# Unacceptable grammars? an eye-tracking study of English negative concord*

FRANCES BLANCHETTE

*Penn State*

AND

CYNTHIA LUKYANENKO

*George Mason University*

ABSTRACT

This paper uses eye-tracking while reading to examine Standard English speakers' processing of sentences with two syntactic negations: a negative auxiliary and either a negative subject (e.g., *Nothing didn't fall from the shelf*) or a negative object (e.g., *She didn't answer nothing in that interview*). Sentences were read in Double Negation (DN; the 'she answered something' reading of *she didn't answer nothing*) and Negative Concord (NC; the 'she answered nothing' reading of *she didn't answer nothing*) biasing contexts. Despite the social stigma associated with NC, and linguistic assumptions that Standard English has a DN grammar, in which each syntactic negation necessarily contributes a semantic negation, our results show that Standard English speakers generate both NC and DN interpretations, and that their interpretation is affected by the syntactic structure of the negative sentence. Participants spent more time reading the critical sentence and rereading the context sentence when negative object sentences were paired with DN-biasing contexts and when negative subject sentences were paired with NC-biasing contexts. This suggests that, despite not producing NC, they find NC interpretations of negative object sentences easier to generate than DN interpretations. The results illustrate the utility of online measures when investigating socially stigmatized construction types.

1

## 1. Introduction

Negation is a primitive component of human language and thought (Horn, 1989 [2001]), and has long been the subject of intense scrutiny and debate by philosophers, linguists, and psychologists alike (e.g., Plato's *Sophist*, 1937 [c.360 BC]; Jespersen, 1917; Wason, 1959). Despite this long history of study, many questions remain open. This paper investigates an aspect of natural language negation which has been central to debates in linguistics (e.g., Giannakidou, 2000; Haegeman & Zanuttini, 1996; Zeijlstra, 2004), but which has thus far received little attention in the psycholinguistic literature: a potential ambiguity of certain sentences containing two negative elements. To illustrate, consider the following sentence:

(1)  I didn't eat nothing this morning.
(2)  a. I ate nothing.
     b. It is not the case that I ate nothing. (= I ate something.)

Without context, sentence (1) is ambiguous between two readings. In the first, paraphrased in (2a) and known as NEGATIVE CONCORD (henceforth NC), the two negative elements (*didn't* and *nothing*) contribute to a single semantic negation. Someone who has skipped breakfast might use (1) on the NC reading to express to a friend why she is so eager for lunch. In the second, paraphrased in (2b) and known as DOUBLE NEGATION (DN), each negative element contributes an independent semantic negation. A person who habitually skips breakfast, but happens to have made time for a meal one morning might use (1) on this reading to correct a friend's assumption that she has not yet eaten, perhaps emphasizing one or both of the negative elements.

Not all sentences with two negations are ambiguous. For instance, the fact that the two negations in the DN reading of (1) can cancel each other out semantically to yield a logical affirmative, shown in (2b), is due to the structural relationship between the negative elements. In other structures, DN does not have a canceling effect, as illustrated by the following:

(3)  The woman who didn't get to breakfast on time ate nothing this morning.

In (3), each negation contributes to the sentence's meaning, but the sentence is still logically negative: the woman did not eat anything. Sentences such as (3) are not ambiguous between NC and DN in the way that (1) is, and have only a DN reading.

2

The NC reading of (1) is not typically considered part of standardized or 'Standard' English varieties. In these varieties, the most common way to express the meaning paraphrased in (2a) is to replace *nothing* with *anything*, a NEGATIVE POLARITY ITEM (NPI). In English, NC is generally associated with varieties such as Appalachian (Wolfram & Christian, 1976) and African American English (Green, 2002), and many others.

The phenomenon of NC is found in a diverse array of human languages including throughout Romance (Zanuttini, 1997), in Afrikaans (Biberauer & Zeijlstra, 2012), in Modern Hebrew (Keren, 2015), in Hungarian (Puskás, 2012), and in many others. Despite (or perhaps because of) its status as a hallmark feature of American English vernacular speech (Wolfram & Fasold, 1974), the use of NC carries a heavy social stigma in many English-speaking societies (Blanchette, 2013; Horn, 2010; Nevalainen, 1998). English DN, on the other hand, is less colloquial, and more heavily pragmatically conditioned than NC, appearing, for example, when a speaker wishes to deny something previously asserted or presupposed (Geurts, 1998; Horn, 1989 [2001]).

This paper seeks to contribute to our understanding of NC and DN in a standardized form of adult American English. Using eye-tracking while reading, which provides insight into how speakers process text from moment to moment (Rayner, 1994, 2009), we investigate how NC and DN sentences with identical surface structure are processed following a single context sentence. Online reading times reveal an interaction between syntax and pragmatic context previously observed only in offline measures. This interaction suggests that adults can have specialized and perhaps even native-like knowledge of construction types that do not appear in their own language varieties.

## 1.1. BACKGROUND

### 1.1.1. *Negative Concord and Double Negation*

A current question in linguistic theory and language acquisition pertains to the status of NC in the grammars of 'Standard English' (SE) speakers, who, though difficult to classify in linguistic terms (Lippi-Green, 1997, p. 53), do not typically use NC in spontaneous speech, and would likely consider it unacceptable in both formal and informal social contexts. A recent experimental study shows that, despite their limited exposure to NC, three- to six-year-olds acquiring Standard English readily generate NC interpretations of sentences with two negatives given an appropriate context. These children behave differently from their adult counterparts, who prefer DN interpretations over NC (Thornton, Notley, Moscati, & Crain, 2016). Based on discontinuities between child and adult performance, these

3

researchers hypothesize that children "expunge" NC from their grammars during the course of acquisition (p. 23). Under this hypothesis, transitioning from a child to an adult SE grammar may involve switching from an NC to a DN grammar.

The hypothesis that children switch grammars during the course of acquisition is in line with predominant linguistic theories which model NC and DN as reflecting distinct underlying systems for encoding negation. In so-called 'NC languages', negative words such as *nothing* are not inherently negative, but instead carry a formal feature that specifies that they must agree with a semantically negative element elsewhere in the clause. NC thus instantiates a syntactic dependency between a morphologically negative but semantically non-negative word, and a semantically negative element elsewhere in the structure (which may be phonologically null). In 'DN languages', however, negative words are inherently negative and therefore form no syntactic dependency. In these languages, overtly negative elements correspond in a one-to-one ratio with semantic negations (Zeijlstra, 2004, 2008).

Recent experimental work on 'NC languages' such as Spanish, Catalan, and French has demonstrated that, in fact, adult speakers readily generate both NC and DN interpretations given the appropriate pragmatic context and set of prosodic cues or gestures (Déprez, Tubau, Cheylus, & Espinal, 2015; Espinal & Prieto 2011; Espinal, Tubau, Borrás-Comes, & Prieto, 2016; Prieto, Borràs-Comes, Tubau, & Espinal, 2013). That is, in these languages, variation between NC and DN readings of sentences with two syntactic negations is predicted by the discourse context in which the sentence is encountered, not by the individual speaker or listener's language.

It is logically possible under theories such as the one in Zeijlstra (2004, 2008) for NC languages to produce DN readings. However, it is unexpected that 'DN languages' such as Standard German, Standard Dutch, and Standard English, in which each overtly negative element is assumed to necessarily contribute a semantic negation, would be able to generate NC readings. Thus, if evidence for NC is found in a language thought to be DN, then this suggests that the language's system for encoding negation may be underlyingly NC. Extending beyond these theories, evidence for NC in a DN language might further suggest that the putative divide between NC and DN languages is only superficial, and that, cross-linguistically, systems for encoding negation are more similar than previously thought.

1.1.1.1. *NC in 'Standard English'*. Blanchette (2017) provides experimental evidence supporting the hypothesis that adult speakers of Standard English, thought to be a DN language, have NC grammars. A series of experiments collected Likert scale acceptability judgments of sentences like (4) through

4

(6) following a single context sentence, which biased readers toward either an NC or a DN interpretation.

(4)    Lucy didn't see nobody at the basketball game last night.    (Object NC/DN)
(5)    Nobody didn't see that basketball game last night.    (Subject NC/DN)
(6)    Didn't nobody see that basketball game last night.    (NC only)[1]

Sentences (4) through (6) each contain the negated auxiliary *didn't* and the negative phrase *nobody*, in different syntactic configurations. In (4) *nobody* resides in object position following the negated auxiliary and the verb; in (5) it resides in canonical subject position preceding the auxiliary; and in (6) it sits in a subject position following the auxiliary. In the simplest terms, the precedence of the negated auxiliary in (4) and (6) can be characterized syntactically in terms of a c-command relation (Reinhart, 1976), in that the preferred NC constructions involve the negated auxiliary c-commanding the negative phrase.

The participants in Blanchette's (2017) study report that they do not produce NC as in (4) through (6), and their mean judgments of these sentences are invariably below the median acceptability level (i.e., below 4 on a scale of 1 to 7) in both NC and DN contexts. Nevertheless, their judgments reflect a reliable acceptability preference for NC contexts when the negated auxiliary c-commands the negative phrase (as in (4) and (6)), and for DN contexts when it does not (as in (5)). The syntactic preference for a c-commanding negated auxiliary in NC constructions is in line with corpus observations for the distribution of NC construction types (Smith, 2001), in which NC constructions with the structure in (4) occur in more varieties than those with the structure in (5) (p. 123). This suggests that speakers who do not use NC are nevertheless sensitive to its distribution frequencies, and perhaps even to its core syntactic properties.

It is worth noting that the pattern of c-command preference between negated auxiliaries and negative phrases observed in Blanchette's work on NC in SE bears resemblance to the distribution of NPI constructions such as *I didn't eat anything this morning*. NPI constructions have been characterized by a constraint that requires them to be in the c-command domain of a downward entailing element (Ladusaw, 1979), the prototype of which is syntactic negation. The following pair of sentences illustrates this for the NPI *anybody*:

---

[1] Sentences like (6) are known as Negative Auxiliary Inversion constructions, in which a negated auxiliary precedes a negative or quantificational subject (Green, 2014). These are equivalent on the surface to yes/no questions, but receive a declarative (and in the case of (6), an NC) interpretation. These were not employed in the current experimental paradigm due to confounds related to their surface similarity to yes/no questions, so we do not discuss them further here.

(7)   Lucy didn't see anybody at the basketball game last night.

(8)   *Anybody didn't see Lucy at the basketball game last night. (cf. Nobody saw Lucy…)

Sentence (8) can be characterized as ungrammatical (*) because, in canonical subject position, the NPI is not c-commanded by a negation. Note that sentence (7) has the same single negative meaning as the object NC construction in (4). It is therefore plausible that participants' preference for NC interpretations where the negated auxiliary c-commands the negative phrase reflects a structural analogy to NPI constructions. We return to this in the 'Discussion' section.

Returning to NC, on the basis of gradient acceptability judgment data, Blanchette (2017) suggests that Standard English speakers have not completely "expunged" their NC knowledge during the course of acquisition, and rather, they have retained at least some grammatical knowledge of the construction, whether on analogy to the grammar of NPI constructions, or as a grammatical construction on its own. Reliable judgments of meaning and use of acoustic cues distinguishing NC and DN readings provide further support for this hypothesis, robustly replicating the syntactic patterns for NC observed in Blanchette (2017) (Blanchette & Nadeu, 2018; Blanchette, Nadeu, Yeaton, & Déprez, 2018).

Why would Standard English-speaking adults display reliable syntactic preferences for certain types of NC constructions, but appear generally unable to access NC meanings in a truth value judgment paradigm? We submit that the discrepancy is due to the difference in methodologies employed in data collection. In completing Thornton et al.'s (2016) untimed, pencil and paper truth value judgment task, adult participants had time to reflect on prescriptive norms, and this reflection may have shaped their responses. It is therefore possible that their response patterns were not a reflex of their underlying grammatical representations, but rather, of prescriptive judgments.

