

Adaptation at the Syntax-Semantics Interface: Evidence from a Vernacular Construction

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Abstract. Expanding on psycholinguistic research on linguistic adaptation, the phenomenon whereby speakers change how they comprehend or produce structures as a result of cumulative exposure to less frequent or unfamiliar linguistic structures, this study asked whether speakers can learn semantic and syntactic properties of the American English vernacular Negative Auxiliary Inversion (NAI) construction (e.g. *didn't everybody eat*, meaning 'not everybody ate') during the course of an experiment. Theoretical analyses of NAI informed the design of a task in which American English-speaking participants unfamiliar with this construction were exposed to NAI sentences in either semantically ambiguous or unambiguous contexts. Participants demonstrated knowledge of the interpretive properties of NAI after only limited exposure to semantically ambiguous input, and they also demonstrated knowledge of syntactic restrictions on its subject type. The results suggest that linguistic adaptation can include the ability to rapidly learn semantic and syntactic properties of grammatical structures from another language variety, and underscore the utility of incorporating models of hierarchical structure and constituency into studies of

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adaptation. It is further proposed that adaptation to unfamiliar structures involves analogy to structures already present in a speaker's grammar.

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1. Introduction

The question of whether and how exposure to unfamiliar or infrequent structures modulates speakers' structural representations has been the subject of much psycholinguistic inquiry and debate (see Kaan & Chun 2018 for recent review). Studies addressing this question typically observe whether changes occur in participants' behaviors during the course of an experiment, as a result of cumulative exposure to unfamiliar or infrequent structures. Researchers then draw inferences about grammatical changes that may underlie these observed changes in behavior. Such studies can serve as useful short-term analogs for linguistic processes that occur naturally over longer timespans, such as language acquisition and change (Kaan & Chun 2018: 86), and can therefore inform fundamental questions, including how and why languages change over time, how people acquire languages, and what happens when languages and language varieties come into contact.

Studies have also employed unfamiliar vernacular structures as a way of examining structural changes during an experiment (e.g., Kaschak & Glenberg, 2004; Fraundorf & Jaeger 2016). Observing the processing of unfamiliar vernacular structures is useful since these structures typically have properties that overlap with, but are not identical to, structures already familiar to speakers. The current study advances this line of research by asking whether speakers can learn

semantic and syntactic properties of the vernacular Negative Auxiliary Inversion (NAI) structure in English. The study moves beyond reading time data to focus on people's interpretation of an unfamiliar structure, taking theoretical analyses of this construction as the basis for experiment design. It shows how consideration of theoretical models of hierarchical structure can advance our understanding of linguistic adaptation, and furthers our knowledge of what structural properties people can adapt to as a result of short-term exposure to an unfamiliar structure.

2. Background

2.1 *Adaptation*

In the psycholinguistic literature, *linguistic adaptation* is the phenomenon by which speakers and listeners change how they comprehend or produce linguistic structures as a result of cumulative exposure to similar structures in the input (see Kaan & Chun 2018 for review). Such changes can occur at all linguistic levels, ranging from adaptation to a particular accent (i.e., at the level of phonology), or word choice, and even to particular syntactic structures. For instance, previous research has shown that people can adapt their interpretation of the quantities denoted by *many* and *some* to match the quantities presented during the course of an experiment (Yildirim, et al. 2016; see e.g., Metzing & Brennan 2003, for related findings at the lexical level). People can also rapidly learn to anticipate either a low- or high-attachment preference for ambiguous relative clause attachment, as in *The uncle of the girl who will ride the motorbike*, based on talker identity, and whether an individual talker produces sentences that always resolve to the high- or low-attachment interpretation (Kamide 2012; see also Chun 2018). People also tend to speed up their reading of less-frequent syntactic structures (e.g., object relative and reduced relative clauses) through repeated exposure, reading them as fast as or even faster than related structures that are

more frequent (e.g., Fine et al. 2013; Kaan et al. 2019; Wells et al. 2009; but see Harrington Stack et al. 2018, for counterevidence).

In a related line of research, Luka and colleagues (Luka & Barsalou 2005; Luka & Choi 2012) investigated how reading aloud affects adaptation. These authors found that people rated grammatical but relatively infrequent pseudo-cleft sentences (e.g., *What the pharmacist recommended is to read the instructions*) as significantly more acceptable after reading sets of other pseudo-cleft sentences aloud, and that such modulations in acceptability could extend up to 48 hours post-exposure. However, there were no parallel changes in acceptability when participants were simply prompted to repeatedly make acceptability judgments about sentences without reading them aloud. Luka and colleagues argue that such results highlight the key role of “reading for comprehension” in linguistic adaptation.

Explanations for adaptation effects, such as changes in reading times and acceptability judgments, often implicate implicit learning mechanisms (e.g., Chang et al. 2006; Dell & Chang 2014; Kleinschmidt & Jaeger 2015; but see Reitter et al. 2011, for an alternative explanation). People are aware of the distributional frequencies of different linguistic structures in their input (e.g., Aslin & Newport 2012; Yang 2010). As the frequency with which one encounters a given structure changes—either over the short-term in an experimental context, or over longer periods of time in a more naturalistic environment—people adjust their expectations regarding the likelihood of encountering that same structure in the future. Over time, such adjustments can lead to cumulative changes in the linguistic system, which constitutes a form of learning. One key piece of evidence favoring such accounts is the inverse frequency effect, whereby adaptation over time is strongest for less common or unfamiliar, yet still attested, linguistic structures (e.g., Bernolet & Hartsuiker 2010; Bock 1986; Jaeger & Snider 2013; Kaschak et al. 2011; Peter et al. 2015). In

essence, adaptation parallels learning in that such effects are greater for something that is initially less well-known versus something that is already well-known. Further, adaptation generalizes beyond the specific lexicalizations people encounter during initial exposure (see Mahowald et al. 2016, for review), providing additional evidence that cumulative changes over time occur at a more abstract level.

Researchers have also begun to explore adaptation by examining how people behave when exposed to an unfamiliar sentence type from a different language variety. Fraundorf and Jaeger (2016) showed that people unfamiliar with the English vernacular *needs* construction (e.g., *the car needs washed*, as used in the Midland dialect region; see Maher & Wood 2011 for a review) will read such sentences as quickly as people familiar with the structure following exposure to as few as four to seven trials (see also Kaschak & Glenberg 2004). Further, participants then generalized this reading pattern to a different and unattested structure, which Fraundorf and Jaeger referred to as the *be-drop* construction (e.g., *The copier will recycled because it no longer works*), reading *be-drop* sentences as fast as they read vernacular *needs* sentences. In contrast, participants who were already familiar with the vernacular *needs* construction exhibited slower reading times upon encountering *be-drop* sentences.

Fraundorf and Jaeger (2016) conclude that the generalization of reading times from vernacular *needs* to *be-drop* may be attributed to the idea that exposure to one unfamiliar structure leads participants to adapt their expectations about further unfamiliar structures in the subsequent input. Because participants who were previously familiar with vernacular *needs* had not treated these sentences as unfamiliar, they had not adapted their expectations about unfamiliar structures, hence their slower *be-drop* reading times. Fraundorf and Jaeger (2016: 45) further suggest that this type of adaptation of expectations may be restricted to structures that can be viewed as “similar”.

Under this analysis, speakers who generalized their reading of vernacular *needs* to *be*-drop sentences would not have generalized to a structure like so-called “positive anymore” (Youmans 1986; see Maher & McCoy 2011 for a description and review), which the authors assume lacks structural similarities to vernacular *needs*.

