open questions that are not fully understood, and they await further investigation. I list a few of them here.

First, the account presented in Chapters 2 and 3 is intended to cover A-bar movement from clausal adjuncts, such as porous relative clauses, purposive clauses, and temporal adjuncts, among others. However, it does not deal with other subclasses of adjuncts that systematically show within-language and cross-linguistic variation, including the present participial adjuncts (i.e. gerundival adjuncts in English) (1) studied by Truswell (2007, 2008, 2011).

- (1) A-bar movement from present participial adjuncts
 - a. What_{t₁} did Mary drive John crazy [trying to fix t₁]?
 - b. What kind of hat_{t₁} did John come back [wearing t₁]?

Truswell shows that this phenomenon has a very limited cross-linguistic distribution, suggesting that this phenomenon is learned. As far as I can tell, these structures seem to be very rare in child-ambient speech and adult-directed texts and speech in English. Further, I am not aware of another A-bar movement phenomenon that covaries with A-bar movement from these participial adjuncts. Supposing that this phenomenon is grammatical (*pace* Kohrt et al. (submitted)), it is not clear to me what the relevant learning account might be.

Second, even though I have shown that A-bar movement from certain adjuncts is possible in some languages, I observed in Chapter 2 and 4 that not all phrases may freely move from them. For example, porous relative clauses do not permit overt movement of adjuncts (2), nor do complement clauses of many verbs (3).

- (2) a. *This is the studio where₁ Paul and Stevie were the only ones₂ [who₂ t₂ wanted to record the song t₁].
- b. *[How thoroughly]₁ do we need to find someone₂ [who₂ t₂ understands this paper t₁]?
- c. *[Under what circumstances]₁ are there many Americans₂ [who₂ t₂ condone violence t₁]?

- (3) a. *That is how₁ Mary realized [John cleaned the kitchen t₁]: with her toothbrush.
- b. *That is the reason why₁ John noticed [that Mary left the window open t₁]: to let in the breeze.

One reasonable interpretation of these facts is that the conditions on overt A-bar movement of adjuncts are more restrictive than those on overt A-bar movement of arguments, as Cattell (1978), Hegarty (1992), and Abrusán (2014) (among others) suggest. However, this is only an intuition: I am not aware of a general theory that addresses all conditions on A-bar movement of adjuncts. The state-of-the-art

appears to be Abrusán, 2014, but this proposal deals with only A-bar movement from a subset of complement clauses; it does not address in detail, for instance, the observations of Cattell (1978) (see discussion in pp. 79–80 in Abrusán, 2014).

Finally, there is much more descriptive work that needs to be done to understand the nature of bridge verbs and long-distance A-bar movement. The results of the acceptability judgment experiment and post hoc classification presented in Chapter 4 shows that many existing generalizations about bridge verbs are not fine-grained enough to capture the range of judgments. There are several next steps for this topic. For example, the post hoc classification is specific enough to make fairly clear predictions about which other verbs might be incompatible with long-distance A-bar movement; these predictions can be tested with a follow-up acceptability judgment study.

A closely-related issue is the extent to which these fine-grained distinctions can be more succinctly captured under a general pragmatic or discourse principle. I suggested that this calls for further theorizing, as existing pragmatics or discourse-based accounts tend to cover explicitly only a small set of verb classes, such as manner of speaking verbs. Further comparative research is also necessary to understand how exactly the pragmatics of these verbs differ cross-linguistically, and to what extent this predicts cross-linguistic variation in the acceptability of long-distance A-bar movement for these verbs.

6.2 Conclusion

One of the key goals in modern linguistics is to understand the nature of the language faculty. Constraints on A-bar movement have played an important role in this research program. They are negative in nature, highly abstract, and difficult to observe directly. Nevertheless, speakers come to possess knowledge of these constraints.

A standard solution to this puzzle is to claim that the knowledge of these constraints is innately specified, and so minimal learning is required on the part of the learner. In this dissertation, I discussed two case studies involving constraints on A-bar movement that pose a problem to this particular proposal. I pointed out that A-bar movement from relative clauses and complement clauses of verbs is sensitive to fine-grained distinctions within a language, and these distinctions vary to a certain extent across languages.