Blanchette (2017) and Blanchette et al. (2018) obtained different results by varying the syntactic position of the negative phrase relative to the negated auxiliary, and by examining both gradient acceptability and binary meaning judgment data on acoustic (not written) stimuli. However, these tasks were also untimed, and are also metalinguistic in nature, hence subject to the same criticisms: participants' judgments could have been based on frequency observations that are unrelated to any underlying grammatical processes. Given the heavy stigma associated with English NC and the conflicting results from different metalinguistic tasks, online observations of the processes underlying these judgments are necessary in order to understand its status in standardized varieties of English.

6

## 1.2. THE CURRENT STUDY

This paper examines the processing of both NC and DN using eye-tracking while reading. We employ eye-tracking while reading in order to observe the moment-to-moment processing of sentences with two negative elements, because this is known to reveal information about the processes underlying metalinguistic tasks (Gordon, Hendrick, Johnson, & Lee, 2006, p. 1308). Furthermore, by examining participants' processing of sentences with two negative elements, rather than their subsequent metalinguistic judgments, we potentially mitigate at least some of the effects of prescriptive pressure. Our results demonstrate that speakers' reading of both context and critical sentences reflects the same interactions between syntactic structure and pragmatic context found in Blanchette and colleagues' previous work, presenting further support for the hypothesis that grammatical mechanisms are at play in Standard English speakers' judgments of both NC and DN sentences.

### 1.2.1. *Predictions*

This study seeks to understand whether Standard English speakers generate NC structures during the course of online processing. The results bear on theories of negation in English, and more generally, the question of whether there exists a grammatical divide between NC and DN languages (as proposed in Zeijlstra 2004, 2008, discussed above). We employ a two by two design, varying the presentation of sentences with two syntactic negations by pragmatic context type (NC vs. DN) and syntactic structure (object vs. canonical subject). We predict that reading times will reflect the interaction between location of negation and pragmatic condition found in previous work. On the basis of previous eye-tracking while reading work on negation, we further expect this interaction to be revealed not during participants' first pass through the context and critical sentences, but rather in measures of late processing such as rereading time and total reading time (Ferguson, Sanford, & Leuthold, 2008). Specifically, we predict that participants will spend more time rereading contexts to determine the correct interpretation for object items in the DN condition, and for subject items in the NC condition.

In order to understand the role of pragmatic ambiguity, we include a condition with an embedded negation in which DN is unambiguously the correct interpretation, as in example (3) above. These are similar to a control condition in Thornton et al. (2016), in which adults and children performed similarly well in accessing the DN interpretation (p. 18). We predict that these will be easier to interpret in context than mono-clausal items which, removed from context, may be ambiguous between NC and DN readings. This greater ease of processing should also be

7

reflected in lower context rereading times overall relative to the potentially ambiguous items.

## 2. Methods

The current study was designed to test whether and to what extent previously observed metalinguistic judgments on NC and DN by adult Standard English speakers can be replicated in online measures. This section details our methods.

### 2.1. PARTICIPANTS

Thirty participants (23 women, 7 men) were recruited in State College, Pennsylvania, a college town in the mid-Atlantic region of the United States. Participants' ages ranged from 18 to 68 (*mean* = 26), and most had spent their childhood in the mid-Atlantic (exceptions: 1 in Florida, 1 in Illinois). All were native speakers of American English, as determined by demographic information reported in a post-task questionnaire. All reported English as their first language, with age of exposure beginning at birth, and four participants reported early concurrent exposure to another language (2 Mandarin, 1 Greek, 1 Spanish). All 30 participants reported that they did not use English NC.[2] The majority were university undergraduates, with relatively high levels of formal education. Participation, including consent, eye-tracking, and the post-task language questionnaire, took approximately 45 minutes, and participants were paid $20 for their time.

### 2.2. MATERIALS AND DESIGN

Stimuli were 32 sentences, 16 of each type shown in (9). For a full list of stimuli, see the 'Appendix'.

(9)  a. He didn't beat nobody at poker.              Negative Object
     b. Nobody didn't watch the game last night.   Negative Subject

---

[2] NC usage reports were elicited via questions like the following:

   (i) Imagine a situation in which you have finished dinner, and you want to tell someone that you skipped dessert. Which of the following are you more likely to say:
      (a) I didn't have no dessert.
      (b) I didn't have any dessert.
      (c) Either of the above

   All participants in our study selected (b), or the NPI variant, for questions like (i). While the social stigma associated with NC weakens the validity of self-reports such as this, in conjunction with the demographic data, and based on post-task debriefing sessions, we feel confident that our participants were not regular NC users.

8

Sentences were counterbalanced for negative NP type (*nobody*, *nothing*, *no* [animate], *no* [inanimate]). The head nouns of negative noun phrases (e.g., *kid* in *no kid*) were controlled for frequency using the SUBTLEX corpus (Brysbaert & New, 2009), such that the mean frequency of the head nouns across conditions was similar (frequency per million words: $M_{subj} = 209$, $M_{obj} = 132$; $t(14) = -0.97$, $p = .35$).[3]

For each critical sentence, we created two context sentences: one that biased readers to interpret the two negatives in the critical sentence as NC, and one that biased readers to interpret them as DN. Context sentences corresponding to (9a) and (9b) are shown below. To avoid potential confounds, we used no syntactic negation in the context sentences.

(10) Negative Concord
    a. Greg had terrible luck at the casino last night.
      He didn't beat nobody at poker. (= he beat no one)
    b. The fans were distracted by the news about the presidential election.
      Nobody didn't watch the game last night. (= no one watched)

(11) Double Negation
    a. Greg lost most of his blackjack games, but he did great at the poker table.
      He didn't beat nobody at poker. (= he beat somebody)
    b. The fans were excited to see their favorite team play.
      Nobody didn't watch the game last night. (= everyone watched)

For these sentences, two lists were created. On each list, half of the negative subject and half of the negative object sentences appeared with NC biasing context sentences, and the other half appeared with DN biasing context sentences. Across lists, each critical sentence appeared in both contexts. Following each item, participants were asked to verify a statement as True or False. The same statement was used for a given critical sentence, regardless of which context it appeared in. As in the context sentences, we also avoided using syntactic negation in the verification statements. The verification statements for (9a) and (9b) were as follows:

---

[3] An anonymous reviewer points out that in addition to raw frequency, the frequency of a negative NP type in a particular syntactic position might influence participants' processing. Our counterbalancing should largely prevent any such effects from creating strong patterns in the results: For every *nobody* or *nothing* in object position, there is another in subject position. The head nouns in the negative NPs did differ in subject and object position, but inspection of means suggests that the qualitative pattern of results did not differ across negative phrase types. A single exception to this generalization is noted in the 'Results' section.

(12) a. Greg lost all of his poker games.
    b. Everyone watched last night's game.

Note that each statement specifically targets the negative dependency, or lack thereof, in the critical sentence. Because the NC and DN interpretations have opposing truth conditions, the truth or falsity of the statement depends on its status as NC or DN, and participants' answers allowed us to probe their interpretation of the critical sentence. For example, endorsing (12a) as True indicates that the participant interpreted the critical sentence as Negative Concord, and concluded that Greg beat no one at poker, while responding False indicates that the participant got the DN reading, and concluded that Greg beat someone. Conversely, endorsing (12b) as True indicates a DN reading, i.e., that there was no one who did not watch the game, and responding False indicates an NC reading, i.e., that no one watched. Thus, participants' responses could be used to determine whether they interpreted the negations as intended by the context manipulation. Verification questions were balanced, such that half were true on the NC reading and half were true on the DN reading. All verification questions can be found with their corresponding items in the 'Appendix'.

For comparison, we also included 8 sentences of the type shown in (13) (cf. Thornton et al., 2016). In these sentences, the negative auxiliary is embedded inside a relative clause (as part of the subject), which blocks it from entering into a concord relation with the negative object, and only the double negation reading is available. Recall that these are classified as DN in that each syntactic negation contributes a semantic negation, but they are distinct from monoclausal DN in that they still receive a logically negative (as opposed to a logically affirmative) interpretation. We call these Syntactic Double Negation because the NC reading is blocked for syntactic reasons.

(13) The boy that didn't have a partner hugged nobody.
    Syntactic Double Negation

As with the Negative Object and Negative Subject sentences, Syntactic DN sentences were also preceded by a context sentence.

(14) The camp counselor told all the kids to give their partners a hug.
    The boy that didn't have a partner hugged nobody.

In addition to the 40 sentences with two syntactic negations, 64 filler sentences of similar complexity were created, 8 of each of 8 types. Examples of each type of filler sentence are shown in (15). These sentence types were chosen to include features common in casual speech, including some features

10

that, like English NC, are considered prescriptively incorrect. The full set of critical and filler sentences with their context sentences can be found in the 'Appendix'.

(15)  a.  The printer didn't work when she needed it.      simple negation
      b.  The kid that liked spinach ate all the salad.     subject relative clause
      c.  Katherine said that she got a good grade on the midterm.  reported speech
      d.  Me and Jake have three papers to finish before Monday.  accusative subject
      e.  Many people often go for walks on Sundays.     double quantifier[4]
      f.  Luke told Jen that soon that he would be ready to leave for dinner.  double *that*
      g.  There are a lot of things that Marcus wonders why he does them.  resumptive pronoun
      h.  The paper that the teacher that the student likes assigned was hard.  center embedding

All stimuli were presented in 25-point Times New Roman font. One en-width subtended .3° visual angle, and no sentence ran to more than one line. Sentences were presented left-aligned, with approximately 3 inches of vertical space between the context and critical sentence.

The eye-tracking portion of the study was run using an SR Research Eye-link 1000+ eye-tracker in head-stabilized mode. Sampling rate was 1000 Hz. Stimuli were presented in black text on a white background, on a 24-inch monitor. Participants' eye-to-screen distance was 90 cm, and head movements were minimized with chin and forehead rests.

### 2.3. PROCEDURE

The eye-tracking portion of the experiment took approximately 30 minutes. Calibration was conducted on a 9-point grid. Following successful calibration, participants completed 4 practice trials with feedback, and then 104 test trials without feedback. On every trial, participants read the context and test sentence pair on one screen, then responded to the verification question on a second screen. They were instructed to press a green sticker (on the 'd' key) if true, and a red sticker (on the 'k' key) if false. The four practice trials preceding the experimental trials had complexity similar to the test trials. Participants proceeded through the trials at their own pace, and were prompted to take a break halfway through the experiment.

Trials were randomized with restrictions. For the first three participants, there could be no more than two trials in a row of the same test condition or filler type (e.g., Syntactic DN, Object NC, Double Quantifier, etc.). After the third participant, a software update allowed us to use a more

---

[4]  See Frazier and Clifton (2011) for examples of non-compositional double quantifier use as attested and acceptable but prescriptively incorrect.

11

restrictive criterion: items of the same test condition or filler type never appeared consecutively.[5]

### 2.4. DATA PREPARATION AND EXCLUSIONS

Fixations less than 80 ms that were within .5° of visual angle of the preceding or following fixation (about 1.5 characters, and the spatial resolution of our eye-tracker) were merged with that fixation. Any remaining fixations shorter than 40 ms were removed from the data, as were any fixations longer than 1200 ms. Such fixations are outside the typical range for reading (Rayner, 2009), and are commonly removed before analysis (see, e.g., Juhasz, White, Liversedge, & Rayner, 2008). This resulted in the removal of 413 fixations, or 1.2% of the data.