Fraundorf and Jaeger (2016) do not discuss the theoretical linguistic implications of their assumption that vernacular *needs* and *be*-drop are similar. If we consider the assumption that these two sentence types are similar from a theoretical linguistic perspective, we see that it implies a form of phonological ellipsis of functional elements for both structures: *to be* is phonologically elided for vernacular *needs* (cf. *the car needs to be washed*), and *be* is phonologically elided for *be*-drop (cf. *the copier will be recycled*). Since this is a phonological and not a structural similarity, it is possible that participants’ faster reading times for *be*-drop reflected adaptation to the expectation that some elements of sentences would be deleted phonologically, as opposed to adjusting their expectations for novel structures. Considering further what this means for vernacular *needs*, the assumption is that the underlying structure is an embedded infinitival passive (e.g., *the car needs to be washed*, *the baby needs to be fed*; but see Edelstein 2014 for an alternative analysis). If this is the case, then vernacular *needs* is not a novel or unfamiliar structure *per se*, but rather a familiar structure with some functional elements phonologically elided. Participants’ faster reading times may therefore have resulted from their learning to map vernacular *needs* sentences onto structures already present in their grammars, as a type of analogical reasoning. The fact that participants had high accuracy on simple comprehension questions following the vernacular *needs* items that assumed synonymy with the embedded infinitival passive supports the idea that they were mapping this “novel” structure onto a structure already present in their grammar. As a preview to our results discussion, we will suggest that participants’ adaptation to the semantic and

semantic properties of NAI, a genuinely novel structure which cannot be analyzed as a phonologically elided variant of a mainstream structure, may have also been facilitated by analogical reasoning.

To date, a majority of research on syntactic adaptation has relied on the analysis of reading times and, to some extent, acceptability judgements. Far less research has considered how people's interpretation of less frequent or potentially unfamiliar syntactic structures may change over time due to increased exposure (but see Chun 2018; KroczeK & Gunter 2017, for exceptions). Further, in addition to questioning what readers actually adapt to, researchers have also asked to what extent adaptation effects, as reported in the experimental literature, are limited in scope to the specific experimental paradigm employed (see Kaan & Chun 2018; Prasad & Linzen 2019, for further discussion). The present study builds on previous work examining how people adapt to unfamiliar structures from another variety by investigating whether and how people learn to interpret NAI constructions, a syntactic structure present in numerous vernacular English varieties. Extending beyond previous work on adaptation to unfamiliar structures from another dialect, the study design is crucially informed by theoretical analyses of the semantic and syntactic properties of this construction. The design and results show how consideration of the underlying hierarchical structure of the constructions under investigation can further our understanding of the phenomenon of adaptation more generally.

2.2 Negative Auxiliary Inversion

2.2.1 General usage and interpretation

To understand the syntax of NAI, it is helpful to first observe negative yes-no questions such as the underlined portion of the following context:

- (1) A study group is discussing the main points from a lecture. One student is surprised to find that some classmates seem confused. She says: Didn't everybody understand what the professor said? I thought it was super clear.

Example (1) contains a (negative) yes-no interrogative, realized syntactically by placement of the auxiliary in pre-subject position.³ Typically, such yes-no questions are realized with a final-rising intonation (Bolinger 1978).

In many varieties of American English, strings that appear as yes-no questions as in (1) can also be used as declarative statements, as in the following context:

- (2) A study group is discussing the main points from a lecture. Most students agree that things were really clear, but one student disagrees. He says: Didn't everybody understand what the professor said. I was totally confused.

In context (2), the underlined portion is string-identical to the interrogative in (1), with the negated auxiliary appearing in pre-subject position. However, in this case the string is pronounced and interpreted as a declarative, with a meaning equivalent to 'not everybody understood what the professor said'. This is the phenomenon of NAI. At its core is the relationship between the subject and the auxiliary, which occur in an order that is non-canonical in both standardized and vernacular Englishes. Two further descriptive characteristics of NAI are that the auxiliary must be negated

³ For a review and discussion of negative yes-no questions as in (1), see Dayal (2016: 270–277). We set the meaning properties of these constructions aside, as they are unrelated to NAI interpretation.

(e.g., Parrott 2000; White-Sustaíta 2010), and the negation appears as the clitic *n't* as opposed to the marker *not* (Blanchette 2015; Parrott 2000; Matyiku 2017; Salmon 2018).

Labov et al. (1968, 1972) observed NAI use by vernacular African American and Latinx speakers in New York, and it has also been observed in White Alabama English (Feagin 1979), West Texas English (Foreman 1999, 2001; Matyiku 2017), Vernacular Texas English (Salmon 2018), African American English (Green 2002, 2014; Parrott 2000; Sells et al. 1996; Weldon 1994), and Appalachian English (Wolfram and Christian 1976; Montgomery 2004; Montgomery and Hall 2004; Tortora and Den Dikken 2010). An overview of the literature on NAI can be found in Matyiku (2011).

Note that the NAI example in (2) above contains the non-negative, universal quantifier subject *everybody*. In anticipation of our methods, we note that this particular NAI pattern served as the focus of our investigation. This is despite the fact that it may be less acceptable than other more frequent forms (e.g., Blanchette & Collins 2018), and despite the fact that it most commonly occurs with morphologically negative subjects, as in *Didn't nobody understand* (e.g., Blanchette & Collins 2018; Matyiku 2017; Sells et al. 1996). NAI constructions with morphologically negative subjects can also be classified as Negative Concord constructions, in which two or more syntactic negations contribute a single semantic negation (as in the 'I ate nothing' reading of *I didn't eat nothing*). Negative Concord is highly stigmatized in English, and can occur independently of NAI. Because of this stigma, and because of independent syntactic and semantic properties of sentences with two negations, it was necessary to avoid Negative Concord in our experiment. Our focus on NAI sentences with universal quantifier subjects, though infrequent, further allowed us to isolate the semantic property of interest, namely, the wide scope of negation.

2.2.2 Negation and quantifier scope

Theoretical analyses of NAI are built on important empirical generalizations about this construction type, one of which pertains to the phenomenon of taking scope. Since May (1977), the phenomenon of scope-taking can be understood as the source of ambiguity in sentences like the following:

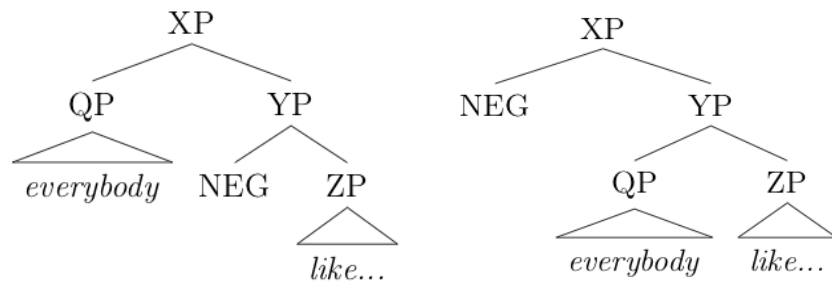
(3) Everybody didn't like the movie.

Sentence (3) is compatible with two truth-conditionally distinct interpretations: (i) everybody is such that they did not like the movie (i.e., nobody liked it), and (ii) not everybody liked the movie (but some may have). We henceforth call these the narrow-scope (i) and wide-scope (ii) negation readings.

The availability of both a wide-scope and a narrow-scope negation reading for sentences like (3) can be attributed to the presence of two scope-bearing elements: a negation (*n't*), and a quantificational noun phrase (*everybody*). May (1977) proposes to model the phenomenon of scope-taking as abstract syntactic movement of scope-bearing elements to a higher, structurally peripheral position. It follows that when two scope-bearing elements are present in a sentence, there are two possible abstract structures. The structures for (3) are illustrated here (QP = quantifier phrase, NEG = negation; irrelevant details omitted):

(3a) narrow-scope negation

(3b) wide-scope negation



In structure (3a), the universal quantifier *everybody* takes wide scope, yielding the narrow-scope negation reading in which nobody liked the movie. Note that in terms of linear order, the string in (3) maps onto the structure in (3a). This contrasts with structure (3b), in which the negation takes scope over the quantificational subject yielding the wide-scope negation reading, despite its surface appearance following the quantifier. The fact that the wide-scope negation reading represented by (3b) is available for the string in (3) shows that quantifiers need not take scope in the order in which they appear on the surface.

