

Negative Polarity Item (NPI) Illusion Is a Quantification Phenomenon

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Illusions of grammaticality have often been used to probe the properties of the human sentence processor in syntactic activities like subject–verb agreement, reflexive binding, and negative polarity item (NPI) licensing. Originally, NPI licensing in processing was thought to be a product of cue-based retrieval. Mounting evidence that the NPI illusion is far from universal suggests that a revised account is necessary. We examine the distribution of the NPI illusion using a single methodology and evaluate its compatibility with existing theories. We find that most licensors fail to show illusion behavior but the negative quantifier *no* and the quantificational phrase *not a single* trigger illusion in high and low relative clause positions. This evidence indicates that distribution of NPI illusion is not predicted by existing processing accounts. Future explanations must engage the unique properties of negative quantifiers to account for the distribution of the NPI illusion phenomenon.

Keywords: linguistic illusion, negative polarity, quantification, sentence processing, speeded judgments

In the following studies, we investigate the distribution of the negative polarity item (NPI) illusion with regard to a set of NPI licensors chosen for their syntactic diversity (Vasishth, Brüssow, Lewis, & Drenhaus, 2008). Although originally a landmark illusion in sentence processing, a growing body of work has shown that the NPI illusion has many unique properties and restrictions (de Dios Flores, Muller, & Phillips, 2017; Mendia, Poole, & Dillon, 2018; Muller & Phillips, 2018; Parker & Phillips, 2016; Xiang, Dillon, & Phillips, 2009, 2013; Vasishth et al., 2008). By exploring a range NPI licensors within a single paradigm, we claim that the NPI illusion is more restricted than previously thought. We show that, among negative licensors, only negative quantifiers give rise to the NPI illusion effect and can do so regardless of the depth of embedding within a relative clause. Both *not* and *no* are negative and NPI licensors, yet the NPI illusion effect only arises with *no*. Beyond *no* we see an illusion effect for *not a single*, a negative quantificational phrase. This result indicates that explanations of the NPI illusion phenomenon must look beyond the factors relevant for licensing NPI and consider the contribution of the other properties of these illusion triggering licensors. We propose a basic account of this phenomenon based on plausible parsing principles and the quantifier raising operation which is designed to narrowly target negative elements which are also D-quantifiers.

NPI and NPI Illusion


Polarity items are words, phrases, or clauses that engage in a dependency relation with a polarity licensing element (Adger & Quer, 1997; Baker, 1970; Fauconnier, 1975; Klima, 1964; Krifka, 1994; Lasnik, 1972; Ladusaw, 1980, 1992; Linebarger, 1987; Von Stechow, 1999). We can consider this dependency relationship to be contingent on three factors: the properties of the polarity licensor, the properties of the polarity item, and a structural licensing condition. In their basic formulation polarity items are split into two groups based on their sensitivity: NPI, which must be in the scope of, or c-commanded by, a downward entailing licensor and positive polarity items (PPI), which must not be c-commanded by a downward entailing licensor (Ladusaw, 1992).

(1a) is downward entailing where, if (1a) is true, the more specific statement in (1c) must be true. In this way downward entailment can be characterized by a pattern of entailment relations and can be attributed to specific elements in a sentence. (1b), a minimal pair of (1a), makes no requirement on the truth of the more specific statement (1d), indicating that the downward entailment we see in (1a) is a consequence of the addition of the negative element.

1. (a) The man **didn't** (*ever*) wear shoes.
- (b) The man did ^{*}(*ever*) wear shoes.
- (c) The man **didn't** wear red shoes.
- (d) The man did wear red shoes.

C-command refers to a structural relation, such that an element, A, c-commands another element, B, if neither A nor B dominates the other, and if the first branching element that dominates A also dominates B (Reinhart, 1997). In (2a) *didn't* c-commands the NPI *anybody* as neither dominates the other and they are both dominated by *T'*. Because *didn't* is downward entailing and c-commands *anybody*, the NPI is licensed and the

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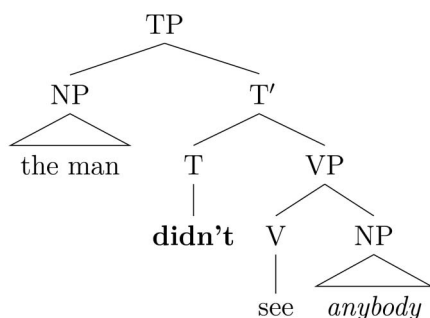
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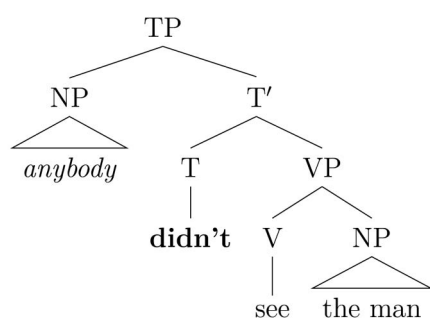
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sentence is grammatical. In (2b) *anybody* is higher than the negative element *didn't* in the syntactic structure, is not c-commanded by a negative element, and is therefore ungrammatical.