After data cleaning, trials were eliminated from the dataset (N = 20, 1.7% of 1200 possible trials) if they contained no data (n = 13; one participant stopped early), if the critical sentence was never fixated (n = 2), or if only one critical sentence interest area (IA) was fixated (n = 5). No participants were excluded for failing to meet the inclusion criteria: all contributed more than half of the possible trials in each critical sentence condition (i.e., 4 of 8), and all had >75% accuracy on filler sentence verification questions.

## 3. Results

The study aimed to test whether interactions between pragmatic context (NC vs. DN) and syntactic location (object vs. subject) previously observed in metalinguistic tasks could be replicated and better understood via the online measure of eye-tracking while reading. We conducted analyses of the accuracy of participants' responses to verification questions, and analyses of context sentence (re)reading and critical sentence reading to compare difficulty of negative object and negative subject sentences in DN and NC contexts.

### 3.1. PRAGMATIC CONTEXT AND THE LOCATION OF THE NEGATIVE ARGUMENT

We first examined the relationship between pragmatic context (DN vs. NC) and negative argument location (subject vs. object) by analyzing participants' verification question responses and eye-movements while reading the negative subject and negative object critical trials. We report the analyses of verification

---

[5] In practice, this was not a major change. In the first three testing sessions, there were only 18 pairs of consecutive trials of the same type out of 312 total trials, and only 4 of these pairs were critical trials.

12

question responses, and then the analyses of reading patterns for trials in which participants' verification question answers correctly reflected the biasing pragmatic context.

### 3.1.1. *Verification question accuracy*

As shown in Figure 1, participants provided more correct responses in NC than in DN contexts for negative object sentences, and more correct responses in DN contexts for negative-subject sentences.

To test this pattern, we fit a binomial generalized linear mixed effects model of verification question accuracy using the *glmer( )* function of the *lme4* package (version 1.1.15; Bates, Maechler, Bolker, & Walker, 2015) in R (version 3.3.3; R Core Team, 2017). Predictor variables, entered into the model using mean-centered effects coding, were the within-participants factors pragmatic context (DN, contrast code: −0.50 vs. NC, contrast code: 0.50), negative location (object, −0.50 vs. subject, 0.50), and their interaction. We included random intercepts for participant and sentence, and used a forward best path algorithm (Barr, Levy, Scheepers, & Tily, 2013, p. 276; α = .2; see also Matuschek, Kliegl, Vasishth, Baayen, & Bates, 2017) to determine which random slopes to include. This led to the inclusion of the random slope of pragmatic context by participant.

This analysis revealed the predicted interaction of pragmatic context and negative location ($N_{trials}$ = 943, $b$ = −2.27, $se$ = 0.33, $z$ = −6.85, $\chi^2(1)$ = 49.48, $p$ < .0001). Neither of the main effects were reliable ($|z|$ < 1, $\chi^2(1)$ < 1, $p$ > .5). Planned comparisons showed that accuracy was reliably higher in DN contexts for the subject-negation sentences ($b$ = −1.39, $se$ = 0.51, $z$ = −2.73, $\chi^2(1)$ = 6.66, $p$ = .01) and was marginally lower in DN contexts for the object-negation sentences ($b$ = 0.87, $se$ = 0.51, $z$ = 1.72, $\chi^2(1)$ = 2.88, $p$ = .09). This provides our first support for the patterns that have been observed previously in acceptability judgment tasks (Blanchette, 2017) and judgments of meaning (Blanchette et al., 2018). In sum, participants arrived at the intended interpretation more often in the object NC and the subject DN sentences, as measured by their responses to the verification question.

This pattern of interaction held not just in the aggregate, but for the majority of individuals in the sample. Figure 2 shows participants' NC accuracy advantage scores for sentences with subject-negation and object-negation. Scores were calculated by subtracting the participant's DN accuracy from their NC accuracy for each negation location. If the value is above zero, this means they were more accurate in NC contexts, and if it is below zero they were more accurate in DN contexts. The majority of participants ($n$ = 20, 67%) had higher NC advantage scores in

13
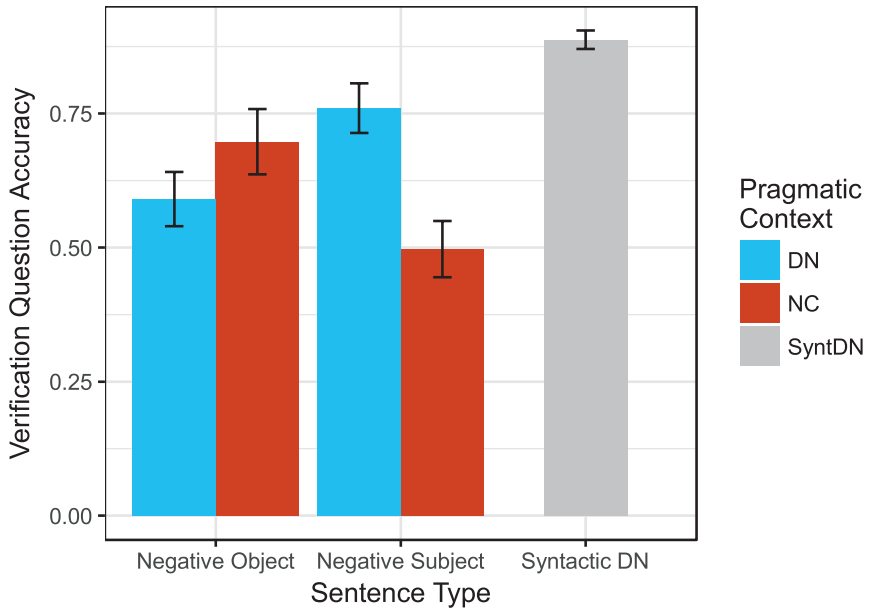
Fig. 1. Verification question accuracy, means and standard error.

negative object sentences than in negative subject sentences. Of the participants who did not, 2 had equal NC advantage scores and only 8 had lower NC advantage scores in negative object than in negative subject sentences.

Note that the verification question responses are still a metalinguistic measure, and that all experimental measures incorporate a certain amount of measurement error. Thus, we do not believe these results should be interpreted as veridical reflections of whether an individual participant has an NC or a DN grammar. However, the fact that the majority of our sample patterned in the predicted direction at the individual level provides strong evidence that the pattern is characteristic of this population. Participants' lower accuracy in NC contexts in negative subject sentences relative to negative object sentences is consistent with the asymmetries found in previous acceptability judgment tasks (Blanchette, 2017) and judgments of meaning (Blanchette et al., 2018). This suggests that the current population and items are sufficiently similar for our analyses of the eye-tracking measures to provide information on the online processes underlying these observed behaviors. Further analyses consider only the trials in which participants answered the verification question accurately.

14

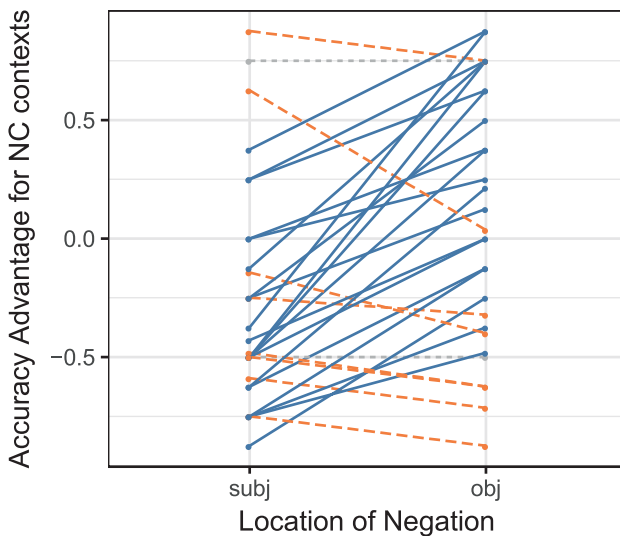Fig. 2. Verification question accuracy individual patterns. Points above 0 indicate higher accuracy in NC than in DN contexts, points below 0 indicate the reverse. The majority of participants (20 of 30) show a greater advantage for NC contexts in negative object sentences than in negative subject sentences (solid lines), a minority show differences in the opposite direction ($n = 8$, dashed lines) or no difference ($n = 2$, dotted lines).

### 3.1.2. *Context sentence measures*

We next asked whether, in trials in which the verification question was answered accurately ($N = 600$, of 943 included trials, 64%), participants spent more time reading or rereading the context sentence in certain conditions. We examined two measures of context sentence reading: First Pass Reading Time (FPRT), defined as the sum of all fixations on the context sentence before it is exited to the right (i.e., before the critical sentence is first fixated) and Rereading time (RRT), defined as the sum of all fixations on the context sentence after it is exited to the right (i.e., after the critical sentence has been fixated).[6] We expect FPRT to be similar across conditions, as no category of context sentence should be easier or harder to read on its own. In contrast, we expect RRTs to differ across conditions, as interpreting certain critical sentences is more difficult in

---

[6] Because the context sentences themselves do not share an overall syntactic frame, comparative analyses of regions within the context sentences were not conducted, as they would not be a valid comparison. Prioritizing naturalness and plausibility of the target interpretation prevented us from controlling the syntactic frame of the context sentence, so we analyze only this coarser-grained measure for the context sentence.

15

some contexts than others. Difficulty should drive eye-movements back to the context sentence during or after critical sentence reading, and therefore result in longer context sentence RRTs.

Mean context sentence FPRTs and RRTs are shown in Table 1. As predicted, FPRTs were similar across conditions, but RRTs were longer in Subject NC than in Subject DN trials, and longer in Object DN than in Object NC trials. That is, participants spent more time rereading the context sentence when the sentence was in a dispreferred context.

To test these patterns, we fit two linear mixed effects models, using the *lmer( )* function of the *lme4* package in R. Predictor variables were the within-participants factors of pragmatic context (DN, –0.47 vs. NC, 0.53), and negative location (object, –0.50 vs. subject, 0.50), and their interaction, as well as the continuous variable character count to control for differences in context sentence length. Random intercepts were included for participant and sentence, and a forward best path algorithm ($\alpha = .2$) was used to determine which random slopes to include.

For FPRT, the model included the random slopes of negative location and pragmatic context by participant and of pragmatic context by sentence. This analysis revealed a reliable effect only of character count ($N_{trials} = 600$, $b = 36.7$, $se = 6.40$, $t = 5.58$, $\chi^2(1) = 26.23$, $p < .0001$), all other $|t| < 1$. Planned comparisons revealed no reliable effect of pragmatic context type in either negative subject or negative object trials (both $|t| < 1$, $p > .5$). Once context sentence length is taken into account, no category of context sentence is consistently more difficult to read than any other.

For RRT, the model included the random slope of negative location by participant. This analysis revealed the predicted reliable interaction of pragmatic context and negative location ($N_{trials} = 600$, $b = 681$, $se = 183$, $t = 3.73$, $\chi^2(1) = 13.69$, $p = .0002$). As in verification question accuracy, neither the main effect of pragmatic context ($t = -1.30$, $\chi^2(1) = 1.70$, $p = .19$) nor the main effect of negative location ($t = -0.04$, $\chi^2(1) = 0.002$, $p = .96$) was reliable. There was no reliable effect of character count on RRT ($t = -1.25$, $\chi^2(1) = 1.58$, $p = .21$). Planned comparisons revealed that the simple main effect of pragmatic context was marginal in subject-negation sentences ($b = 220$, $se = 120$, $t = 1.83$, $\chi^2(1) = 3.34$, $p = .068$) and reliable for negative object sentences ($b = -461$, $se = 141$, $t = -3.28$, $\chi^2(1) = 10.50$, $p = .001$). Participants spent more time rereading DN context sentences than NC context sentences when the critical sentence contained a negative object, and spent marginally more time rereading NC than DN context sentences when the critical sentence contained a negative subject.