This kind of variation appears to pose major learning problems: given how abstract these constraints are in the first place, how might learners identify the appropriate variant for their languages?

In the case of A-bar movement from porous relative clauses, I observed that porous relative clauses can be distinguished from other relative clauses using certain semantic properties. Of interest was a property I called “tense dependence.” I presented two distinct syntactic hypotheses to capture this property, building on work by researchers such as Sichel (2018), Ogihara (1996), and Grano and Lasnik (2018), and showed how these treatments of tense dependence can be linked to A-bar

movement.

Further, not all languages have A-bar movement from porous relative clauses (Cinque, 2010), which suggests that some aspect of this phenomenon is learned from one's linguistic environment. However, an analysis of corpora in two different languages — English and Mandarin Chinese — shows that learners of these languages are very unlikely to observe A-bar movement from porous relative clauses (cf. Pearl and Sprouse, 2013a,b). Building on the observation of tense dependence, I suggested that learners of these languages resolve the learning problem by using evidence from a superficially-unrelated source: A-bar movement from non-finite purposive clauses. I argued that despite appearances, purposive clauses, like porous relative clauses, also have dependent tense. I presented evidence from cross-linguistic co-variation and corpus analyses to show that learners of English and Mandarin Chinese corpora can observe A-bar movement from purposive clauses.

The fact that English and Mandarin learners can observe A-bar movement from purposive clauses, however, does not in principle guarantee that they will conclude that their languages allow A-bar movement from porous relative clauses. I argued that the fact that these learners draw such a conclusion implies that there are restrictions on a learner's hypothesis space. As a result, for learners, the observation of A-bar movement from purposive clauses provides clear evidence for a very small number of hypotheses (possibly only one).

I also reviewed variation in the acceptability of A-bar movement from the complement clauses of verbs. I noted that existing generalizations about these effects are often made on the basis of a small number of verbs. I presented a 100-verb accept-

ability judgment experiment that allowed for a more systematic assessment of these claims for English. The experiment results suggest that existing proposals about bridge verbs are too coarse-grained: English speakers appear to be sensitive to more fine-grained distinctions than those usually described in the literature. However, the experiment results also suggest that in English, the factivity of a verb has a limited impact on long-distance A-bar movement, which provides an interesting contrast with languages like Dutch, where for some speakers, long-distance A-bar movement across (at least) cognitive factive verbs is more marked. While English learners have access to evidence that long-distance A-bar movement is compatible with cognitive factive verbs, the evidence is not robust for many such verbs. I argue that it is likely that English learners generalize across the class of cognitive factive verbs. To that end, I looked at what kind of learning mechanism might let them form these generalizations despite sparse evidence, comparing the Sufficiency Principle (Yang, 2016, 2017) and an alternative Bayesian-inspired approach.

Finally, the fact that these constraints can be shaped by linguistic experience also has implications for our theories of syntax. I argued, for instance, that existing accounts of these phenomena, as much as they are elegant, tend to lack sufficient “flexibility” to capture the range of variation in these constraints. The variation we observe suggests that A-bar movement from porous relative clauses and complement clauses do not have a single source. Following Truswell (2007, 2011), I further noted that the case of porous relative clauses and purposive clauses also presents challenges for proposals that derive adjunct islandhood from more basic syntactic principles.

Overall, the picture that emerges from these case studies is that despite ap-

pearances, learners might have access to evidence in their linguistic experience that allows them to learn the appropriate points of variation. However, the presence of evidence alone is insufficient, because the evidence might be sparse and/or look superficially very different from the phenomenon to be learned. It appears that some kind of learning bias is needed, so that learners can draw the “right” conclusions on the basis of limited evidence. More generally, the study of difficult-to-observe phenomena through the lens of variation and actual linguistic experience can help shed light on the learning biases and linguistic dimensions that matter for language acquisition.

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