2. (a)



(b)



Many proposals exist that state different requirements for licensing NPI than those stated here. In general, these approaches do not share the same notions of c-command and downward entailment but instead state alternative structural and meaning requirements. Two prominent areas of research in NPI then are explorations of the properties and environments that allow for NPI. Looking at properties, there have been many proposals of more relaxed licensing features than downward entailment, including Strawson entailment, nonveridicality, pragmatic strengthening, negative presupposition, or some combination of these features which are then deployed in different cases to capture the distribution of NPI (Chierchia, 2004, 2006, 2013; Giannakidou, 2011; Israel, 2004; Kadmon & Landman, 1993; Krifka, 1994; Lahiri, 1998; Von Stechow, 1999). The structural relationship between licensors and polarity items and the identifying consequences of differing licensing structures for NPI and the broader set of polarity items is another critical research agenda (Barker, 2018; Collins & Postal, 2014; Gajewski, 2007; Homer, in press; Szabolcsi, 2004). Investigations in this area often look at complex structures with multiple licensing elements, various levels of embedding, and other structural factors. To illustrate, the small set of NPI examples in (3) are generally acceptable and have been argued to use distinct licensing conditions. Although one could be concerned about the mismatches between theoretical accounts and processing oriented research, we set this issue aside for now and adopt the somewhat simplified licensing condition based in downward entailment and c-command presented above.

3. (a) **No** man *ever* wore red shoes.

(b) **Only** the man *ever* wore red shoes.

(c) **Few** men *ever* wore red shoes.

(d) **More than three** men *ever* wore red shoes.

(e) The men **haven't** *ever* wore red shoes.

(f) The man **regrets** that he *ever* wore red shoes.

Investigations into the processing of NPI have uncovered that, for certain NPI containing ungrammatical sentence types, readers find the sentence to be more acceptable, read the NPI or following words quicker, and present with shorter fixation durations (Parker & Phillips, 2016; Vasishth et al., 2008). The general schematic of such sentences is given in (4c), with the grammatical and ungrammatical baselines (4a) and (4b). (4b) and (4c) are equally ungrammatical per the licensing conditions on NPI. Because these sentences have the same status in grammar, the ameliorative effects we see for structures similar (4c) are commonly said to be NPI illusions, which are part of a wider phenomenon of illusions of grammaticality that emerge from the properties of the human sentence processor.

4. (a) **No** man who the woman trusted will *ever* go to Paris.

(b) The man who the woman trusted will *ever* go to Paris.

(c) The man who **no** woman trusted will *ever* go to Paris.

To date, there have been several proposals for how best to account for illusory NPI licensing. We will be focusing on three: Cue-based retrieval, feature percolation, and negative inferencing. Each of these models capture subsets of the NPI illusion data with varying degrees of success, but we will see that all three fail to account for the whole distribution of NPI illusions. In the present study we further extend our knowledge of the distribution of NPI illusions, and propose an account for NPI illusion that narrowly targets the processing of negative elements which are also D-quantifiers.

Cue-Based Approaches to NPI Illusion

The earliest account of the NPI illusion relied on content-addressable, cue-based retrieval models of sentence comprehension (Lewis & Vasishth, 2005; Vasishth et al., 2008). Although we assume that comprehenders need to connect the various linguistic elements that they hear or read in some sort of structural representation, we find that comprehenders will sometimes accept or treat as more acceptable, certain sentences which are in fact ungrammatical (Lewis & Vasishth, 2005; Phillips, Wagers, & Lau, 2011; Van Dyke & Lewis, 2003; Vasishth et al., 2008; Wagers, Lau, & Phillips, 2009). These illusions of grammaticality, much like in the case of the NPI illusion discussed above, often present with more favorable acceptability judgments, faster reading times and shorter fixation durations compared with ungrammatical baselines. Cue-based retrieval models of sentence comprehension were developed in part to capture these differences between grammatical expectation and observed processing behavior (Lewis & Vasishth, 2005; Parker, Shvartsman, & Van Dyke, 2017; Van Dyke & Lewis, 2003; Vasishth et al., 2008; Wagers et al., 2009).

A robust and well-studied case of illusion that has been modeled in a cue-based framework is agreement attraction, which has been found in many processing measures with a diverse array of meth-

odologies (Dillon, Mishler, Sloggett, & Phillips, 2013; Patson & Husband, 2016; Staub, 2010; Tanner, Nicol, & Brehm, 2014; Wagers et al., 2009). This illusion refers to the fact that comprehenders give higher acceptability ratings and experience faster reading times for (5c) than (5b).

5. (a) The keys to the **cabinet** *are* on the shelf.
- (b) The key to the **cabinet** *are* on the shelf.
- (c) The key to the **cabinets** *are* on the shelf.

In (5b) the subject and verb mismatch in their grammatical number marking resulting in an ungrammatical sentence. In (5c) these elements mismatch in the same way but a structurally inaccessible element *cabinets* does happen to match the verb on this number marking feature. The illusion of agreement attraction boils down to a bump in acceptability or processing speed due to the contribution of an inaccessible matching number feature.

In cue-based sentence processing models, sentences are processed through a feature-driven parallel access memory mechanism to form long distance connections between incoming elements and elements that the comprehender has previously integrated into their structural representation, subject to constraints on working memory (Lewis & Vasishth, 2005). For our interests this means that linguistic dependencies are formed when the tail element of a potential dependency triggers the memory retrieval process to search for the head of the dependency.

Working within the example of subject verb agreement, when a comprehender encounters a verb with plural agreement morphology, such as *are* in (5), retrieval cues such as [+plural] and [+Nom.] trigger the activation of previously encountered elements that match these cues (Van Dyke & Lewis, 2003). If an element is activated by all the cues, such as *keys* in (5a), it ought to be successfully retrieved and linked to the verb. If no element matches all the cues then the retrieval should fail and the comprehender should experience processing penalties for what will be an ungrammatical structure, as in (5b). However, there is some room between completely matching a prior element and having no matches at all. It is possible for an element to match on just a subset of cues. In (5c), *cabinets* does exactly this. In this case, the occasional mistaken retrieval of the inaccessible *cabinets* on the basis of its single matching cue, [+plural], forms a connection between two elements that should not be able to be linked, resulting in an illusion of grammaticality. As a general model of sentence processing, retrieval error can also produce a negative polarity illusion, provided the right set of cues.