In sum, even in trials in which participants answered the verification question accurately, longer RRTs indicate that the correct interpretation is more difficult to achieve for negative object sentences in DN contexts and for

16

TABLE 1. *Full Sentence Reading Times, mean and standard error*

| | Context Sentence | | Critical Sentence |
|---|---|---|---|
| | First Pass Reading Time | Rereading Time* | Total Reading Time* |
| Subject | | | |
| DN | 2905 (222) | **495 (72)** | 3150 (293) |
| NC | 2975 (237) | **715 (138)** | 3522 (562) |
| Object | | | |
| DN | 3229 (211) | **945 (273)** | **2946 (302)** |
| NC | 2785 (168) | **503 (109)** | **2475 (322)** |

NOTES: * indicates that the interaction of pragmatic context and negative location was reliable for that measure; **bold font** indicates that the simple main effect of pragmatic context was either reliable or marginal in that cell.

negative subject sentences in NC contexts, echoing the patterns found in the verification question analysis and in previous studies.

### 3.1.3. *Critical sentence total reading time*

Difficulty interpreting a sentence in context may also be reflected in reading time on the critical sentence itself. We therefore also examined total reading time on the critical sentence.[7] Total time (TT) was defined as the sum of all fixations to the critical sentence. Means are shown in the rightmost column of Table 1. We again see the familiar, predicted, cross-over interaction:[8]

---

[7] Our study was designed to test this coarse-grained measure, as the negative subject and negative object sentences, by necessity, differed in length and word type at a finer-grained level. However, for comparison with other studies in the literature, we did analyze reading measures in smaller interest areas within the negative subject and negative object critical sentences separately, including First Pass Reading Time, Rereading Time, Total Time, and Go-Past Time for the subject, negative auxiliary, verb phrase, negative object, and adjunct. There were several cells where the effect of pragmatic context was marginal, always in the predicted direction (Object DN RRT > Object NC RRT on the auxiliary and negative object, Object DN TT > Object NC TT on the auxiliary, .05 < p < .07), but no effects reached significance. The fact that the predicted effects are revealed only in the coarse-grained analyses, and there only in the late measures, is consistent both with previous studies of negation (e.g., Ferguson et al., 2008; Noh et al., 2013), and with the affordances of our design. Because these analyses were less-suited to our design, we do not report them here in full.

[8] Critical sentence total time was the only measure for which the four negative NP types did not all show the same qualitative pattern. For TT, *nobody* trials showed a similar NC advantage in both subject and object position, while all other negative NP types (*nothing*, *no* [animate], *no* [inanimate]) all showed an NC advantage in object position and no difference or a DN advantage in subject position. Given the sparsity of the data when split by NP type, this pattern cannot support strong conclusions, but it is notable that the only qualitative break from the interaction we observe is in favor of the NC reading, despite its proscription in Standard English.

17

TT was longer for negative subject sentences in NC contexts than in DN contexts, and for negative object sentences in DN contexts than in NC contexts.

As before, we tested this pattern with a linear mixed effects model. Predictor variables were pragmatic context (DN, –0.47 vs. NC, 0.53), and negative location (object, –0.50 vs. subject, 0.50) and their interaction, and character count. Random intercepts for participant and sentence were included, and a forward best path algorithm led to the inclusion of random slopes for negative location and pragmatic context by participant. This analysis revealed the predicted interaction ($N_{trials}$ = 600, $b$ = 989, $se$ = 361, $t$ = 2.74, $\chi^2$(1) = 7.00, $p$ = .008), a reliable effect of character count ($b$ = 65, $se$ = 22.7, $t$ = 2.87, $\chi^2$(1) = 7.72, $p$ = .005), a marginal main effect of negative location ($b$ = 423, $se$ = 222, $t$ = 1.91, $\chi^2$(1) = 3.63, $p$ = .057), and no main effect of pragmatic context ($b$ = –166, $se$ = 270, $t$ = –0.62, $\chi^2$(1) = 0.40, $p$ = .53). Planned comparisons revealed that the simple main effect of pragmatic context was reliable in negative object sentences ($b$ = –655, $se$ = 318, $t$ = –2.06, $\chi^2$(1) = 4.10, $p$ = .04), but not in negative subject sentences ($b$ = 331, $se$ = 327, $t$ = 1.01, $\chi^2$(1) = 1.00, $p$ = .32). Critical sentence reading times were marginally longer in negative subject than in negative object sentences, and the reliable, predicted interaction of pragmatic context and negative location indicated that the effect of pragmatic context differed reliably in the two sentence types.

### 3.1.4. *Summary*

Overall, our analysis of the critical experimental conditions revealed the predicted interaction between pragmatic context and the location of the negative argument to be reliable in both the offline, metalinguistic measure of verification question accuracy, and in the online measures of processing provided by context sentence RRT and critical sentence TT. Participants were less accurate and slower in Object DN than in Object NC, and in Subject NC than in Subject DN. This study thus provides the first online support for the effects previously observed in metalinguistic judgment tasks. Our results suggest that participants expect sentences with a negative auxiliary and negative object to express NC meanings, and sentences with a negative subject and negative auxiliary to express DN meanings. When these expectations are not met, they are slower and more reliant on revisiting context information to construct the target interpretation.

### 3.2. SYNTACTIC VS. PRAGMATIC DN

In addition to our investigation of pragmatic context and negation location, we were also interested in the relationship between pragmatically

18

driven DN interpretations and syntactically driven ones such as (13). The latter have a negative phrase in object position, but require a DN interpretation because of the structural distance between the negative auxiliary and the negative object. Analyzing these sentences in comparison with context-dependent DN interpretations allows us to begin disentangling the effect of having two negations from the effect of having to use pragmatic constraints to disambiguate between two potential readings. The Syntactic DN sentences have two negations, but only one possible reading.

To ask whether the critical sentence's reliance on context for disambiguation made processing of DN meanings more difficult, we compared question response accuracy, context sentence FPRT and RRT, and critical sentence TT in the three DN trial types: syntactic DN, negative subjects in DN context, and negative objects in DN context.[9] The sentence reading times for Syntactic DN sentences are shown in Table 2, and those for Subject and Object DN sentences are shown in Table 1. For all analyses, we constructed two orthogonal contrasts for sentence type: one that compared syntactic to pragmatic DN (Syntactic DN vs. Subject and Object DN) and one that compared Subject to Object DN within the pragmatically ambiguous condition. We focus on the former comparison, as the latter largely duplicates the simple effects analyses in the previous section.

Note that these analyses differ in two ways from the analyses of pragmatic context and negation location in the previous section: first, they include a different subset of trials (the Subject and Object DN and the Syntactic DN trials, but not any of the NC trials). Second, there is one three-level factor of interest (DN type), rather than two two-level factors (pragmatic context and negation location). We test this three-level factor using the two orthogonal contrasts described above.

### 3.2.1. *Verification question accuracy*

We fit a binomial mixed effects model of verification question response accuracy with DN sentence type as a predictor. Because DN type had three levels (Syntactic DN, Subject DN, Object DN), we used two orthogonal,

---

[9] We did not include critical sentence FPRTs in either this or the main analysis because this measure was not well defined. This is because following the critical sentence, participants proceeded to a different screen in order to respond to the verification question, so their point of exit from the critical sentence could not be determined in the same way as it could for the context sentence.

19

TABLE 2. *Full sentence reading times for Syntactic DN, mean and standard error*

| | Context Sentence | | Critical Sentence |
|---|---|---|---|
| | First Pass Reading Time | Rereading Time | Total Reading Time |
| Syntactic DN | 3409 (248) | 630 (101) | 3170 (197) |

weighted, Helmert-coded contrasts.[10] The first contrast (constraint type) compared syntactic DN (contrast code: 0.67) to the two pragmatic DN sentence types (contrast code for each: –0.33). The second contrast (negation location) compared Object DN (contrast code: –0.50) to Subject DN sentences (contrast code: 0.50). The model included random intercepts for participant and sentence, and revealed the predicted reliable effect of constraint type ($N_{trials}$ = 710, $b$ = 1.75, $se$ = 0.43, $z$ = 4.08, $\chi^2(1)$ = 15.14, $p$ < .001) and the expected effect of negation location ($b$ = 1.03, $se$ = 0.37, $z$ = 2.78, $\chi^2(1)$ = 7.10, $p$ = .008). This means that participants were more accurate in their responses with Syntactic DN than with the pragmatically constrained critical sentences, and, as reported above, they were more accurate with Subject DN than with Object DN.

### 3.2.2. *Reading times*

We also examined participants' reading patterns on the context and critical sentences in trials with accurate verification question responses across DN types ($N_{trials}$ = 528, of 710 included trials, 74%). We fit linear mixed effects models of context sentence FPRT and RRT and critical sentence TT using the same Helmert-coded DN sentence type predictor as above, and with character count as a continuous measure of sentence length. The first contrast compared Syntactic DN (0.60) to the two Pragmatic DN sentence types (both –0.40), and the second compared negative object (–0.54) to negative subject sentences (0.46).

The model for FPRT included random intercepts for participant and sentence. It revealed a reliable effect of character count ($N_{trials}$ = 528, $b$ = 39, $se$ = 8, $t$ = 4.65, $\chi^2(1)$ = 17.72, $p$ < .001) and constraint type ($b$ = 465, $se$ = 145, $t$ = 3.21, $\chi^2(1)$ = 9.38, $p$ = .002), but not of negation location ($t$ = –0.22, $\chi^2(1)$ = 0.04, $p$ = .84). This suggests that the context sentences preceding

---

[10] These and all other contrasts were properly weighted with the help of the *psycholing* package for R (Fraundorf, 2017).

20

syntactic DN sentences were more difficult to read on the first pass than those preceding pragmatic DN critical sentences.

The model for RRT included the random intercepts for participant and sentence and the random slope of DN sentence type by participant. For rereading times, we found no reliable effects of DN type for either contrast (syntactic vs. pragmatic, $t = -0.49$, $\chi^2(1) = 0.26$, $p = .61$; object vs. subject, $t = -1.89$, $\chi^2(1) = 3.62$, $p = .06$) or for character count ($t = -1.03$, $\chi^2(1) = 1.06$, $p = .30$). However, in light of the apparent baseline differences in context sentence difficulty revealed by the FPRT analysis, the lack of difference in RRT should be interpreted with caution: participants spent longer reading the context sentences preceding syntactic DN critical sentences even on the first pass, which suggests that they were more difficult to read, and may therefore have also required more rereading time independently of any effect of the critical sentence.

A linear mixed effects model of TT on the critical sentence in each of these DN conditions, with predictors and random effects as for RRT, above, revealed reliable effects of character count ($N_{trials} = 528$, $b = 55$, $se = 24$, $t = 2.26$, $\chi^2(1) = 5.11$, $p = .02$) and constraint type ($b = -1242$, $se = 638$, $t = -1.95$, $\chi^2(1) = 3.91$, $p = .05$), but not negation location ($t = -0.11$, $\chi^2(1) = 0.01$, $p = .91$). Participants spent reliably more time reading pragmatically constrained DN critical sentences than they did syntactically constrained ones. This is most likely because the pragmatically constrained sentences are ambiguous, while the syntactically constrained ones are not. This result strongly suggests that critical sentence ambiguity slowed processing for a subset of our negative sentences.

In short, differences in verification question accuracy and critical sentence total time suggest that there is added complexity involved in correctly determining the meaning of the pragmatically constrained double negation sentences. The lack of consistent differences between pragmatically and syntactically constrained DN in context sentence RRT suggests either that this added complexity does not drive stronger reliance on the context, or that the differences in context rereading are subtle enough that the current set of sentence pairs, intended for exploratory analysis of DN, is not well-enough matched to reveal them. Future work that focuses on examining different types of DN in context (cf. Noh, Choo, & Koh, 2013) could shed further light on this issue.