Carden (1970, 1973) explored the extent to which individuals may prefer the wide scope or the narrow scope negation reading for sentences like (3), concluding based on context-free judgments that speakers have either a wide scope negation dialect, a narrow scope negation dialect, or a dialect that allows for both readings. In a study of related *all...not* constructions (e.g., *all the moviegoers didn't like the movie*) in the British National Corpus, Tottie and Neukom-Hermann (2010) find that the wide scope negation reading is more frequent than the narrow scope negation reading. For the purpose of this study, we assume that both the wide and narrow scope negation readings of (3) are generally available for English speakers, given the appropriate context.

The proposition in (3) can also be asserted in the form of an NAI construction, as follows:

- (4) Didn't everybody like the movie.

Sentence (4) has the same two scope-taking elements as (3), *n't* and *everybody*, so we might expect it to also be truth-conditionally ambiguous. However, as first observed in Foreman (1999:11; see also Matyiku 2017), in NAI only the wide-scope negation reading is possible, and quantificational subjects must take narrow scope relative to the negation. This means that only (4b) is available as a reading of (4), and (4a) is not:

(4a) ‘Nobody liked the movie.’ (~~narrow-scope negation~~)

(4b) ‘Not everybody liked the movie.’ (wide scope negation)

Numerous theoretical works have sought to model the lack of scope ambiguity in NAI (Blanchette & Collins 2018; Foreman 1999; Green 2014; Matyiku 2017; Sells et al. 1996; among others). Several theories derive the obligatory wide scope of negation by proposing that the negation raises over the subject overtly in the syntax. In theories such as Foreman (1999) and Matyiku (2017), the wide scope negation property of NAI serves as the impetus for overt syntactic raising, while in Green (2014) the construction is associated with a special negative focus feature that triggers raising of the negation (see also White-Sustaíta 2010).

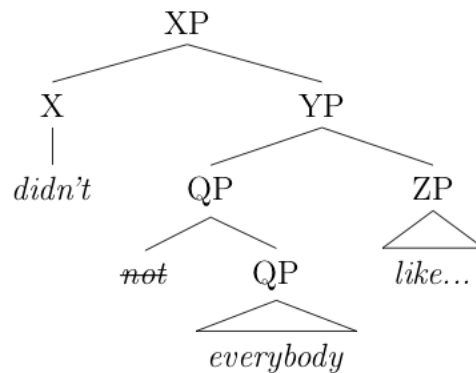
Blanchette and Collins (2018) take a different approach to modeling the lack of scope ambiguity in NAI. They hypothesize that NAI involves the following grammatical constraint:

(5) The NAI Subject Condition (Blanchette & Collins 2018: 9, ex. (19))

In NAI, the subject is negative.

For a sentence like (4), this means that the underlying structure of the quantifier phrase *everybody* is actually a negated quantifier phrase, akin to *not every player*. Instead of raising over the subject as in other theories, the negation instead raises from within the subject, as follows:

(6) Blanchette & Collins (2018)



The negation enters the structure as a specifier of the quantificational noun phrase (see *not*), and from there raises and cliticizes to a higher position (as *-n't*). Given that the negation is introduced as part of the quantifier phrase, the structure captures the fact that there is no inverse scope reading in which the quantifier takes wide scope relative to the negation.

Note that prior to raising of the negation, the structure in (6) would yield the following string:

(7) Not everybody liked the movie.

Thus, according to Blanchette and Collins (2018), the NAI construction in (6) is a structural analogue of (7), with the minimal difference of the raised negation. As outlined in the next section, this proposal also captures restrictions on the type of noun phrase allowed to occur in NAI subject position.

2.2.3 *Phrase type constraints on NAI subject position*

In addition to the lack of scope ambiguity in NAI, previous theoretical work has also built on an important generalization regarding the type of subject that can occur in NAI, first observed by Foreman (1999: 11–12; see also Matyiku 2017 for an extensive description of the subject restrictions in NAI). Note first that NAI sentences with quantificational and Negative Polarity Item subjects are parallel in meaning and acceptability with sentences in which *not* occurs immediately preceding the subject:

- (8) (a) Didn't everybody finish their homework. (Foreman 1999: 11, ex. (29d))
 (b) Not everybody finished their homework.
- (9) (a) Didn't many people go to the party. (Foreman 1999: 11, ex. (29b))
 (b) Not many people went to the party.
- (10) (a) Dudn't anybody seem to understand.⁴ (Feagin 1979: 235, ex. (73))
 (b) Not anybody seemed to understand.
- (11) (a) Didn't half the students do their homework. (Foreman 1999: 8, ex. (29f))
 (b) Not half the students did their homework.

⁴ We maintain Feagin's (1979) original spelling of the auxiliary, which reflects the vowel quality typically employed by the Alabama English speakers she surveyed.

Importantly, the set of subject types that according to previous literature are impossible in NAI are also unacceptable when immediately preceded by *not*:

- (12) (a) *Didn't Jamie see the fight. (Matyiku 2017: 16, ex. (1.19))
 (b) *Not Jamie saw the fight.
- (13) (a) *Didn't the teachers go to the party. (Foreman 1999: 11, ex. (28c))
 (b) *Not the teachers went to the party.
- (14) (a) *Didn't few people live there then. (Matyiku 2017: 75, ex. (3.5b))
 (b) *Not few people lived there then.
- (15) (a) *Didn't some person come. (Matyiku 2017: 76, ex. (3.6b))
 (b) *Not some person came.

A quantitative acceptability judgment study with speakers familiar with NAI (primarily from Appalachia) in Blanchette and Collins (2018) confirms this pattern, noting that while the acceptability of attested NAI subjects as in (8) through (11) declines as a function of frequency, the unattested subjects in (12) through (15) are all equally unacceptable.⁵

Given these observations, speaker knowledge of NAI thus also appears to include an understanding of the type of phrase that can occur in subject position. Different theories have different ways of deriving this knowledge. For example, Foreman (1999) (following Kiss 1996), attributes the distribution of subjects to a mechanism of obligatory movement of referential

⁵ Salmon (2018) observes that for some Texan speakers, NAI sentences with definite subjects as in (13a) are possible under certain pragmatic conditions. We set this issue aside here, as it does not play a role in our experiment design or results interpretation.

subjects as in (12) through a Referential Phrase, which excludes constructions such as (12a). Green (2014) appeals to a more general condition in which NAI subjects must be “strongly quantificational”.

For Blanchette and Collins (2018), the distribution of subjects in NAI is derived by the same mechanism that derives the obligatory wide scope negation of NAI, namely, the constraint that NAI subjects must be (underlyingly) negative, as stated in (5) above. Because in this analysis the negation directly modifies the quantifier (see structure (6)), it follows that the same constraints which (dis)allow *not*-phrases in subject position are also in effect in NAI. Under this theory, speaker knowledge of the constraints on NAI subject type is thus equivalent to speaker knowledge of the constraints on *not*-phrase subjects.

2.3 *Adaptation at the syntax-semantics interface?*

While the previous adaptation studies discussed above examined reading times and acceptability judgments, in the present study we rely on the theoretical models of the semantic and syntactic properties of NAI constructions to probe whether and how native English speakers unfamiliar with NAI adapt to its semantic properties during an interpretation task. Specifically, we asked whether participants can adapt to the wide scope interpretation of negation in NAI constructions with universal quantifier subjects. Participants were exposed to NAI sentences in ambiguous contexts and asked to choose between a wide and a narrow scope negation interpretation. A subset of participants received an additional “training” block that provided them with further exposure to NAI. For some of the participants who received the training block, the NAI constructions were presented in contexts intended to unambiguously bias participants toward the wide scope negation interpretation.