NPI illusions are thought to arise when an element that is inaccessible is retrieved based on a partial match, as in any other illusion. In this case, a valid negation feature, [+Neg], but the absence of the proper structural licensing feature, [+C-command] occasionally causes a mistaken retrieval (Vasishth et al., 2008). Returning to (4a), we see a sentence where a word, *no*, is a match for both retrieval cues, in (4b) where there is no match for the negation cue, and (4c) where the negation cue is matched by *no*, but it is in an invalid position for the locality cue to match. This third condition could give rise to an illusion of grammaticality in the cue-based model, on the basis of a single feature match. However, recent work on NPI processing presents a challenge to

how NPI are implemented in the current formulation cue-based retrieval.

Much of the investigation of polarity in processing has been limited to the forms *no* and *ever* (Phillips et al., 2011). A growing body of experimental work in a number of different methodologies has uncovered differing processing profiles for a variety of NPI and NPI licensors as well as differences between NPI illusion and other grammaticality illusions (de Dios Flores et al., 2017; Mendia et al., 2018; Parker & Phillips, 2016; Xiang et al., 2009, 2013).

If proper licensing of NPIs requires the formation of a dependency with a negative element as proposed in a cue-based system, all classes of NPI should be susceptible to the illusion phenomenon illustrated in (4c). This however is not the case, as the NPI *any* has been shown to not to cause the NPI illusion effects in acceptability judgments, speeded acceptability judgments and self-paced reading (Parker & Phillips, 2016). This finding presents a challenge to the cue-based implementation of NPI licensing as it predicts that *any* needs to be licensed by a negative element and triggers retrieval in much the same way as an NPI like *ever* does. The simplest amendment for this behavior would be to alter the retrieval cues on a subset of the NPI like *any* to capture the fact that they do not cause illusions. This however would sacrifice the shared licensing features on NPI as a broader class. It would also make accounting for standard licensing cases difficult, as it would be unclear what sort of cue pattern would result in retrieval for (4a) and (4c) for NPI like *ever*, but only (4a) for NPI like *any*. In other words, the challenge is capturing what appears to be not a broad NPI illusion but a more item-specific illusion that applies to some subset of NPI, possibly only *ever*. The same challenge applies on the other end of the dependency, as the negative element *haven't* seems not to produce illusions (de Dios Flores et al., 2017). If one were to alter the cues on this type of negation to prevent it from interfering from inside a relative clause, it would doubtlessly predict a change in the ability of *haven't* to license NPI in a more straightforward sentence such as (3d). Taken at a broadest level the problem facing the cue-based account is that it predicts that all NPI and NPI licensors should give rise to the same illusion effects, though evidence suggests exceptions for both particular NPI and NPI licensors, and any attempts to compensate for the illusion effects cause a disruption to standard licensing cases presented in (3).

Percolation Approaches to NPI Illusion

If cue-based approaches appear unable to capture the existing pattern of NPI illusion without damaging amendments, there are alternative accounts to consider. Primarily developed in discussions of the agreement attraction illusion, feature percolation could also be extended to apply to the NPI illusion (Eberhard, Cutting, & Bock, 2005; Franck, Vigliocco, & Nicol, 2002; Patson & Husband, 2016). In this system illusions arise as a result of the percolation of a feature, like number or polarity, through the syntactic structure of its host noun phrase. Each phrase is marked with a feature value from -1 , very singular, to 1 , very plural, for each binary feature by combining of all the relevant features contained within the phrase. Looking to example (5), the noun phrase in (5a) would receive the feature value closest to 1 as the highest element in the noun phrase *the*

keys to the cabinet is plural and the lower further away element is singular. In (5b) the noun phrase has only singular features and would be weighted with a -1 . In (5c) we have a higher singular and a lower plural element, so this feature value would be closer to -1 ; however, there is a possibility for the phrase to be misinterpreted as plural, due to the contribution of the lower *cabinets*. Adapting this idea to NPIs with negation instead of number quickly runs into the same issues as the cue-based system. Namely, the process of weighting the negation feature on matrix noun phrase in an illusion sentence like (4c) should be invariant across NPIs, yet we know that the NPI licenser *haven't* does not produce illusions in the same contexts where the NPI licenser *no* does. We should similarly be concerned that the negative element *any* doesn't produce the illusion effect while presumably still being subject to the licensing conditions that impact *ever*. Under a percolation system, one would need to both restrict where features can percolate from to capture the lack of illusions for *haven't* and develop a reason that *any* should be immune from percolated negation feature information.

Pragmatic Approaches to NPI Illusion

There also exist a class of accounts that have emerged based on the differences observed in ERP responses to different NPI and NPI licensers. Traditional NPI licensers such as *no*, (3a), and those that lack a negation component such as *only* (3b), have been shown to have different processing profiles in ERP (Xiang et al., 2013). The difference between *no* and *only* in processing has been attributed to the elements having a different relationship to the NPI. As we have previously discussed *no* licenses NPI in a traditional syntactic way, by being a c-commanding negative element. *Only* and verbs like *regret*, (3f), are not theoretically analyzed as negative elements, nor in a such a way that different features, like downward entailment, could allow it to be an NPI licenser (Giannakidou, 2006). *Only* and verbs like *regret* do however, generate a certain set of inferences that would be compatible the presence of an NPI, with an example shown in (6).