## 4. Discussion

This study aimed to contribute to our understanding of whether and how NC and DN are represented in the minds of adult Standard English speakers. The results from our 30 native American English-speaking adults, all of

21

whom report being non-NC-users, reveal a reliable preference for, and relative ease with, Object NC over Object DN. In the context of previous work on this topic (Blanchette, 2017; Blanchette et al., 2018), the interaction we found between pragmatic context (NC vs. DN) and negative location (subject vs. object) in participants' verification question accuracy is unsurprising. However, replicating this effect with an online measure allows us to draw broader generalizations from our reading time data to the population of SE speakers. We note further that this interaction is unexpected under theories that assume NC and DN to belong to different types of grammars (e.g., Zeijlstra, 2004), and that it contrasts with the results in Thornton et al. (2016), in which SE-speaking adults reliably resisted NC interpretations of sentences with negative objects. In the online reading time measures, the interaction between pragmatic context and negative location can be understood as a clash between expected interpretation, perhaps driven by participants' initial structural representations (cf. Dussias, 2010, p. 151), and the intended interpretation, as shaped by the preceding linguistic context. Participants spent more time reading the critical sentence and rereading the preceding context when the target interpretation did not match their expected one (i.e., Subject NC or Object DN).

Note that the two reading time measures, critical sentence total reading time and context sentence rereading time, which bore out the predicted interaction, are relatively late measures of processing (Gordon et al., 2006). Previous psycholinguistic studies can help us to understand why our effects were revealed in relatively coarse-grained, late measures. While these have not specifically explored NC, there is a large body of work examining sentences with a single syntactic negation, such as *there was no eagle in the sky* (Kaup, Yaxley, Madden, Zwaan, & Lüdtke, 2007), and *a robin is not a tree* (Fischler, Bloom, Childers, Roucos, & Perry, 1983). Studies comparing negative sentences like these to affirmative ones have revealed a "negation effect" (Kaup, Lüdtke, & Zwaan, 2007, p. 260), in which negative sentences take longer to process than matched affirmatives. The effect has been replicated in numerous studies, and it is typically elicited in paradigms in which little or no facilitating context is provided. Where limited clues are provided as to how a sentence is integrated into a discourse, negative sentences are reliably more difficult to process than affirmative ones. (See Tian & Breheny, 2016, for a recent review.)

Slow, late processing of negation has also been observed in physiological measures including eye-tracking while reading (Ferguson et al., 2008; Noh et al., 2013), eye-tracking in the visual world paradigm (Orenes, Beltrán, & Santamaría, 2014; Orenes, Moxey, Scheepers, & Santamaría, 2016; Tian, Ferguson, & Breheny, 2016), ERP (Ferguson et al., 2008; Fischler et al., 1983; Nieuwland & Kuperberg, 2008; Schiller, van Lenteren, Witteman, Ouwehand,

22

Band, & Verhagen, 2017), and fMRI (Tettamanti, Manenti, Della Rosa, Falini, Perani, Cappa, & Moro, 2008). As with behavioral tasks, a relatively consistent effect across all of these different measures is that negative sentences, at least when presented with no facilitating context, are processed more slowly and with more difficulty than affirmatives. The fact that our effects were seen in later measures suggests that this is also true, and perhaps even more so, when there are two syntactic negations (cf. Ferguson et al., 2008).

While negation is clearly difficult to process out of context, the role of pragmatic context has also been shown to play an important role in facilitating negation processing. Previous work has shown that providing a highly naturalistic pragmatic context actually facilitates the processing of a single syntactic negation, effectively nullifying any differences between affirmatives and negatives (Nieuwland & Kuperberg, 2008). When context sets up the expectation of a negation, this makes the negation easier to process. In our experiment, the contexts in the pragmatically ambiguous critical condition were created to clearly support either an NC or a DN interpretation, and our avoidance of negation in the context sentence may have actually negatively impacted their naturalness. This could have been particularly true for the DN sentences, which seem to more naturally follow a preceding statement with explicit negation (e.g., *everybody doesn't like something, but nobody doesn't like Sara Lee*[11]). We note, however, that the previous work which formed the basis for our predicted interactions included experiments in which the negative sentences were presented with no preceding context at all (Blanchette, 2017, Experiment 1, and the perception/meaning judgment task in Blanchette et al., 2018), as well as DN sentences which included an explicit negation in the context sentence (Blanchette, 2017, Experiment 3), and the relevant effects were still present. This suggests that properties of the critical sentences themselves are driving the interaction. Future work that varies the context sentences more systematically, on a par with the critical sentences, may serve to better inform the question of precisely how the context sets up the intended interpretation.

## 4.1. ONLINE MEASURES AND PRESCRIPTIVE PRESSURE

Regarding the influence of prescriptive pressure, if this pressure is having an effect on reading times, then we would expect it to amplify the syntactic bias for negation in subject position, making DN much easier than NC.

---

[11] The example is from the classic Sara Lee commercial, which can be viewed here: <https://www.youtube.com/watch?v=Iirw147LHkQ>(accessed 3 August 2018).

In contrast, we would also expect this pressure to work against the syntactic bias for negation in object position, making Object NC harder than it would be without the prescriptive pressure and therefore reducing or reversing differences between Object NC and Object DN. However, if anything, the results show larger numeric differences in the object condition than in the subject condition. This suggests that prescriptive pressure is either playing little to no role in these measures, or that it is substantially outweighed by the participants' grammatical knowledge. A study comparing NC processing in English and a language without prescriptive pressure to avoid NC, but with the asymmetry between negative subject and negative object sentences (e.g., Spanish), could give further insight into these processes.

### 4.2. STANDARD ENGLISH AND NEGATIVE CONCORD TYPOLOGY

Previous work on NC has revealed an important distinction between 'Strict' and 'Non-Strict' NC languages (Giannakidou, 1998). In Strict NC languages (e.g., Greek; Giannakidou, 2000), negative words in NC constructions must always co-occur with a negative marker, regardless of their syntactic position. This includes constructions in which a negative subject co-occurs with, but is not c-commanded by, the negative marker, in a structure analogous to the Subject NC constructions investigated here. Non-Strict NC languages (e.g. Spanish; Herburger, 2001) are distinct from Strict NC languages in that only postverbal negative words require a preceding negative marker. In these languages, negative subjects are not employed in NC constructions with a following negative marker (i.e., Subject NC is not possible), and may occur in clauses with no accompanying negation. If we assume that SE is an NC language, then we can ask whether it should be classified as Strict or Non-Strict. The pattern uncovered by experimental results suggests that it fits best in the Non-Strict category, given SE speakers' dispreference for Subject NC. The distinction between strict and non-strict NC languages thus reveals an additional reason for comparing SE, by hypothesis a Non-Strict NC language, and Spanish, whose status as Non-Strict is well established. It also suggests that the introduction of a Strict NC language such as Greek into the comparison could reveal further insight into the nature of NC in SE, and the distinction between strict and non-strict NC languages more generally.

### 4.3. NEGATIVE CONCORD AND NEGATIVE POLARITY

We conclude our discussion by returning to the similarity between NC constructions such as those in the current study, and NPI constructions, such as *I didn't eat anything*. In SE, the two constructions appear to require, or at

24

least strongly prefer, a c-command relation between the NPI or negative phrase and the preceding negation (cf. *anybody didn't eat*, and the NC interpretation of *nobody didn't eat*, which was dispreferred in our experimental paradigm). The similarity of these constructions, and the clear acceptability of the NPI construction in SE, raise the question of whether, in processing NC, SE speakers are making a direct analogy to NPI constructions. The design of the current study did not include NPIs, and therefore cannot directly inform questions about the relationship between NC and NPI constructions in SE. However, our results suggest that further research in this direction would be fruitful. Such a study could not only clarify the status of NC in SE, but also inform theoretical questions about whether NC and NPI constructions are derived by similar syntactic mechanisms (e.g., Collins & Postal, 2014; Blanchette, 2015), or whether they are the reflex of distinct grammatical processes, either syntactic or semantic (e.g., Herburger, 2001).

It is relevant to note that, while less frequent than Object NC, Subject NC is indeed a feature of numerous English varieties, including Appalachian English (Wolfram & Christian, 1976), African American English (Green, 2002), and others (Smith, 2001). While these same varieties readily allow both NPIs and negative words in postverbal positions following a negation (e.g., *I didn't eat nothing/anything*), only negative words are allowed as canonical subjects, and NPIs are not (e.g., *nobody didn't eat* but *\*anybody didn't eat*; Tortora & Den Dikken, 2010). The existence of Subject NC in these other varieties, and the impossibility of NPIs in subject position, indicates that NPIs and NC are not always interchangeable, and suggests that comparative work across English varieties using similar forms of online data collection could shed light on the relationship between NC and NPI constructions more generally.

Such further investigations will build on a strong base: unlike NC, English NPI constructions have received substantial attention in the psycholinguistic literature (e.g., Parker & Phillips, 2016; Phillips, Wagers, & Lau, 2011; Tesan, Johnson, & Crain, 2012; Xiang, Dillon, & Phillips, 2009; Xiang, Grove, & Giannakidou, 2013). Several papers focus on 'grammatical illusions', in which NPIs are not licensed by a c-commanding negation, but are linearly preceded by a negative element or 'potential licensor' in a non-c-commanding position, yielding higher levels of acceptability than when there is no preceding negation or 'potential licensor' in the structure (Drenhaus, Saddy, & Frisch, 2005). An eye-tracking while reading study examining the NPI illusion finds evidence of the effect in the late measures of right bounded reading time and regression path duration, in the region of the NPI (Vasishth, Brüssow, Lewis, & Drenhaus, 2008, p. 704). Researchers have argued that the effect is due not to speakers' competence in understanding the linguistic constraints on NPI

constructions, but rather, requires a processing explanation (Vasishth et al., 2008, p. 689). By building on these previous empirical findings, future studies will be able to further explore the relationships between NPIs and NC within and across varieties of English.

### 4.5. CONCLUSION

NC is found in numerous languages as a means for marking negation (Auwera & Alsenoy, 2016). We submit that studying how humans process NC constructions is essential to understanding how negation is represented in human language in general. The particular examination of NC in SE which we have presented here has illustrated one way in which the online measure of eye-tracking while reading can reveal processes underlying metalinguistic judgments, which may otherwise be confounded by prescriptive pressure. Our results suggest that NC constructions, which are unacceptable and not typically used by SE speakers, are nevertheless processed in consistent, predictable ways by speakers of this variety. This suggests that these constructions are represented in SE speakers' grammars, and that their widespread unacceptability may be even more an artifact of prescriptive pressure than previously thought. This finding opens the door for examination of other constructions and features typically thought to be associated only with vernacular varieties. While it is clear that some speakers switch back and forth between markedly different grammatical systems (e.g., Terry, Hendrick, Evangelou, & Smith, 2010), using the appropriate language variety in each of several different contexts, our work raises important questions about the grammatical systems of ostensibly mono-dialectal speakers.

### REFERENCES

Auwera, J., & Alsenoy, L. (2016). On the typology of Negative Concord. *Studies in Language,* **40**, 473–512.

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: keep it maximal. *Journal of Memory and Language*, **68**, 255–278.

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Lme4: linear mixed-effects models using Eigen and S4. R package version 1.1–10. Online <https://github.com/lme4/lme4pureR>.

Biberauer, T., & Zeijlstra, H. (2012). Negative Concord in Afrikaans: filling a typological gap. *Journal of Semantics,* **29**, 345–371.