The design of the interpretation task was intended to allow us to investigate whether and how input impacts participants' adaptation to the syntactic-semantic properties of an unfamiliar vernacular structure. If exposure leads participants to adapt, then this may be reflected in an increase in wide scope negation interpretations later in the experiment. Unlike the vernacular *needs* structures employed in previous psycholinguistic studies (Kaschak & Glenberg 2004; Fraundorf & Jaeger 2016), NAI constructions cannot be analyzed as phonologically elided variants of a more mainstream or supra-regional structure. Instead, the surface position of the negation relative to a universal quantifier subject in NAI reflects a close and transparent relationship between structure and meaning. Capitalizing on this transparent relationship, we hypothesized that if participants display evidence of adapting to the wide scope negation interpretation during the course of the experiment, then this provides support for genuine *structural* adaptation to an unfamiliar sentence type from another variety at the syntax-semantics interface. In other words, if participants adapt toward the wide scope negation reading of NAI during the course of the experiment, then this reflects learning about the relationship between structure and meaning for this construction type. We further hypothesized that beyond mere exposure, receiving unambiguous input that supports only a wide scope negation reading might lead to better adaptation. As a preview to our results, because participants quickly adapted to the wide scope negation interpretation early in the experiment, our design did not ultimately allow us to determine the effects of ambiguous as compared with unambiguous input.

In addition to asking whether participants would adapt to the wide scope negation interpretation of NAI constructions with universal quantifier subjects, we also asked whether and how they would extend their behaviors from the interpretation task to a subsequent naturalness rating task. This task included NAI constructions with universal quantifier subjects presented in

wide scope and narrow scope negation contexts. If exposure leads to adaptation to the wide scope negation interpretation, and if this knowledge is generalized to a new task, then participants may give higher ratings to NAI items with universal quantifier (*every*) subjects in wide-scope negation contexts than in narrow-scope negation contexts.

Applying theoretical insights into the nature of restrictions on NAI subject type (see section 2.2.3), we further asked whether participants would generalize their behaviors from the interpretation task when asked to rate NAI sentences with subject types to which they had not previously been exposed. In addition to universal quantifier subjects, participants were asked to rate NAI sentences with acceptable and attested *many* subjects as well as NAI sentences with unacceptable and unattested *few* subjects. Connecting this to Fraundorf & Jaeger's (2016) study of vernacular *needs*, while their study tested whether participants would generalize their behaviors to a construction with a similar surface pattern (i.e., one that could be analyzed as an instance of phonological elision), the current generalization task aimed to determine whether participants would generalize their learning beyond one specific NAI structure type to the class of NAI structures more generally. If previous exposure leads to structural generalization, then participants may differentiate between NAI sentences with acceptable and attested *many* subjects and those with unacceptable and unattested *few* subjects, giving higher ratings to NAI items with *many* subjects and lower ratings to NAI items with *few* subjects. In both cases, if more previous exposure or if the nature of the exposure leads to better structural generalization, then differences in naturalness ratings between acceptable and unacceptable subject types may be greater for participants who received additional input during the interpretation task, and especially for those who received unambiguous input. As we will show, the results of the naturalness rating task

provide new insight into the possible role of analogical reasoning in facilitating adaptation at the structural level.

3. Methods

3.1 Participants

237 adult native speakers of American English were recruited via Amazon Mechanical Turk and randomly assigned to one of three groups: (1) no additional training group, (2) unambiguous training group, and (3) ambiguous training group. Participants received \$10 as compensation for their participation. Fifty-eight participants were excluded based on responses to a post-task questionnaire, either because they reported having spent a significant portion of their lives in a region where NAI is known to be in use ($n=37$; excluded regions included West Texas and states considered part of Southern Appalachia), because they reported hearing the construction regularly despite being from a region where it has not been documented ($n=12$), or because they participated in more than one of our group surveys ($n=9$), such that the final number of participants was 179. Of these included participants, 59 received no additional training on the NAI construction (42 male; 17 female; mean age 36.4, range 22–71), 61 received additional unambiguous input on NAI which biased interpretation toward wide-scope negation (40 male; 21 female; mean age 36.2, range 22–62), and 59 received additional but ambiguous input on NAI (32 male; 27 female; mean age 35.5, range 22–59). These groups are similar or greater in size to participant groups in other adaptation work (cf. Luka & Choi 2015). Figure 1 illustrates the regions where participants in each group reported to spending the longest portion of their lives.

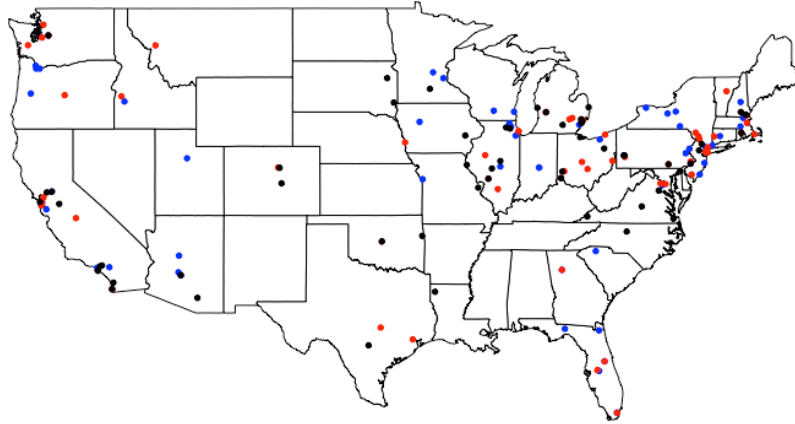


Figure 1. Locations where participants in each group reported to having spent the longest portion of their lives. Participants from the no additional training group are coded in black, participants from the unambiguous training group are coded in blue, and participants from the ambiguous training group are coded in red.

3.2 Materials

3.2.1 The Interpretation Task

Within the interpretation task, participants were asked to select one of two images that best represented their interpretation of linguistic contexts including an NAI sentence with a universal quantifier subject (e.g. *everybody*, *every kid*). This task included 16 NAI sentences with an *every* subject placed in ambiguous contexts that could support either a wide-scope negation or a narrow-scope negation interpretation (e.g., *I was planning a class activity about Hogwarts yesterday. I was really surprised when my coworker told me it was a bad idea because didn't*

every kid read Harry Potter in class last year). Eight ambiguous NAI sentences with *every* subjects appeared in the pre-training block and eight appeared in the post-training block. The ambiguous contexts for these sentences were accompanied by a set of two images, one depicting a wide scope negation interpretation, and the other depicting a narrow scope negation interpretation. Visuals conveyed separate readings through the placement of red Xs over different objects in the composite image. To illustrate, Figure 2 contains the NAI construction *didn't every kid read Harry Potter in class last year* presented in a linguistic context followed by two graphics of students in class. One graphic has some but not all of the students Xed out, which is compatible with the wide-scope negation reading, and in the other graphic all of the students are Xed out, which is compatible with the narrow-scope negation reading. The location of the wide scope negation versus narrow scope negation interpretation was balanced across items such that both interpretations occurred as option A and option B the same number of times. In addition, all NAI constructions were presented in embedded contexts (Green 2014) to prevent participants from interpreting them as yes-no questions.

I was planning a class activity about Hogwarts yesterday. I was really surprised when my coworker told me it was a bad idea because didn't every kid read Harry Potter in class last year.

A



B



Figure 2. Sample stimulus item from the interpretation task.

Option B is the wide scope negation interpretation for NAI.