6. The man regrets that he (*ever*) wore red shoes → The man would prefer it if he had **not** (*ever*) worn red shoes

The inference we see in (6) contains a negation and would thus be perfectly able to host an NPI. In this split licensing pathway *only* and verbs like *regret* “rescue” NPI through this implication, which itself would be a grammatical host for NPI, as a last resort when faced with a sentence that has an NPI and no true licenser like *no* (Giannakidou, 2011; Giannakidou & Etxeberria, 2018; Xiang et al., 2013). The split licensing pathway itself does not make clear why illusions arise or if they are possible for both licensing and rescuing elements. To this point, it is has also been shown in speeded acceptability judgments that it is possible to generate something that looks much like the NPI illusion in cases where there is no overt licenser, but there is a previous context that invites inferences like in (6) (Mendia et al., 2018). In the example in (7), we see a context sentence which sets up an expectation about the reference set of the matrix noun phrase, such that *a small number of the plants* should not be evaluated as meaning *all of the plants* despite the

plausibility of the interpretation outside of this context (Mendia et al., 2018).

7. Whenever the summer is really dry, Susy expects all of her plants to die. However, a small number of the plants have *ever* died.

This leads to something of a puzzle, as the contextual inferring in (7) appears to give rise to an acceptable NPI in the following sentence in the absence of a licenser, but we also have the evidence from Xiang et al., 2013 that shows no illusion effect for sentences with *only*. This means that it appears that these inferences sometimes trigger illusions but not always. This lack of clarity on the application conditions of these rescuing elements is a target for current research, as is further specification what makes for a suitable rescuing agent (Giannakidou & Etxeberria, 2018; Mendia et al., 2018). There however also exists the question of what separates the cases of pragmatically motivated illusions such as the Mendia et al. (2018) illusions from illusions using traditionally negative licensers such as *no*, as the difference between licensing and rescuing does not lend itself to positing a shared processing mechanism.

This discussion leaves the current theoretical status of NPI processing in a somewhat uncomfortable place. Broader theories like cue-based retrieval and feature percolation face serious challenges in expanding to cover the edge cases of NPI illusion while retaining standard licensing cases. Pragmatic accounts that appeal to rescuing on the other hand, need more development to say exactly when NPI can be rescued, when these rescuing conditions can trigger NPI illusion, and what if anything separates NPI illusion cases involving true licensers from those involving rescuing elements.

A compounding issue is the nature of the evidence in NPI processing. Researchers have employed variety of methodologies to investigate different facets of NPI processing including eye tracking, self-paced reading, ERP, acceptability judgments, and speeded acceptability judgments (de Dios Flores et al., 2017; Drenhaus, Saddy, & Frisch, 2005; Mendia et al., 2018; Parker & Phillips, 2016; Vasishth et al., 2008; Xiang et al., 2013, 2009). However each of these methods comes with different assumptions and provides different information, making it hard to say definitively whether processes observed only in one methodology align with processes observed in other methodologies.

To begin addressing these issues, we examined a broad set of NPI licensers chosen for their syntactic properties through the use of speeded acceptability judgments with a goal of uncovering the basic distribution of NPI illusion in a standardized experimental setting. This distribution information in turn is used to determine the basic properties needed for a generalizable account of the NPI illusion and to develop a basic theory of NPI illusion.

The Present Study

The sentential negation *didn't* shares the same syntactic negation property as *no*, as indicated by the acceptability of (6a) and (6b). Different predictions about these licensers' ability to generate illusions, (6c) and (6d), are made by the three different accounts presented above. Under a cue-based account we would

anticipate no differences between these elements on the basis of their shared negation feature. A pragmatic account would also not predict a difference between these elements, as both are traditional negation containing NPI licensors. Feature percolation accounts where depth is a factor in percolation strength could be compatible with a difference in illusion ability, as there is a difference of syntactic structure such that *didn't* appears lower in the structure than *no*.

8. (a) **No** hunter will *ever* shoot a bear.
 (b) The hunter **won't** *ever* shoot a bear.
 (c) The fisherman who **no** hunter respected will *ever* shoot a bear.
 (d) The fisherman who the hunter **didn't** respect will *ever* shoot a bear.

We examined the illusion behavior of *didn't* in Experiment 1 using a speeded judgments task, with the aim to replicate the distinction between *haven't* and *no* in illusory licensing originally shown by de Dios Flores et al. (2017). We then extended this exploration to a variety of alternative licensors and structural configurations. In addition to *didn't* we also tested two other syntactically negative elements, *not* in Experiment 2 and *never* in Experiment 3. While sharing the negative feature, these three negations all occupy different syntactic positions and could reveal whether there is any role of structural height in the distribution of NPI illusion, as might be predicted under a feature percolation account. Experiment 4 investigated downward entailing verbs like *doubt*, which lack a syntactic negation component, much like *only*. If the processing system presupposes that negation is a critical feature, as cue-based retrieval and feature percolation do, these verbs would not be expected to give rise to the NPI illusion. A rescuing account could either be compatible or incompatible with an illusion for these items, depending on how the application conditions for rescuing are formulated. Testing these verbs also serves as a check of another syntactic position from which NPI can be licensed. Experiment 5 tested a more deeply embedded position with the same element, *no*, that has been used in the relative clause subject position of many NPI illusion investigations. If structural height is a critical feature, as it is in feature percolation, we should be able to observe a point at which the illusion switches off as elements become too deeply embedded to percolate with enough strength to trigger illusions, or simply observe illusions for all positions. Experiment 6 investigated the compositionally negative phrase *not a single* in both relative clause subject and more deeply embedded positions. This investigation should reveal whether the illusion generating ability observed for *no* is idiosyncratic to that item or is shared by other negative elements in the same syntactic positions, even if their negation property is compositionally derived.