Blanchette, F. (2013). Negative Concord in English. *Linguistic Variation,* **13**, 1–47.

Blanchette, F. (2015). *English Negative Concord, Negative Polarity and Double Negation.* Unpublished doctoral dissertation, CUNY Graduate Center.

Blanchette, F. (2017). Micro-syntactic variation in English Negative Concord. *Glossa: A Journal of General Linguistics*, **2**, 1–32.

Blanchette, F., & Nadeu, M. (2018). Prosody and the meanings of English negative indefinites. *Journal of Pragmatics,* **129**, 123–139.

Blanchette, F., Nadeu, M., Yeaton, J., & Déprez, V. (2018). English Negative Concord and Double Negation: the division of labor between syntax and pragmatics. In *Proceedings of the Annual Meeting of the Linguistic Society of America*, **3**(53), 1–15.

Brysbaert, M., & New, B. (2009). Moving beyond Kucera and Francis: a critical evaluation of current word frequency norms and the introduction of a new and improved word frequency measure for American English. *Behavior Research Methods*, **41**(4), 977–990.

Collins, C., & Postal, P. (2014). *Classical NEG raising: an essay on the syntax of negation*. Cambridge, MA: MIT Press.

Déprez, V, Tubau, S., Cheylus, A., & Espinal, M. T. (2015). Double Negation in a Negative Concord language: an experimental investigation. *Lingua*, **163**, 75–107.

Drenhaus, H., Saddy, D., & Frisch, S. (2005). Processing negative polarity items: when negation comes through the backdoor. In S. Kepser & M. Reis (eds.)*, Linguistic evidence: empirical, theoretical, and computational perspectives* (pp. 145–165). Berlin: De Gruyter.

Dussias, P. E. (2010). Uses of eye-tracking data in second language sentence processing research. *Annual Review of Applied Linguistics*, **30**, 149–166.

Espinal, M. T., & Prieto, P. (2011). Intonational encoding of Double Negation in Catalan. *Journal of Pragmatics*, **43**, 2392–2410.

Espinal, M. T., Tubau, S., Borrás-Comes, J., & Prieto, P. (2016). Double Negation in Catalan and Spanish: interaction between syntax and prosody. In P. Larrivée & C. Lee (eds.), *Negation and polarity: experimental perspectives* (pp. 145–176). Dordrecht: Springer.

Ferguson, H. J., Sanford, A. J., & Leuthold, H. (2008). Eye-movements and ERPs reveal the time course of processing negation and remitting counterfactual worlds. *Brain Research*, **1236**, 113–125.

Fischler, I., Bloom, P., Childers, D., Roucos, S. E., & Perry, N. W. (1983). Brain potentials related to stages of sentence verification. *Psychophysiology*, **20**, 400–409.

Fraundorf, S. (2017). Psycholing: R functions for common psycholinguistic and cognitive designs. Online <https://github.com/sfraundorf/psycholing>.

Frazier, L., & Clifton, C. (2011). Quantifiers undone: reversing predictable speech errors in comprehension. *Language*, **87**, 158–171.

Geurts, B. (1998). The mechanisms of denial. *Language*, **74**, 274–307.

Giannakidou, A. (1998). *Polarity sensitivity as (non)veridical dependency*. Amsterdam: John Benjamins.

Giannakidou, A. (2000). Negative … Concord? *Natural Language and Linguistic Theory*, **18**, 457–523.

Gordon, P., Hendrick, R., Johnson, M., & Lee, Y. (2006). Similarity-based interference during language comprehension: evidence from eye tracking during reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **32**(6), 1304–1321.

Green, L. (2002). *African American English: a linguistic introduction*. Cambridge: Cambridge University Press.

Green, L. (2014). Force, focus and negation in African American English. In R. Zanuttini & L. R. Horn (eds.), *Micro-syntactic variation in North American English* (pp. 115–142). New York: Oxford University Press.

Haegeman, L., & Zanuttini, R. (1996). Negative Concord in West Flemish. In A. Belletti & L. Rizzi (eds.), *Parameters and functional heads* (pp. 117–179). Oxford: Oxford University Press.

Herburger, E. (2001). The Negative Concord puzzle revisited. *Natural Language Semantics*, **9**, 233–289.

Horn, L. (1989 [2001]). *A natural history of negation*. Chicago: CSLI Publications.

Horn, L. (2010). Multiple negation in English and other languages. In L. Horn (ed.) *The expression of cognitive categories: expression of negation* (pp. 117–148). Berlin: Walter de Gruyter.

Jespersen, O. (1917). *Negation in English and other languages*. Copenhagen: A. F. Høst.

Juhasz, B. J., White, S. J., Liversedge, S. P., & Rayner, K. (2008). Eye movements and the use of parafoveal word length information in reading. *Journal of Experimental Psychology: Human Perception and Performance*, **34**(6), 1569–1579.

27

Kaup, B., Lüdtke, J., & Zwaan, R. A. (2007). The experiential view of language comprehension: How is negation represented? In F. Schmalhofer & C. A. Perretti (eds.), *Higher level language processes in the brain: inference and comprehension processes* (pp. 255–288). Mahwah, NJ: Lawrence Erlbaum Associates.

Kaup, B., Yaxley, R., Madden, C. J., Zwaan, R. A., & Lüdtke, J. (2007). Experiential simulations of negated text information. *Quarterly Journal of Experimental Psychology*, **60**(7), 976–990.

Keren, E.-H. (2015). From negative polarity to negative concord – Slavic footprints in the diachronic change of Hebrew *meʔuma, klum,* and *sum davar*. *Journal of Jewish Languages*, **3**, 183–198.

Ladusaw, W. A. (1979). *Polarity sensitivity as inherent scope relations*. Doctoral dissertation, University of Texas. Published, New York: Garland (1980).

Lippi-Green, L. (1997). *English with an accent*. London: Routledge.

Matuschek, H., Kliegl, R., Vasishth, S., Baayen, H., & Bates, D. (2017). Balancing Type 1 error and power in linear mixed models. *Journal of Memory and Language*, **94**, 305–315.

Nevalainen, T. (1998). Social mobility and the decline of Multiple Negation in Early Modern English. In J. Fisiak and M. Krygier (eds.), *Advances in English historical linguistics (1996)* (pp. 263–291). Berlin: Mouton de Gruyter.

Nieuwland, M. S., & Kuperberg, G. R. (2008). When the truth is not too hard to handle: an event-related potential study on the pragmatics of negation. *Psychological Science*, **19**(12), 1213–1218.

Noh, E.-J., Choo, H., & Koh, S. (2013). Processing metalinguistic negation: evidence from eye-tracking experiments. *Journal of Pragmatics*, **57**, 1–18.

Orenes, I., Beltrán, D., & Santamaría, C. (2014). How negation is understood: evidence from the visual world paradigm. *Journal of Memory and Language,* **74**, 36–45.

Orenes, I., Moxey, L., Scheepers, C., & Santamaría, C. (2016). Negation in context: evidence from the visual world paradigm. *Quarterly Journal of Experimental Psychology*, **69**(6), 1082–1092.

Parker, D., & Phillips, C. (2016). Negative polarity illusions and the format of hierarchical encodings in memory. *Cognition*, **157**, 321–339.

Phillips, C., Wagers, M. W., & Lau, E. F. (2011). Grammatical illusions and selective fallibility in real-time language comprehension. In J. Runner (ed.), *Experiments at the interfaces* (Syntax & Semantics, Vol. 37). Bingley: Emerald Publications.

Plato (1937 [c.360 bc]). *The Sophist*, trans. B. Jowett. New York: Random House.

Prieto, P., Borràs-Comes, J., Tubau, S., & Espinal, M. T. (2013). Prosody and gesture constrain the interpretation of double negation. *Lingua*, **131**, 136–150.

Puskás, G. (2012). Licensing Double Negation in NC and non-NC languages. *Natural Language & Linguistic Theory,* **30**, 611–649.

R Core Team. (2017). R: a language and environment for statistical computing. R Foundation for Statistical Computing: Vienna. Online<http://www.R-project.org>

Rayner, K. (1994). Eye movements during skilled reading. In J. Ygge & G. Lennerstrand (eds.), *Eye movements in reading* (pp. 205–218). New York: Elsevier.

Rayner, K. (2009). Eye movements and attention in reading, scene perception, and visual search. *Quarterly Journal of Experimental Psychology*, **62**(8), 1457–1506.

Reinhart, T. M. (1976). *The syntactic domain of anaphora*. Unpublished doctoral dissertation, Massachusetts Institute of Technology.

Schiller, N. O., van Lenteren, L., Witteman, J., Ouwehand, K., Band, G. P. H., & Verhagen, A. (2017). Solving the problem of double negation is not impossible: electrophysiological evidence for the cohesive function of sentential negation. *Language, Cognition, and Neuroscience*, **32**(2), 147–157.

Smith, J. (2001). Negative concord in the Old and New World: evidence from Scotland. *Language Variation and Change,* **13**, 109–134.

Terry, J. M., Hendrick, R., Evangelou, E., & Smith, R. L. (2010). Variable dialect switching among African American children: inferences about working memory. *Lingua,* **120**, 2463–2475.

28

Tesan, G., Johnson, B. W., & Crain, S. (2012). How the brain responds to *any*: an MEG study. *Brain & Language*, **120**, 66–72.

Tettamanti, M., Manenti, R., Della Rosa, P. A., Falini, A., Perani, D., Cappa, S. F., & Moro, A. (2008). Negation in the brain: modulating action representations. *NeuroImage,* **43**, 358–367.

Thornton, R., Notley, A., Moscati, V., & Crain, S. (2016). Two negations for the price of one. *Glossa: A Journal of General Linguistics,* **45**, 1–30.

Tian, Y., & Breheny, R. (2016). Dynamic pragmatic view of negation processing. In P. Larrivée & C. Lee (eds.), *Negation and polarity: experimental perspectives* (pp. 21–44). Heidelberg: Springer.

Tian, Y., Ferguson, H., & Breheny, R. (2016). Processing negation without context – why and when we represent the positive argument. *Language, Cognition, & Neuroscience*, **31**(5), 683–698.

Tortora, C., & Den Dikken, M. (2010). Subject agreement variation: support for the configurational approach. *Lingua,* **120**, 1089–1108.

Vasishth, S., Brüssow, S., Lewis, R. L., & Drenhaus, H. (2008). Processing polarity: how the ungrammatical intrudes on the grammatical. *Cognitive Science*, **32**, 685–712.

Wason, P. C. (1959). The processing of positive and negative information. *Quarterly Journal of Experimental Psychology*, **11**, 92–107.

Wolfram, W., & Christian, D. (1976). *Appalachian speech*. Arlington, VA: Center for Applied Linguistics.

Wolfram, W., & Fasold, R. (1974). *The study of social dialects in American English*. New York: Prentice Hall.

Xiang, M., Dillon, B., & Phillips, C. (2009). Illusory licensing effects across dependency types: ERP evidence. *Brain & Language*, **108**, 40–55.

Xiang, M., Grove, J., & Giannakidou, A. (2013). Dependency-dependent interference: NPI interference, agreement attraction, and global pragmatic inferences. *Frontiers in Psychology* **4**, article 708. Online <https://doi.org/10.3389/fpsyg.2013.00708>.

Zanuttini, R. (1997). *Negation and clausal structure: a comparative study of Romance languages*. Oxford: Oxford University Press.

Zeijlstra, H. (2004). *Sentential negation and negative concord*. Unpublished doctoral dissertation, University of Amsterdam.

Zeijlstra, H. (2008). On the syntactic flexibility of formal features. In T. Biberauer (ed.), *The limits of syntax* (pp. 143–174). Amsterdam: John Benjamins.