In between the pre- and post-training blocks, the unambiguous training and ambiguous training groups both received a “training” block with ten additional NAI sentences with *every* subjects. For the unambiguous training group, the items were presented in unambiguous contexts intended to bias the reader toward a wide scope negation interpretation, as in (16). The ambiguous training group received the same NAI constructions but in contexts that were ambiguous between a wide and a narrow scope negation interpretation, as in (17).

(16) Wide scope negation

I asked people to RSVP to my party by this Friday. I’m getting really frustrated because, even though I have a couple responses, didn’t everybody call me to RSVP.

(17) Narrow scope negation

I asked people to RSVP to my party by this Friday. I’m getting really frustrated because didn’t everybody call me to RSVP.

The ambiguous training group thus received more exposure to the same type of items included in the pre- and post-training blocks, while the unambiguous training group received implicit training toward the wide scope negation interpretation. As in the pre- and post-training blocks,

all items in the training block were accompanied by images illustrating the narrow and wide-scope negation interpretations.

Thirty-two filler stimuli of three separate types were created to accompany the target stimuli. Sixteen items appeared in the pre-training block, 16 appeared in the post-training block, and 10 appeared in the training block. The filler items included sentences with potentially ambiguous relative clause attachment (e.g., *My husband told me that the coach of the football player who was standing on the sidelines got really upset about the call by the referee*), vernacular forms (e.g., *Number 815 is running so fast that he might could win the race*, with double modal *might could*), or non-systematic spelling errors (e.g., *The wresler in the middle won the gold medal*). The fillers were presented in context and with images, in a style consistent with the presentation of the critical items. Table 1 summarizes the design of the interpretation task.

Group	Pre-training Block	Training Block	Post-training Block
Ambiguous Training	8 ambiguous NAIs 16 fillers	8 ambiguous NAIs 10 fillers	8 ambiguous NAIs 16 fillers
Unambiguous Training	8 ambiguous NAIs 16 fillers	8 unambiguous NAIs 10 fillers	8 ambiguous NAIs 16 fillers
No Training	8 ambiguous NAIs 16 fillers		8 ambiguous NAIs 16 fillers

Table 1. Summary of the interpretation task design

Twenty-two speakers from Appalachia and 24 speakers from regions where NAI has not been identified in the literature and who reported themselves as non-NAI users completed the interpretation task in a norming study prior to the present experiment (see AUTHORS, 2020, for

details). These norming data showed that speakers from Appalachia selected wide scope negation responses more frequently ($M = .67$, $SD = .25$) than speakers from outside the region ($M = .59$; $SD = .32$), with the non-Appalachian speakers also exhibiting greater inter- and intra-speaker variability in their responses compared to the Appalachian speakers. Based on the Appalachian participants' norming study responses, three critical items were modified prior to running the present study.

3.2.2 *The Naturalness Rating Task*

Naturalness rating stimuli were created by placing NAI constructions with *every*, *many*, and *few* quantifier subject types in written contexts of one to three sentences. Participants were prompted to rate the naturalness of the NAI sentence as presented in context on a scale from 1 to 7 (1 = completely unnatural; 7 = completely natural). The task included eight sentences with *many* NAI subjects, as in example (18), and eight sentences with *few* NAI subjects, as in (19). Sixteen *every* NAI subject-type contexts were also included, eight of which biased participants towards a wide scope negation reading, as in (20), and eight of which biased participants towards a narrow scope negation reading, as in (21).

(18) *Many*

The kennel was full of dogs who needed new homes. One family showed up last Friday afternoon to buy a puppy but for the most part didn't many parents want a dog for their kids.

(19) *Few*

I was arguing with Jen because she said she had blocked the most shots of any goalkeeper in the league. I had to break the news to her that didn't few goalies block shots like she did.

(20) Wide scope negation

Last night my coworkers and I decided to go out for karaoke. All the girls had a great time, and even though my friends Tom and Chris did a duet, I noticed that didn't every guy si a song.

(21) Narrow scope negation

Last night my co-workers and I decided to go out for karaoke. All the girls had a great time, but I thought the guys didn't want to be there because I noticed that didn't every guy sing a song.

There were two versions of the 16 *every* subject-type items, such that each NAI sentence with a universal quantifier subject appeared in both a wide scope and a narrow scope negation context. Different versions of the same context were distributed to separate lists in a Latin Square design, such that each participant only saw one version of any given item.

Thirty-two filler items were also included with the naturalness rating stimuli. Eight filler items featured non-canonical word order (e.g. *My wife and I went on a trip to the Grand Canyon last weekend. It was amazing, but I forgot to bring a camera us with*), eight filler items featured

different vernacular forms (e.g., *Grace was talking to her friend about whether to volunteer at the animal shelter. She knew she'd be busy on Monday, but she said she might could go Tuesday*), eight filler items featured an ambiguous relative clause attachment (e.g., *The judge at the recent murder trial was trying really hard to maintain a fair and impartial atmosphere in the courtroom. At one point during the trial the judge was annoyed that the attorney of the defendant who mumbled was questioned about personal matters*), while an additional eight filler items contained no special features.

3.3 Procedure

Participants were recruited through Amazon Mechanical Turk and independently completed the survey on personal devices. All participants were prompted to complete the pre-training and post-training modules, which had NAI sentences with universal quantifier (*every*) subjects in ambiguous contexts that elicited either a wide-scope negation or a narrow-scope negation reading. As described above, participants in the ambiguous and unambiguous training groups also completed a training module in between pre- and post-training, either with *every* subjects in ambiguous contexts (the ambiguous training group) or in unambiguous contexts (the unambiguous training group). Participants completed the modules in one continuous task and were not made aware of these module changes. After the interpretation task, all participants completed the naturalness rating task in which they rated contexts featuring a variety of NAI subject-types (see above). Target and filler items were presented together in randomized order within each task and task block.

Finally, participants completed a language background questionnaire, in which they self-reported personal and demographic information. The unambiguous training group and ambiguous training group surveys took approximately 60 minutes to complete, while the no training group survey took approximately 45 minutes to complete.

3.4 *Statistical Analyses*

3.4.1 *The Interpretation Task*

Analysis of the interpretation task results was conducted using a mixed-effect logistic regression model with the package lme4 version 1.1.26 (Bates et al. 2015) and *a priori* contrasts for hypothesis testing in R version 4.0.2 (R Core Team, 2020). Following methods outlined in Schad et al. (2020), contrast objects were assigned to a model matrix constructed using the MASS package (Venables & Ripley 2002) and employed as fixed effects in the regression model. Testing block was included as a fixed effect, coded using repeated contrasts (.5 = post-training vs. -.5 = pre-training). Training group was also included as a fixed effect and coded using Helmert contrasts. This allowed us to first compare the groups that received additional input with each other (1 = unambiguous vs. -1 = ambiguous, 0 = no training), and then compare the no training group participants with the mean score of the two “training” groups combined (2 = no training vs. -1 = unambiguous and ambiguous). The random effects structure was determined according to a parsimonious approach (Bates et al. 2015; Matuschek et al. 2017), beginning with the maximal model including all random intercepts and slopes justified by the design, and removing components accounting for little or no variance whose removal did not lead to a loss in goodness of fit. The maximal model for the interpretation task included the fixed

effects of block and training group, random intercepts for participant and item, a random slope for block by participant, and random slopes for the two training group comparisons by item—one for the contrast between unambiguous and ambiguous, and one for the contrast between no training and training. Stepwise model comparison led to the removal of random slopes for the two training group comparisons by item.