By working through the syntactic positions that can host NPI licensing elements in a principled way within the same paradigm, we can generate an understanding of the distribution of NPI illusion that is free from the uncertainty that arises from comparing across methodologies. Additionally, by testing these various negative elements, we can see whether existing theories properly predict the distribution of NPI illusion. We find that

NPI illusion only occurs with the licensors *no* and *not a single* but appears in both relative clause subject and positions deeply embedded in the relative clause. Although this pattern of results is not predicted by any of the three theories, a pattern emerges that suggests that the status of the licensor as a D-quantifier appears to be important to the illusion phenomenon. An approach to illusion based on the processing of these quantifiers is presented in the General Discussion section.

Experiment 1

The goal of Experiment 1 was to confirm that the illusion pattern seen in sentences with an inaccessible *no* does not hold for *didn't*. A similar study has previously found evidence to support a lack of illusion behavior for *haven't* (de Dios Flores et al., 2017). Although sentential negation retains the same plausible negation feature as *no*, it differs in its syntactic placement which could be a relevant factor for a feature percolation account of NPI illusion. We compared the two negative elements in a speeded judgment task against the baselines of properly licensed NPI and sentences without an NPI licensing element, a structure shared with Experiments 2–6. Speeded judgments have been successfully used to capture illusion phenomenon because of the tight restriction on the time participants have to reflect on the grammaticality of the sentence (de Dios Flores et al., 2017; Drenhaus et al., 2005; Parker & Phillips, 2016; Vasishth et al., 2008). The illusion within this paradigm presents as an increased proportion of acceptable ratings compared with the ungrammatical licensor absent baseline.

Method

Participants were 64 English speakers contracted through Amazon's Mechanical Turk (<https://www.mturk.com/>). An initial 72 participants were recruited, although two were dropped from the analysis for self-reporting as non-native English speakers and six were dropped from the analysis for failure to comply with task directions. The target recruitment number for all experiments was selected to ensure sufficient statistical power for the experiments and fillers respecting the number of items and conditions. All participants were compensated \$2 for their participation. The task itself was estimated to take around 20 min though participants were allowed 1 hr to complete the task with the ability to pause during that time. The average completion time was just over 30 min, including the reading of forms and any breaks taken.

The task materials consisted of 32 items with four conditions each, which were structured as a subject modified by an object relative clause with a main clause predicate containing the NPI *ever*. In the grammatical baseline condition, the matrix subject contained the NPI licensing negative quantifier *no*. In the licensor absent baseline the sentence contained no NPI licensor in any position. In the attested illusion condition the subject of the relative clause contained *no*, as commonly used in previous studies. These three conditions are present in Experiments 2–6. In the tested illusion condition the relative clause verb was preceded by *didn't*. In all cases the NPI *ever* immediately preceded the main clause verb and came directly after the

Table 1
Experiment 1 Item

Condition	Text
Matrix <i>no</i>	No senator who the farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Licensor absent	The senator who the farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Relative <i>no</i>	The senator who no farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Relative <i>didn't</i>	The senator who didn't believe the farmer to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.

Note. Bolded terms indicates the negative elements following the convention utilized through the examples in the article.

auxiliary *will*. An example item is presented in Table 1 and full items appear in Appendix A. In all cases, care was taken to construct the items such that all sentences were similarly plausible and as close to identical as possible outside of the critical manipulations.

Each participant rated a total of 116 sentences, consisting of 32 NPI sentences and 84 filler sentences. The filler sentences consisted of two subsets with similar length and complexity to the NPI sentences. One set focused on semantic mismatches with verbs and manner adjuncts while the other set consisted of mismatches of syntactic number in reflexive binding. Overall the items were balanced such that participants saw an equal mix of good and bad sentences, outside of the target illusion sentences.

Sentences were presented using Ixex Farm (Drummond, 2013). Sentences were presented one word at a time at a rate of 275 ms per word with a 100-ms pause between words. Participants were instructed to read each sentence carefully and to determine whether it was a good sentence of English or not. At the end of each sentence a response screen appeared for 3 s during which a participant could press the *f* key for a good sentence of English or the *j* key if they thought the sentence was not a good sentence of English. If the participant failed to respond within the 3-s window a message displayed that informed them that their response was too slow. After each sentence was judged participants could begin the next sentence at any time by pressing the space key. Participants completed a short practice section, received a restatement of the instructions and then began the experiment. Presentation order was randomized across participants using Ixex Farm's Latin squaring and randomization method.

Results

Data was analyzed using logistic mixed-effect models which were estimated using the lme4 package (R Core Team, 2013). Fixed factors were coded by a three-layer Helmert contrast. The first layer is the ungrammaticality contrast which compares the single grammatical condition, matrix *no*, weighted 1, and the two illusion cases and the licensor absent case each weighted $-1/3$. The next layer drops the grammatical condition, weighted 0, and compares the licensor absent case, weighted -1 , with the two illusion cases each weighted $1/2$. The final layer compares the attested illusion weighted 1,

relative *no*, with the experimental illusion, in this case relative *didn't*, weighted -1 . This model architecture is employed for all subsequent experiments along with maximally converging random effects structures for each experiment.¹

The results of Experiment 1 are presented graphically in Figure 1, along with the results of Experiments 2–6. The grammaticality contrast was significant ($p < .001$), the licensor absence contrast was significant with a ($p < .05$), and the tested illusion contrast was significant with a ($p < .001$). Full model output can be found in Table 4.