# Appendix

# Items

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| ***Critical Items: Object Double Negation*** | | | | |
| 1 | Dave has been having bad luck as a goalkeeper, but today's game was different. | He didn't block no shots during the game. | Dave failed to block all the shots taken at his goal. | F |
| 2 | Dr Ryan was surprised to be called in to the hospital on her day off. | She didn't treat no patients at the hospital. | Dr Ryan treated patients at the hospital. | T |
| 3 | Gina usually refuses to answer questions, but she really liked the reporter this time. | She didn't answer nothing in that interview. | Gina answered questions during the interview. | T |
| 4 | Greg lost most of his blackjack games, but he did great at the poker table. | He didn't beat nobody at poker. | Greg lost all of his poker games. | F |
| 5 | Jack hardly ever sees people on his way home, but last night was different. | He didn't see nobody last night. | Jack saw at least one person. | T |
| 6 | Janet usually skips breakfast, but this morning she was especially hungry. | She didn't eat nothing for breakfast. | Janet skipped the first meal of the day. | F |
| 7 | Kyle was happy to see people he knew at the freshman orientation party. | He didn't have no friends at the party. | Kyle had a few friends at the freshman orientation party. | T |
| 8 | Kyra expected the library shelf to be empty, but was happy to find what she needed. | She didn't find no books about writing. | Kyra left the library without the writing books she was looking for. | F |
| 9 | Lance was tired of being alone on New Year's, so this year he decided to make a change. | He didn't kiss nobody at midnight. | Lance was left without someone to kiss at midnight. | F |
| 10 | Lara expected to find the safe empty when she opened it, but she was surprised. | She didn't find nothing in the safe. | Lara found something in the safe. | T |
| 11 | Lenny dislikes animals, but was surprisingly welcoming toward his friends' dog. | He didn't let no pets in his house. | Lenny let his friends bring their pet to his house. | T |

## Appendix (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *12* | Lisa was pleasantly surprised at the paint selection Walmart had. | She didn't get no paint from Walmart. | Walmart was missing the paint Lisa was looking for. | F |
| *13* | Marvin usually avoids gardening, but he agreed to help a friend on his day off. | He didn't water no plants that day. | Marvin avoided watering plants on his day off. | F |
| *14* | Meera tends to drink juice instead of water, but today she ran a long race. | She didn't drink no water after the race. | Meera drank water when she finished the race. | T |
| *15* | Sabeena was surprised to find several dresses that suited her. | She didn't like nothing in that boutique. | Sabeena disliked all the stuff being sold in that boutique. | F |
| *16* | Sandeep usually travels alone, but this year his friend wanted to travel with him. | He didn't bring nobody on vacation. | Sandeep brought a friend on vacation with him. | T |

### Critical Items: Object Negative Concord
*Note that only the context column differs from items 1–16.*

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *17* | Dave had a terrible day as his soccer team's goalkeeper. | He didn't block no shots during the game. | Dave failed to block all the shots taken at his goal. | T |
| *18* | Gina strongly disliked the newspaper reporter that was interviewing her. | She didn't answer nothing in that interview. | Gina answered questions during the interview. | F |
| *19* | Greg had terrible luck at the casino last night. | He didn't beat nobody at poker. | Greg lost all of his poker games. | T |
| *20* | Jack felt very lonely on his walk home from work yesterday. | He didn't see nobody last night. | Jack saw at least one person. | F |
| *21* | Janet woke up late and had to rush to get to work on time. | She didn't eat nothing for breakfast. | Janet skipped the first meal of the day. | T |
| *22* | Kyle felt lonely when he went to the freshman orientation party at his new school. | He didn't have no friends at the party. | Kyle had a few friends at the freshman orientation party. | F |
| *23* | Kyra was disappointed at the library's book selection. | She didn't find no books about writing. | Kyra left the library without the writing books she was looking for. | T |
| *24* | Lance was sad to be alone on New Year's. | He didn't kiss nobody at midnight. | Lance was left without someone to kiss at midnight. | T |
| *25* | Lara opened the safe and was disappointed when she looked inside. | She didn't find nothing in the safe. | Lara found something in the safe. | F |

## Appendix (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *26* | Lenny's friends were visiting, and he was explaining his house rules. | He didn't let no pets in his house. | Lenny let his friends bring their pet to his house. | F |
| *27* | Lisa tried and failed to find the right color paint for her bedroom walls. | She didn't get no paint from Walmart. | Walmart was missing the paint Lisa was looking for. | T |
| *28* | Marvin was tired so he took a day off from his gardening job. | He didn't water no plants that day. | Marvin avoided watering plants on his day off. | T |
| *29* | Meera preferred to drink Gatorade after a long run. | She didn't drink no water after the race. | Meera drank water when she finished the race. | F |
| *30* | Sabeena went to a special boutique but still failed to find the right dress. | She didn't like nothing in that boutique. | Sabeena disliked all the stuff being sold in that boutique. | T |
| *31* | Sandeep decided to do some traveling by himself during his time off. | He didn't bring nobody on vacation. | Sandeep brought a friend on vacation with him. | F |
| *32* | The hospital Denise worked at was very slow during her shift that day. | She didn't treat no patients at the hospital. | Denise treated patients at the hospital. | F |

### Critical Items: Subject Double Negation

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *33* | All John's close friends were ready to pitch in after his party was over. | Nobody didn't help clean after the party. | All John's friends left without helping to clean up. | F |
| *34* | All the teams in the tournament were rewarded for good sportsmanship. | No team didn't win a prize at the tournament. | All the teams won a prize at the tournament. | T |
| *35* | Carl made sure all the babies got enough sleep at day care. | No babies didn't nap in the afternoon. | All of the babies slept in the afternoon. | T |
| *36* | Francesca broke everything when she bumped into the cabinet. | Nothing didn't fall from the shelf. | Everything in the cabinet fell off the shelf. | T |
| *37* | Frank gave his first-graders a simple assignment, and everyone finished it fast. | No children didn't finish their work during class. | All the children had to finish their work after class. | F |
| *38* | Ken's picture frames fell off the wall during the storm, but he got lucky. | Nothing didn't land in a safe place. | Ken's picture frames landed in safe places. | T |
| *39* | Lots of families visited the animal shelter and found dogs to adopt. | No dogs didn't move to a new home. | Most dogs were left at the animal shelter. | F |

**Appendix** (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *40* | The fans were excited to see their favorite team play. | Nobody didn't watch the game last night. | Everyone watched last night's game. | T |
| *41* | The loud neighborhood was unusually quiet throughout the evening yesterday. | Nobody didn't sleep enough last night. | People were able to get enough sleep. | T |
| *42* | The orchestra in the park was playing a beautiful symphony, and everyone stopped. | Nobody didn't listen to the music. | Everyone ignored the music playing in the park. | F |
| *43* | The preschoolers had a hard time sitting still with their milk and cookies. | No milks didn't spill during snack time. | All the preschoolers drank their milks neatly from their cups. | F |
| *44* | The school arranged for classes to meet online after the snow storm. | No classes didn't meet on the snow day. | Classes were cancelled on the snow day. | T |
| *45* | The school regretted letting students bring their toys outside to recess. | No toys didn't break on the playground. | All the students' toys broke on the playground. | T |
| *46* | The servers kept the dishes on hot plates until it was time to eat. | Nothing didn't stay warm for the dinner. | The dishes were cold at dinner time. | F |
| *47* | The workshop was extremely well organized. | Nothing didn't start on time at the workshop. | The workshop events all started late. | F |
| *48* | There are certain stations that both the express and local trains had to stop at. | No train didn't stop at the last station. | Every train stopped at the last station. | T |

### Critical Items: Subject Double Negation
*Note that only the context column differs from items 33–48.*

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *49* | All John's close friends disappeared as soon as his party was over. | Nobody didn't help clean after the party. | All John's friends left without helping to clean up. | T |
| *50* | All the teams in the tournament were punished for bad sportsmanship. | No team didn't win a prize at the tournament. | All the teams won a prize at the tournament. | F |
| *51* | Frances got lucky when she bumped into the cabinet. | Nothing didn't fall from the shelf. | Everything in the cabinet fell off the shelf. | F |
| *52* | Frank made his first-graders complete a really challenging assignment. | No children didn't finish their work during class. | All the children had to finish their work after class. | T |
| *53* | Ken's picture frames fell off the wall and were damaged during the storm. | Nothing didn't land in a safe place. | Ken's picture frames landed in safe places. | F |

# Appendix (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *54* | The animal shelter had dogs up for adoption for a long time. | No dogs didn't move to a new home. | The dogs were left at the animal shelter. | T |
| *55* | The babies were all playful and restless after lunch. | No babies didn't nap in the afternoon. | All of the babies slept in the afternoon. | F |
| *56* | The fans were distracted by news about the presidential election. | Nobody didn't watch the game last night. | Everyone watched last night's game. | F |
| *57* | The huge snow storm made it difficult to get to campus. | No classes didn't meet on the snow day. | Classes were cancelled on the snow day. | T |
| *58* | The last stop on the train line was undergoing heavy construction. | No train didn't stop at the last station. | Every train stopped at the last station. | F |
| *59* | The meal was prepared too early, and the dishes sat out for a long time. | Nothing didn't stay warm for the dinner. | The dishes were cold at dinner time. | T |
| *60* | The orchestra in the park was competing with a loud and rowdy baseball game. | Nobody didn't listen to the music. | Everyone ignored the music playing in the park. | T |
| *61* | The preschoolers sat quietly while having their milk and cookies. | No milks didn't spill during snack time. | All the preschoolers drank their milks neatly from their cups. | T |
| *62* | The teachers were surprised at how careful students were with their toys during recess. | No toys didn't break on the playground. | All the students' toys broke on the playground. | F |
| *63* | The workshop was disorganized, and there were lots of scheduling mistakes. | Nothing didn't start on time at the workshop. | The workshop events all started late. | T |
| *64* | There were lots of loud parties happening in the usually quiet neighborhood. | Nobody didn't sleep enough last night. | People were able to get enough sleep. | F |

### Critical Items: Syntactic Double Negation

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *65* | All the dogs except for one raced to find their food bowls. | The dog that didn't find her bowl ate nothing for dinner. | One of the dogs went without food at dinner. | T |
| *66* | Most of the hotel workers were able to help drive guests to the airport. | The man that didn't have a car drove nobody to the airport. | The man without a car was able to give rides to the airport. | F |
| *67* | The camp counselor told all the kids to give their partners a hug. | The boy that didn't have a partner hugged nobody at camp. | All the kids had a partner to hug. | F |

**Appendix** (*Cont.*)

| | Context | Item | Question | T/F |
|---|---------|------|----------|-----|
| 68 | The candidates were all expected to be friendly with the crowd after speaking. | The candidate that didn't like people shook no hands after his speech. | All the candidates shook hands after their speeches. | F |
| 69 | The teacher passed out bread for the kids to feed the ducks. | The girl that didn't get bread fed no ducks at the lake. | The girl without bread fed some ducks at the lake. | F |
| 70 | The teachers with enrolled students were busy planning their lesson. | The teacher that didn't have students planned no lesson for the first day. | One teacher had zero planning to do for the first day. | T |
| 71 | There was lots of good desserts at the party, and most guests enjoyed them. | The guest that didn't like sweets ate nothing at the party. | One guest chose to skip the food at the party. | T |
| 72 | There were house painting jobs available for everyone in need of work. | The woman that didn't need work painted no houses last week. | The woman who had work decided against painting houses last week. | T |