3.5.2 *The Naturalness Rating Task*

For the naturalness rating task, because the data were collected on a 7-point Likert scale, which is an ordinal as opposed to a continuous measure, the ratings were analysed using ordinal regression (Lidell & Kruschke 2018). This method differs from the common experimental syntax practice of using linear models (e.g., Sprouse & Almeida 2017), which assume participants treat the rating scale as equally spaced. Unlike linear regression, ordinal regression allows for the possibility that participants will treat the distance between 1 and 2, for example, as larger than the distance between 2 and 3, because they are reluctant to give the minimum rating of 1. The inclusion of random intercepts and slopes for participant accounts for systematic differences in how participants treat the scale (thus obviating the need for z-score transformation), and random intercepts and slopes for item further account for potential systematic biases toward or against particular items within a condition.

A cumulative link mixed effects regression model was fit to the raw rating scores, using the *clmm()* function of the ordinal package (version 2020.8-22; Christensen 2020) and a probit link function. Repeated contrasts, which compare adjacent levels of a factor, were used to code the context (i.e., syntactic subject type) factor. Since this factor has four levels, three

comparisons were made: *many* vs. *few* ($.25 = \text{many}$, narrow scope negation, and wide scope negation; $-.75 = \text{few}$), narrow scope vs. wide scope negation ($.75 = \text{narrow scope negation}$, $-.25 = \text{wide scope negation}$, *many*, and *few*), and wide scope negation vs. *many* (wide scope and narrow scope negation = $.5$, *many* and *few* = $-.5$).⁶ Training group was coded using the same Helmert contrast coding as in the interpretation task analysis.

4. Results

4.1 The Interpretation Task Results

The interpretation task included filler sentences with a potentially ambiguous relative clause attachment, a different vernacular form (e.g., a double modal), or an unsystematic spelling error. Participants' accuracy levels for these items averaged between 90–91% in pre-training and between 89–90% in the post-training block, indicating that they understood the nature of the task.

Figure 3 shows results for the critical items, and Table 2 contains the results of the mixed logit model.

⁶ The fact that these contrast settings yield the intended comparisons is not intuitive. The more intuitive settings for the *many* vs. *few* comparison would be $1 = \text{many}$, $-1 = \text{few}$, and $0 = \text{wide and narrow scope negation}$; and for the wide-scope vs. narrow-scope negation comparison they would be $1 = \text{wide-scope negation}$, $-1 = \text{narrow scope negation}$, and $0 = \text{many and few}$. See Schad et al. (2020) for an explanation of the relationship between hypothesis testing and contrast matrices, and why repeated contrast settings do not intuitively reflect the hypotheses being tested.

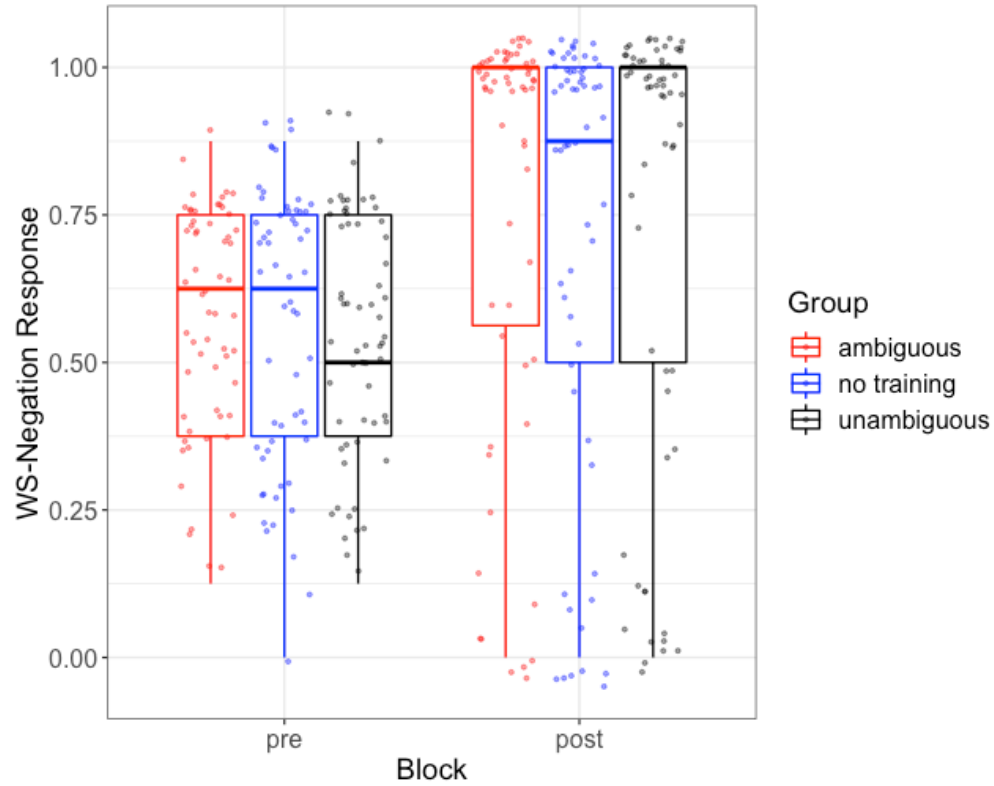


Figure 3. Proportion of wide-scope negation responses by group for pre- and post-training blocks. Box plots show overall quartiles and median, and jittered points represent individual participants' average target response rates.

Predictor	Parameter estimates			
Fixed effects	Est.	Std. error	z-value	Pr ($> z $)
(Intercept)	2.05	0.30	6.83	< .001
Post-training vs. Pre-training Block	3.54	0.54	6.61	< .001
Training Group				

Input: Unambiguous vs. Ambiguous	−0.11	0.32	−0.35	.725
Training: No Training vs. Training	−0.11	0.18	−0.61	.544
Block x Training Group				
Block x Group (Input: Unamb. vs. Amb.)	−0.11	0.54	−0.20	.843
Block x Group (Training: No Training vs. Training)	−0.21	0.31	−0.69	.490
Random effects structure: (1 Item) + (1 + Block Subject)				

Table 2. Summary of the mixed logit model for the interpretation task

As seen in Table 2, there was a reliable effect of block because all three groups were more accurate overall in post-training (ambiguous: $M = 75\%$, $SD = .19$; unambiguous: $M = 75\%$, $SD = .21$; no training: $M = 73\%$, $SD = .16$) than in pre-training (ambiguous: $M = 55\%$, $SD = .19$; unambiguous: $M = 56\%$, $SD = .21$; no training: $M = 57\%$, $SD = .16$). However, there was no reliable block by group interaction, because the accuracy gains made by the ambiguous and unambiguous groups were similar, and the overall gains for the two training groups were similar to those made by the no training group.

4.1.1 *Rapid Adaptation in the Pre-Training Block*

The fact that all three groups gave significantly more wide-scope negation responses in the post-training block than in the pre-training block, despite only two of the groups having received more input via a training block, suggests that many participants began systematically giving wide scope negation responses at some point during pre-training. We further explored response patterns during the pre-training block to see how quickly this occurred. Specifically, we

determined for each participant the critical trial at which they had given three wide-scope negation responses in a row. Table 3 illustrates participants' response patterns during the pre-training block.

<i>Trial</i>	3	4	5	6	7	8
<i>Cumulative Percent (N)</i>	15% (27)	21% (38)	30% (54)	40% (72)	53% (95)	61% (109)

Table 3. Cumulative percent (N) of participants who had given exactly three target responses in a row at each critical trial during the pre-training block, beginning at the third critical trial.

As Table 3 shows, 61% of the 179 participants reached a point at which they gave three wide scope negation responses in a row during pre-training. This means that the majority of participants had already adapted to the wide scope negation interpretation by the end of the pre-training block, after seeing only eight critical trials. A Fisher exact test comparing the proportion of participants who got three trials in a row correct in the ambiguous, unambiguous, and no training groups detected no differences across groups ($p = 1$). A Wilcoxon Rank Sum test detected no differences across groups in the amount of time taken to get three wide-scope negation responses in a row ($p > .05$). Participants from all three groups therefore appear to have converged on the wide scope negation at a similarly rapid pace during pre-training.