Discussion

The results of Experiment 1 verify that sentences with *no* in the relative clause do indeed allow for illusory readings, but the sentences with *didn't* do not appear to have the same illusion behavior or have it to a significantly reduced degree. This result poses a challenge to the retrieval account as the relative clause *didn't* should be target by the same retrieval cues as *no*. However, there are a few alternative explanations that could also result in this lack of illusion for *not*. One potential explanation is that participants do not read, process, or otherwise integrate negative contractions in this type of reading task, because the possibility of errors in reading is high, the visual footprint of contracted negation is small, and introduction of negation into an interpretation can strain plausibility (Gibson, Bergen, & Piantadosi, 2013). This could easily be tested by examining *did not* where the negative element is clearly detached and occupies a distinct perceptual space in the sentence. On the other hand, a percolation account might claim that the position occupied by sentential negation is too low, near tense, to generate illusions, whereas *no* sits higher, above tense. Although from these two points alone a full structural account is underspecified, we can also investigate *never* which exists as an adjunct near the verb,

¹ We elect to use this architecture as opposed to one with pairwise comparisons to the baseline for each illusion, because these pairwise comparisons can be effectively reasoned by analysis of the licensor absent versus illusions contrast and the attested versus tested illusion contrast. Although this architecture doesn't allow us to explicitly rule out illusions for the less highly rated of the illusion conditions, it does allow us to evaluate whether there are significant differences between the potential illusion cases and the classic illusion case, without the increased chance of false positives that would result from conducting additional pairwise comparisons.

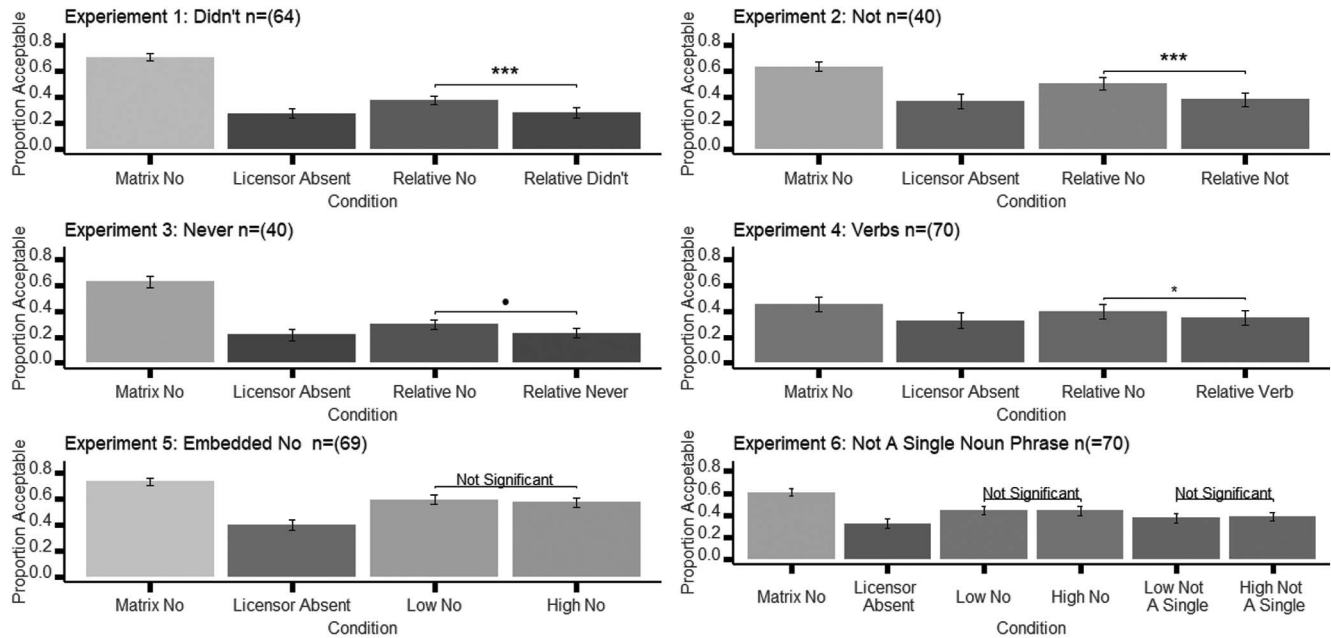


Figure 1. Results of Experiments 1–6. * mark significance values obtained from models which are summarized in Table 4.

as well as NPI hosting verbs like *doubt* which occupy the verb position itself.

Experiment 2

This experiment follows the same design as Experiment 1 with the only change being the use of *did not* instead of *didn't*. It could be possible that in the relatively quick presentation of these sentences participants incorrectly read or process contracted forms. To ensure that the results of Experiment 1 are not an artifact of some property of contraction we investigate the uncontracted forms here.

Method

Participants were 40 English speakers contracted through Amazon's Mechanical Turk. All participants were compensated \$2 for their participation. The task itself was estimated to take around 20 min, although participants were allowed 1 hr to complete the task with the ability to pause during that time. The average completion time was just over 30 min.

The task materials consisted of 32 items with four conditions. These were identical to the items from Experiment 1, except for the sentential negation condition which was written as *did not* as opposed to *didn't*. Full items appear in Appendix B. The fillers remain the same as those from Experiment 1.

The procedure for this experiment follows that of Experiment 1.

Results

The data analysis for this experiment mirrors that of Experiment 1, with the final contrast being between the *no* relative clause sentences and the *did not* relative clause sentences.

The results of Experiment 2 are presented graphically in Figure 1. The ungrammaticality contrast was significant ($p < .001$), the licensor absence contrast was significant with a ($p < .05$), and the tested illusion contrast was significant with a ($p < .001$). Full model output can be found in Table 4.