**Filler Items: Accusative Subject**

| | Context | Item | Question | T/F |
|---|---------|------|----------|-----|
| 73 | Don has a weekly study schedule that he likes to stick to. | Him and Fatima study at the library together on Wednesday nights. | Don studies at the library by himself on Wednesday nights. | F |
| 74 | Everyone in our dorm has assignments to work on this weekend. | Me and Jake have three papers to finish before Monday. | Jake is free the entire weekend, with very little work to do. | F |
| 75 | Grace is running in her first marathon, and she's bringing a friend. | Her and Clarissa will run the marathon together. | Grace will run the marathon with her friend Clarissa. | F |
| 76 | Greg and his friends are talking about what they want to do when they graduate. | Him and Kurt hope to get jobs right after college. | Greg and Kurt want to be employed when they graduate. | T |
| 77 | I did a lot of playing outside when I was a little kid. | Me and my brother used to play tag and hide and go seek. | I played only video games when I was growing up. | F |
| 78 | Jane and her roommates are figuring out how to divide the chores. | Her and Bob will take turns mowing the lawn on Sundays. | Both Jane and Bob will help to mow the lawn. | T |
| 79 | Keesha decided to do a presentation instead of a final paper for English class. | Her and three other students gave presentations on the last day. | Keesha gave a presentation on the last day of English class. | T |
| 80 | My group of friends decided we'd all take our moms out for Mother's Day. | Me and my mom are going out for afternoon tea. | At least one person in the group will go out for tea. | T |

35

## Appendix (*Cont.*)

| | Context | Item | Question | T/F |
|---|---------|------|----------|-----|
| **Filler Items: Double Quantifier** | | | | |
| *81* | People do different things to relax on weekends. | Many people often go for walks on Sundays. | People rarely take walks on Sundays. | F |
| *82* | The assignments and exams for the math class were relatively easy. | Everybody always finished the exam early. | Some people finished the exam late. | F |
| *83* | The museum along the river was old and outdated. | Few tourists seldom visited that museum. | People hardly visited the museum along the river. | T |
| *84* | The musicians were dedicated to improving during the workshop. | Many musicians often practiced for several hours after class. | The musicians only practiced during class. | F |
| *85* | The neighborhood was known for being dangerous. | Few taxi drivers rarely drove to that neighborhood. | Taxi drivers drove to the neighborhood even though it was dangerous. | F |
| *86* | The ocean water at that beach was cold and shark infested. | Few beach goers rarely swam in that water. | The beach goers stay on land instead of swimming. | T |
| *87* | The professor gave challenging problems for the students to work on. | Many students frequently asked questions about the problems in class. | Students ask questions during class time. | T |
| *88* | The race was held on a very hot day in the middle of summer. | Everyone always drank lots of water during the race. | People drank water while they were racing. | T |
| **Filler Items: Double That** | | | | |
| *89* | Frank and Cory decided to work on their school project all morning. | Frank said to Cory that later that he would need to stop working on the project. | Frank would be able to keep working after the morning. | F |
| *90* | Gaby was getting ready to take a long road trip on her vacation. | Sam reminded Gaby that before she left for vacation that she should close the windows. | Sam planned to close the windows himself. | F |
| *91* | Grace washed her clothes but then forgot to put them in the dryer. | Christian reminded Grace that later that she would need to finish the laundry. | Christian decided to refrain from telling Grace about the laundry. | F |
| *92* | Jacqui was taking her son Brian to get his first haircut at the barber shop. | Jacqui promised Brian that afterward that he would get an ice cream. | Brian was promised an ice cream after his haircut. | T |

**Appendix** (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| 93 | Jeff told Amy he was worried when she boarded her flight. | Amy said to Jeff that when her flight landed that she would call him. | Amy failed to respond to Jeff's concerns. | F |
| 94 | Luke and Jen were getting ready to go out to dinner together. | Luke told Jen that soon that he would be ready to leave for dinner. | Luke said he would need a lot more time to get ready. | T |
| 95 | Martin was concerned that Katya was working too much without eating. | Katya told Martin that after she finished her homework that she would eat. | Katya was planning to eat after finishing her homework. | T |
| 96 | Steve wanted company while he was working at the coffee shop. | Steve promised Jessica that if she went to the coffee shop with him that he would buy her a coffee. | Steve said he'd buy Jessica a coffee if she accompanied him. | T |

### Filler Items: Reported Speech

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| 97 | Abby's friend asked her when she'd be ready to have dinner. | Abby said that she'd be ready for dinner when her basketball practice ended at 7. | Abby said she'd be ready for dinner after basketball practice. | T |
| 98 | Corinna's daughter asked her where she was going. | Corinna said that she was taking the dog to the veterinarian for a check-up. | Corinna told her daughter that she was on her way to the veterinarian. | T |
| 99 | Glenda and her roommates were sharing their travel schedules for the year. | Glenda said that she planned to visit her family during spring break. | Glenda told her roommates she would stay at school and work during spring break. | F |
| 100 | Jackie and Lisa were discussing what their kids wanted for their birthdays. | Jackie said that Max asked for a puppy. | Jackie said her kids all asked for toys instead of pets. | F |
| 101 | Mark and his brother were telling their parents about school. | Mark said that one professor gave really interesting lectures. | Mark told his parents that all of his professors were boring. | F |
| 102 | Steve asked Barry what he should order at the restaurant. | Barry said that he always gets a pizza with anchovies. | Barry said that he always orders a salad at the restaurant. | F |
| 103 | The roommates were trying to figure out what needed cleaning. | Ron said that Rickie had cleaned the bathroom last week. | Ron had information about when the bathroom was cleaned. | T |
| 104 | The students were talking about a challenging class they were taking. | Katherine said that she got a good grade on the midterm. | Katherine said she did well on the midterm exam. | T |

## Appendix (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| ***Filler Items: Resumptive Pronouns*** | | | | |
| *105* | After a long flight, Giselle and her colleague attended different lectures at a conference. | Giselle attended a lecture that if it had been shorter she would have stayed awake. | Giselle had a hard time staying awake during the lecture. | T |
| *106* | Derek and his friends were taking turns choosing songs for karaoke. | Derek chose a song that if his friends had known it better they would have sung along. | Derek's friends all sang along with the song he chose. | F |
| *107* | Different people brought different foods for us to eat on our camping trip. | Jeff brought some eggs that if we had eaten them we would have gotten sick. | Jeff only brought dried fruit and candy on the trip. | F |
| *108* | Karina and I were cleaning out the house we had lived in for a long time. | Karina kept the pictures that if we had thrown them away we would have been sad. | The pictures were saved by Karina. | T |
| *109* | Maria and her sister Giovanna have different reactions to the weather. | Maria is someone who whenever there's a thunderstorm she hides. | Maria will hide if there is thunder and lightning. | T |
| *110* | Mitch and Minnie went to different parties last night. | Minnie went to a party that if it had been closer to home she would have stayed longer. | Minnie stayed all night at the party she went to. | F |
| *111* | Sasha and Sarita went to a diner for a late lunch. | Sasha ordered a burger that if she had eaten it all she would have been stuffed. | Sasha's meal was more than enough to fill her up. | T |
| *112* | Sometimes Marcus sits and thinks about all of the things he does each day. | There are a lot of things that Marcus wonders why he does them. | Marcus knows why he does most of the things he does. | F |
| ***Filler Items: Simple Negation*** | | | | |
| *113* | Corinne moved her favorite flower into her bedroom. | The flower didn't stay alive indoors. | Corinne's flower flourished in her bedroom. | F |
| *114* | Jackie fixed the swiveling chair so that people could sit quietly in it. | The chair didn't squeak after being fixed. | The chair still squeaked after Jackie fixed it. | F |
| *115* | Jennie and Timeka had hot cocoa after they did the dinner dishes. | The mugs didn't get washed until the next morning. | The mugs were left dirty overnight. | T |
| *116* | Kristal was unable to print her homework in time for class. | The printer didn't work when she needed it. | Kristal's printer failed to print out her assignment. | T |

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *117* | Some required courses are only held one semester per year. | The introductory statistics course didn't meet during spring semester. | Students were unable to take introductory statistics in the spring. | T |
| *118* | The campus café workers arrived to work late because of the snow. | The coffee didn't get brewed in time for the breakfast rush. | The coffee was ready on time, in spite of the snow. | F |
| *119* | The morning rain affected the recess schedule at the elementary school. | The kindergarten class didn't go outside at recess. | All classes were able to go outside at recess. | F |
| *120* | The musicians rushed to prepare their instruments, but some took too long. | The violin didn't get tuned before the performance. | The violin was out of tune during the performance. | T |

***Filler Items: Center Embedding***

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| *121* | All the kids planted flowers in the school garden. | The flower that the boy that the girl hugged planted was growing. | The flower failed to grow. | F |
| *122* | People had different opinions about the farmers in their area. | The food that the farmer that the people liked grew was organic. | The food had artificial chemicals. | F |
| *123* | The articles were all of different lengths. | The article that the reporter that the employer paid wrote was short. | The article was very long. | F |
| *124* | The people who attended the dinner had a wonderful time. | The food that the chef that the woman hired cooked was delicious. | The food was really tasty. | T |
| *125* | The pilots all flew different kinds of planes to their destinations. | The plane that the pilot that the passengers liked flew was delayed. | The plane failed to leave on time. | T |
| *126* | The police officers were all assigned a specific squad car to drive. | The car that the cop that the chief hired drove was brand new. | The car was old and decrepit. | F |
| *127* | The riding instructor chose different horses for her students. | The horse that the boy that the instructor taught rode was gentle. | The instructor chose a gentle horse for the boy. | T |
| *128* | The student got lots of different assignments from her teachers. | The paper that the teacher that the student likes assigned was hard. | The paper was a hard assignment. | T |

## Appendix (*Cont.*)

| | Context | Item | Question | T/F |
|---|---|---|---|---|
| ***Filler Items: Subject Relative Clause*** | | | | |
| 129 | Many of the roads in that town were made of gravel and dirt. | The road that was paved got the most traffic at rush hour. | The paved road had more traffic than the other roads. | T |
| 130 | Most kids tried to avoid the vegetable dishes at the birthday party. | The kid that liked spinach ate all the salad at the party. | The spinach salad was left untouched. | F |
| 131 | Sarah and Steven decided to clean out their t-shirt drawers. | The t-shirts that had holes were thrown away that day. | Some t-shirts had to be discarded. | T |
| 132 | Some of the neighborhood families let their cats outside to play with the children. | The cats that had claws were kept inside in the daytime. | All the cats in the neighborhood were let out to play. | F |
| 133 | Some of the scheduled concerts were more popular than others. | The concert that sold the fewest tickets was cancelled yesterday. | One of the concerts was cancelled. | T |
| 134 | The restaurant was beginning to get crowded. | The servers that had full sections were busy that night. | Some servers had sections that were full. | T |
| 135 | The rides at the amusement park were due for regular maintenance. | The ride that needed repair was closed for the weekend last week. | All of the amusement park rides remained open. | F |
| 136 | There were several groups waiting to be seated at the restaurant. | The group that had a reservation sat first last night. | The first group to arrive sat before the group with the reservation. | F |
| ***Practice Items*** | | | | |
| 137 | I like to go dancing with my friends. | Me and my friend Adrienne went swing dancing last Friday. | Last Friday, I went swing dancing. | T |
| 138 | Jessie and her friends went hiking in a new state park. | Jessie avoided the trail that if they'd taken it they would have gotten lost. | Jessie and her friends took a trail that might have gotten them lost. | F |
| 139 | Katy was telling her sister about her new boyfriend. | Katy said that he was a sophomore majoring in English. | Katy told her sister that her boyfriend was majoring in Spanish. | F |
| 140 | Teams from several high schools were competing in a relay race. | The team that won the race got a cash prize. | The winning team was awarded money. | T |