4.2 The Naturalness Rating Task Results

Figure 4 illustrates the results for the naturalness rating task. The results of the ordinal

regression model are included in Table 4.

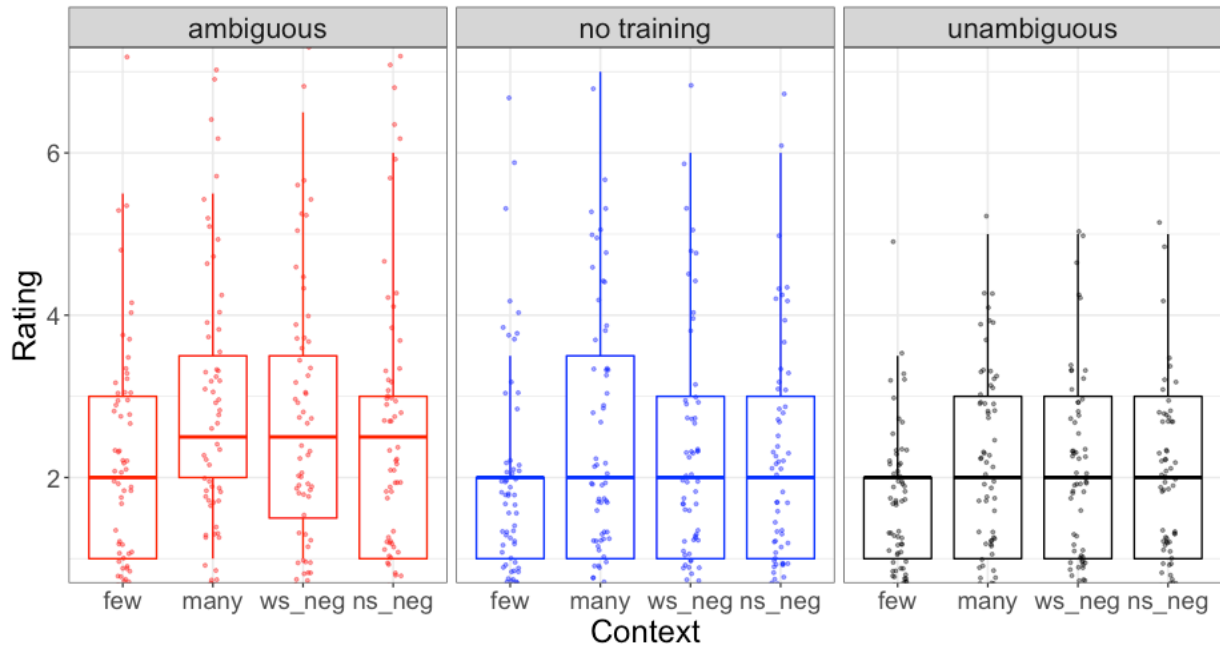


Figure 5. Naturalness ratings by group for narrow-scope negation (ns neg), wide-scope negation (ws neg), *many*, and *few* subject types. Box plots show overall quartiles and median, and jittered points represent individual participants' median responses for each condition.

Predictor	Parameter estimates			
Fixed Effects for Context	Est.	Std. error	z-value	Pr ($> z $)
<i>Many</i> vs. <i>Few</i>	0.72	0.12	6.18	< .001
Narrow Scope vs. Wide Scope Negation	-0.08	0.05	1.54	.122
Wide Scope Negation vs. <i>Many</i>	-0.22	0.10	-2.29	.022
Fixed Effects for Group				

Input: Unambiguous vs. Ambiguous	−0.37	0.15	−2.37	.017
Training: No Training vs. Training	−0.03	0.09	−0.34	.734
Context x Training Group				
<i>Many</i> vs. <i>Few</i> x No Training vs. Training	0.02	0.04	0.45	.653
Narrow vs. Wide Scope Neg. x Unamb. vs. Ambig.	−0.02	0.05	−0.43	.666
Random effects structure: (1 + Group Item) + (1 + Context Subj)				

Table 4. Summary of the ordinal mixed effects regression model for naturalness ratings

Within the context type fixed effects, there was a reliable effect of *many* vs. *few*, because participants gave higher ratings overall for acceptable and attested *many* items ($MED = 2.57$, $SD = .53$) than for unacceptable and unattested *few* items ($MED = 2.02$, $SD = .74$). However, there was no reliable effect of context for the *every* sentences, because, overall, speakers did not rate *every* sentences in wide scope negation contexts ($M = 2.40$, $SD = .46$) differently from those in narrow scope negation contexts ($M = 2.40$, $SD = .49$). A reliable effect of wide scope negation vs. *many* reflects higher ratings for *many* items ($M = 2.57$, $SD = .53$) than for *every* items presented in wide scope negation contexts.

For the group fixed effects, there was a reliable effect of input type during the training block, because the ambiguous training group ($M = 2.68$, $SD = 1.52$) gave higher ratings overall than the unambiguous training group ($M = 2.03$, $SD = 1.01$). There was no reliable effect of input amount during the interpretation task, because the no training group ($M = 2.32$, $SD = 1.38$) gave similar ratings overall to the two training groups combined. A lack of reliable interactions

between context and training group shows that there was no evidence that either input amount or input type during the interpretation task triggered larger differences between *many* and *few* items or between wide scope and narrow scope negation contexts.

5. Discussion

This study was designed to explore whether adaptation can be observed at the interface between syntax and semantics, using insights from theoretical analyses of the vernacular NAI structure as a basis for investigation. The results of the interpretation task revealed a reliable increase in wide scope negation interpretations during the course of the experiment, whereby the majority of participants adapted to this reading early on during the pre-training block. In the naturalness rating task, participants from all three groups preferred NAI sentences with attested *many* subjects over those with unattested *few* subjects. We discuss these results here in light of both adaptation theories and theoretical models of NAI.

5.2 Implications for Adaptation Theories

An open question in research on linguistic adaptation is the extent to which adaptation reflects genuine changes in *structural* representations, or merely changes in sensitivity to atypical surface forms (e.g., Kaschak & Glenberg 2004; see also Kaan & Chun 2018). The results from the interpretation task suggest something beyond mere sensitivity changes took place. In order to achieve the observed change from chance-level performance in the pre-training block to reliably choosing the wide scope negation interpretation in the post-training block, participants would have had to adjust the mapping between NAI constructions and their

meaning. This adjustment would have required some degree of adaptation beyond simply becoming more familiar with the surface form of this construction and, in turn, using this increased familiarity to speed up processing of the targeted—and possibly other similar—constructions.

The present findings expand the scope of research on how exposure can rapidly modulate speakers' interpretations of familiar, yet ambiguous, constructions (e.g., Chun 2018; Kamide 2012; Kroczeck & Gunter 2017; Yildirim et al. 2016), by showing that speakers can coalesce on a particular interpretation, even when exposed to a construction that is completely unfamiliar. The results complement and extend upon studies investigating adaptation to the vernacular *needs* structure (Fraundorf & Jaeger 2016; Kaschak & Glenberg 2004), in which participants' reading times reliably increased after only a small amount of exposure. As discussed in section 2.1, one possible analysis of the vernacular *needs* structure is that it is a form of phonological elision of a mainstream or supra-regional structure, and this is indeed what Fraundorf and Jaeger (2016) appear to assume in their experiment. NAI, however, cannot be analyzed as a phonologically elided variant of a mainstream structure. Thus, while our participants are likely accustomed to interpreting the phrasing *didn't everybody* as part of a yes-no interrogative (as in (1)), the fact that they came to interpret this phrasing with a declarative 'not every' meaning supports the conclusion that they formed a new structure-meaning pairing during the course of the experiment. The current study therefore provides the first evidence that adaptation as measured via an interpretation task that specifically targets the relationship between structure and meaning can also occur very rapidly. Extending beyond the current work, future studies employing online measures could serve to inform whether more input or unambiguous input further facilitates

adaptation, using the information provided by the current study as a baseline for predicting how people adapt to the meaning of NAI sentences.