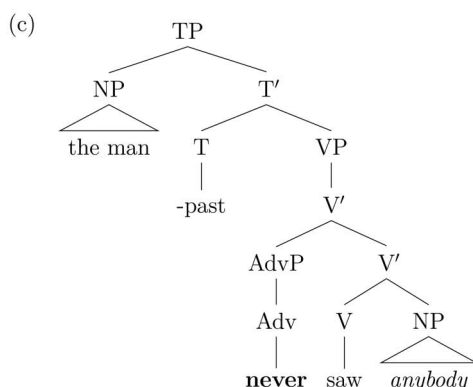
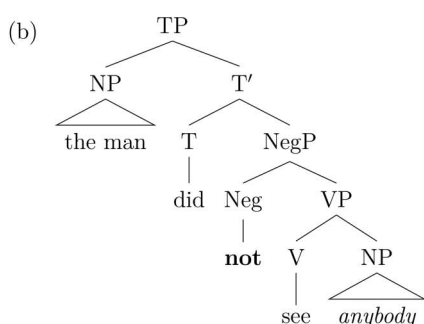
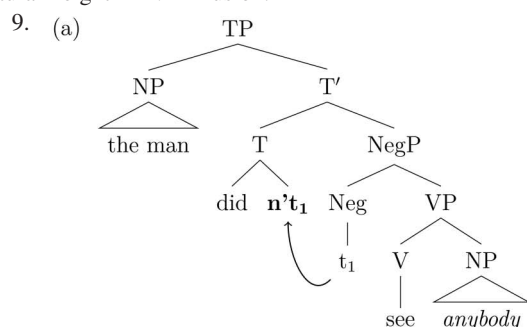
Discussion

The results from Experiment 2 indicate that *did not* follows the same pattern as *didn't* and does not trigger an illusion. This result also supports the notion that some form of mistake in reading based in the morphological presentation of the negation or lack of integration isn't driving the result of Experiment 1, where no illusions are found of *didn't*.

Experiment 3

This experiment follows the same approach as the previous experiments but investigates the negative element *never*. In an account for NPI illusion where structural height plays a critical role, such as feature percolation, we have a strong prediction about the possibility of *never* generating illusions. Both *didn't* and *did not* failed to match the attested illusion effect for relative clause subject *no*. As *didn't* and *did not* occupy the tense position (9a) and the head position of a negative phrase (9b) respectively, the lack of illusion for these elements would predict that elements below them are also too deeply embedded to trigger illusion (Potsdam, 1997). *Never* satisfies this requirement because it is attached as an adjunct near the verb (9c), according to patterns in both tense movement and negative inversion (Santorini & Kroch, 2007). We also have clear predictions for a cue-based account, as *never* is a negative element and would then be expected to be a potential illusion

licensor, though this account already struggles to explain the lack of illusion observed in Experiments 1 and 2. By testing *never* we can get a better sense of the role of specific syntactic positions and structural height in NPI illusion.



Method

Participants were 40 English speakers contracted through Amazon’s Mechanical Turk. All participants were compensated \$2 for their participation. The task itself was estimated to take around 20 min though participants were allowed 1 hr to complete the task with the ability to pause during that time. The average completion time was just over 30 min.

The task materials consisted of 32 sets of four items which were identical to the items from Experiment 1, except for the sentential negation condition which contained the negative element *never* as opposed to *didn’t*. The relative clause structure for the *never* sentences allowed the negative adverb *never* to appear as the first element following the complementizer *who*, matching the linear position of the *no* illusion sentences. Full items appear in Appendix C. The fillers remain the same as those from Experiments 1 and 2.

The procedure for this experiment follows that of previous studies.

Results

The data analysis for this experiment mirrors that of previous studies, with the final contrast being between the *no* relative clause sentences and the *never* relative clause sentences.

The results of Experiment 3 are presented graphically in Figure 1. The ungrammaticality contrast was significant ($p < .001$) and the tested illusion contrast was marginally significant with a ($p < .06$). Full model output can be found in Table 4.

Discussion

The results of Experiment 3 present a slight challenge for interpretation because of the lack of a significant licensor absence contrast and the weak effect for the tested illusion contrast. That being said, a visual inspection of the results in Figure 1 does suggest that *never* likely follows the previously attested pattern, and the difference in significance’s owes to a weaker presentation of the attested relative clause subject *no* illusion in this experiment. This seems to favor the interpretation that relative clause *never* does not provide the boost in acceptability that characterizes the NPI illusion effect. This is consistent with the predictions of a feature percolation account and provides another challenge for the cue-based approach. To summarize, we appear to have mounting evidence to suggest that the ability to license these NPI illusions appears to be unique to the classic relative clause subject *no* case that has been commonly reported in the literature. The next experiment aims to move deeper into the relative clause by testing NPI hosting verbs, like *doubt*.

Experiment 4

Experiment 4 tests an additional syntactic position, that of the NPI hosting verb. Under both a feature percolation account and a cue-based account, these NPI hosting verbs are not predicted to give rise to NPI illusions. In a feature percolation account, these elements should be too low to give rise to illusion, as the verb occurs below *didn’t*, *did not*, and *never*, which all failed to give rise to illusions. Further, as referenced in the discussion of rescuing, verbs that can host NPI are thought to not be truly negative licensors and instead are regarded as rescuers. This means they critically lack a negative feature, which should mean the appropriate cue is not present to percolate in the first place. Cue-based approaches also predict no illusion as these verbs lack the required negation feature and are merely rescuers. As discussed in the introduction, depending on the proposed relationship between rescuing and illusion, pragmatic accounts predict that these verbs could give rise to the illusion effect.

Method

Participants were 70 English speakers contracted through Amazon’s Mechanical Turk. An initial 72 participants were recruited, although two were dropped from the analysis for failing to comply with task instructions. All participants regardless of data use were compensated \$2 for their participation. The task itself was estimated to take around 20 min though participants were allowed 1 hr to complete the task with the ability to pause during that time. The

average completion time was about 30 min, including the reading of forms and any breaks taken.