Extending beyond the interpretation task, the naturalness rating task asked participants to focus on the relative naturalness or acceptability of NAI sentences, some of which included a universal quantifier subject as in the interpretation task. Despite the robust adaptation that occurred for all groups during the interpretation task, the increase in wide scope negation responses on the interpretation task did not translate into meaningful differences in naturalness ratings for wide scope versus narrow scope negation readings with *every* subject sentences in the naturalness rating task. Similar to other lab-based research on structural priming and adaptation where exposure often consists of a short period of concentrated exposure to relatively homogeneous sentences, these results from the naturalness rating task suggest that adaptation under more controlled circumstances may not generalize across distinct experimental tasks (e.g., Kaschak et al. 2014; see also discussion in Kaan & Chun 2018).

The absence of evidence for more generalized adaptation during the naturalness rating task may be due to differences in the type of knowledge that different tasks tap into. The naturalness rating task required participants to make distinctions based on acceptability rather than interpreting the unfamiliar structure itself. Participants may have focused primarily on the syntactic properties of the NAI sentences in the naturalness rating task rather than the presentation of these sentences in their larger context. However, to successfully make an acceptability distinction between wide scope and narrow scope negation *every* sentences, participants would have had to interpret these sentences in their larger context. The fact that participants did not do this robustly suggests that they were more focused on the syntactic properties of the target sentence than they were on computing its meaning in the larger context.

This explanation is supported by the fact that, as figure 4 shows, participants rated both the wide-scope vs. narrow-scope negation sentences with *every* subjects higher overall than those with unnatural *few* subjects, while sentences with attested and natural *many* and *every* subjects received similar ratings. We therefore hypothesize that participants' ratings were driven primarily by the syntactic properties of the subject as preceded by the negation, as opposed to the semantic interpretation of the sentence as elicited by the context.

The hypothesis that participants were relying on syntactic properties of the NAI construction as opposed to the broader context is further supported by the fact that they did, in fact, make a clear distinction between acceptable *many* subject sentences and unacceptable *few* subject sentences. Note that this acceptability distinction is embedded in the syntactic properties of the target sentences themselves, and is not dependent on the larger context. To account for the combined results from the interpretation task and naturalness rating task, we hypothesize that when interpreting an unfamiliar structure during the interpretation task, participants quickly learned to analogize NAI constructions with a parallel structure that was already part of their grammar, namely sentences with *not every* subjects (e.g., *not everybody liked the movie*). As outlined in greater detail below, this led participants to adopt the wide scope negation interpretation of NAI constructions during the interpretation task, which would be analogous to the wide scope negation interpretation of *not every* subjects (i.e., some but not all) that was already part of their grammar. Similarly, they would reliably distinguish between *many* and *few* subject sentences in the naturalness rating task based on analogy with attested and acceptable *not many* subjects (e.g., *not many people lived there then*) versus unattested and unacceptable *not few* subjects (e.g., **not few people lived there then*). Under such an account, analogy with a similar and already familiar structure could lead to rapid adaptation of the sort observed in the

interpretation task, and it could also account for the distinctions participants made between NAI with *many* and *few* subjects, despite being previously unfamiliar with this structure.

5.3 Implications for Syntactic Theories of NAI

As described in section 2.2, a subset of syntactic theories of NAI appeal to semantically or pragmatically motivated syntactic raising of the negation over the subject. Under these theories, the negation raises for semantic reasons, to mark its wide scope (Foreman 1999; Matyiku 2017), or for pragmatic reasons, to mark the focal status of the construction (Green 2014; White-Sustaíta 2010). Under a theory that postulates semantically motivated movement, we might expect unambiguous input that forces the wide scope negation to be required in order to trigger adaptation toward this reading, but as we saw in the interpretation task, simple exposure was sufficient. Similar reasoning applies to the hypothesis that the construction is pragmatically marked (Green 2014). Because adaptation toward the wide scope negation reading occurred without any pragmatic focusing of the critical items, for our participants at least, focus was not necessary to trigger the wide scope negation reading.

Blanchette & Collins (2018) provide a model in which NAI constructions are parallel to constructions in which *not* immediately precedes a quantificational subject. Under this theory, NAI constructions prohibit narrow scope negation and *few* subjects for the same reason: The negation directly modifies the subject underlyingly (see structure (6)). Extending this analysis to the results of the interpretation task, it is possible that participants were analogizing to an already familiar and established construction: sentences with *not every* subjects (e.g., Foreman 1999). The fundamental connection between NAI and *not every*—or *not*+QP—sentences in Blanchette & Collins also serves to explain the fact that participants reliably distinguished between *many*

and *few* subjects. If participants understand that *not* and *many* can form a constituent underlyingly, and that *not* and *few* cannot, then the hypothesis that their behaviors toward NAI represent an analogy to this familiar variant predicts their ratings of NAI sentences with *many* and *few*.

An alternative explanation of participants' lower *few* ratings is that, since *few* introduces an implicit negation and occurs immediately following an explicit negation, they simply disliked the sequencing of two negations in a row, possibly due to a violation of the Gricean maxim of quantity, where a single affirmative would suffice. In ruling out NAI and *not* phrase constructions with *few*, Blanchette & Collins (2018) appeal to a syntactic condition that prohibits a negation from directly modifying another negation (the so-called *NEG NEG constraint; see Collins 2018). Such an appeal to syntax seems necessary since *few* subjects can apparently precede negation, as in *few people didn't eat*, and it is possible for negation to precede and take wide scope relative to *few* subjects, as in *it is not the case that few people ate*. The available evidence therefore supports a syntactic explanation in which the negation directly modifies the quantifier, though future work could benefit from exploring the effect of implicit double negation in NAI with *few* subjects more directly.

6. Conclusion

Using the vernacular NAI construction, the present study explored whether linguistic adaptation can be observed at the syntax-semantics interface. Participants were able to acquire the interpretive properties of the NAI construction after only a brief period of exposure, and they readily distinguished between acceptable and attested sentences with *many* subjects and unacceptable and unattested sentences with *few* subjects. As such, the present study showed

ways in which linguistic adaptation research can extend beyond questions pertaining to reading times to investigate whether speakers can learn the semantic properties of an unfamiliar construction at the syntax-semantics interface. In so doing, this study provides evidence that genuine structural change can occur during adaptation. Regarding the structural changes underlying speakers' shift toward the wide scope negation reading of NAI, our explanation relied crucially on the syntactic properties of hierarchical structure and constituency. This suggests that future studies of adaptation, and syntactic adaptation in particular, could benefit from extending beyond linear order to consider more explicitly how the notions of hierarchical structure, constituency, as well as other syntactic properties, can help explain how speakers adapt their mental representations as a result of exposure to unfamiliar or infrequent structures.

Also central to our explanation of the observed results is the notion of adaptation as analogy. Specifically, we proposed that the adaptation observed during the interpretation task and the native-like knowledge speakers demonstrated during the naturalness rating task were the result of their having analogized this unfamiliar structure to a structure already present in their grammar. Analogy has played a central role in historical linguistics in explaining language change over longer periods of time (e.g., Lahiri 2003), but to our knowledge, it has not previously been considered in the context of linguistic adaptation. By appealing to analogy, alongside syntactic theory, the present study highlights ways in which drawing on established concepts in other fields of linguistic inquiry can lead to a more fine-grained understanding of the processes underlying linguistic adaptation. Similarly, the present study adds to our understanding of how, through studying linguistic adaptation, we can gain insights into fundamental and cross-cutting questions in linguistics more broadly.

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