The task materials consisted of 24 items with four conditions. Alongside the two baseline conditions and the attested *no* illusion conditions from previous studies, the experimental condition contained an NPI hosting verb instead of another negative element. A total of six verbs were used; *doubt*, *forgot*, *refuted*, *denied*, *be amazed* and *be surprised*. These verbs were selected to maintain a shared clause structure while including a reasonably diverse set of NPI hosting verbs. Additionally, each verb is presented in its form which takes a sentential complement, which is the form that allows for the presence of an NPI. An example item is presented in Table 2 and full items appear in Appendix D.

Each participant rated a total of 104 sentences, consisting of 24 NPI sentences and 80 filler sentences. The filler sentences were similar in length and complexity to the NPI sentences. One set investigated gender mismatch in reflexive binding while the other set investigated question formation with sentential embedding nouns. Overall the items were balanced such that participants saw an equal mix of good and bad sentences, outside of the target illusion sentences.

The procedure for this experiment follows that of previous studies.

Results

The data analysis for this experiment mirrors that of previous studies, with the final contrast being between the relative clause *no* and the relative clause NPI hosting verb conditions.

The results of Experiment 4 are presented graphically in Figure 1. The ungrammaticality contrast was significant ($p < .001$), the licensor absence contrast was significant with a ($p < .05$), and the tested illusion contrast was significant with a ($p < .05$). Full model output can be found in Table 4.

Discussion

Conforming with the predictions of both feature percolation and cue-based accounts, NPI hosting verbs appear unable to trigger NPI illusion. We also have more evidence suggesting that rescuing cannot trigger illusions, as now both NPI hosting verbs and *only* have been shown not to give rise to NPI illusion (Xiang et al., 2013).

The standard construction in NPI illusion investigations places the negative quantifier in the subject position of a relative clause, a maximally high position. To truly disambiguate role of the

lexical object *no* and its place in the syntax, we should investigate this licensor in an alternate position in a relative clause. Experiment 5 addresses this issue directly by looking at the potential for illusion with the negative quantifier in the subject position of the relative clause, the classic illusion case, and a more deeply embedded position.

Experiment 5

In this experiment the critical manipulation is the location of the *no* in the relative clause, rather than the type of negative expression. In the attested baseline illusion, *no* appears in the subject position of the relative clause (10a), whereas in the test case *no* appears in a more deeply embedded relative clause position (10b). Cue-based accounts would predict illusions for this lower position as well as the higher position, on the basis of the presence of the negation cue. Feature percolation accounts should however predict no illusion for this lower position, as Experiments 1–4 have shown no illusions for elements that are lower than relative subject *no* and higher than the embedded position *no* we are testing.

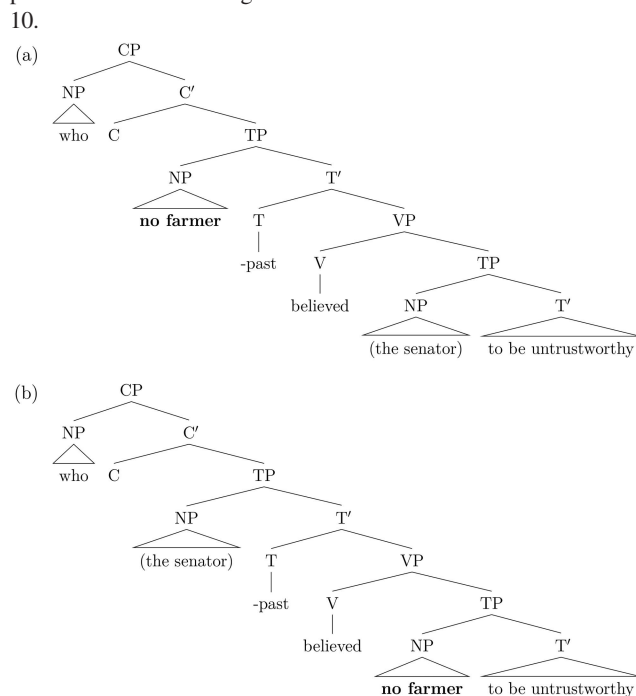


Table 2
Experiment 4 Item

Condition	Text
Matrix <i>no</i>	No hunter who the fisherman remembered would go camping will <i>ever</i> shoot a bear with a bow.
Licensor absent	The hunter who the fisherman remembered would go camping will <i>ever</i> shoot a bear with a bow.
Relative <i>no</i>	The hunter who no fisherman remembered would go camping will <i>ever</i> shoot a bear with a bow.
Relative verb	The hunter who the fisherman forgot would go camping will <i>ever</i> shoot a bear with a bow.

Note. Bolded terms indicates the negative elements following the convention utilized through the examples in the article.

Method

Participants were 69 English speakers contracted through Amazon's Mechanical Turk. An initial 72 participants were recruited, although three were dropped from the analysis because of a technical glitch in data collection. All participants, regardless of data use, were compensated \$2 for their participation. The task itself was estimated to take around 20 min though participants were allowed 1 hr to complete the task with the ability to pause during that time. The average completion time was about 35 min, including the reading of forms and any breaks taken.

The task materials consisted of 32 items with four conditions; these were identical to the previous studies items with the exception of the tested illusion condition. In this case the *no* in the relative clause is more deeply embedded and follows the relative clause verb in surface order. An example item is presented in the first 4 rows of Table 3 and full items appear in Appendix E.

Each participant rated a total of 128 sentences, consisting of 32 NPI sentences and 96 filler sentences. The filler sentences were similar in length and complexity to the NPI sentences. The fillers consisted of three sets. One set investigated plausibility of instruments in ellipsis, one set investigated the adverbs *either* and *too*, and the third investigated wh-extraction from relative clauses. Overall the items were balanced such that participants saw an equal mix of good and bad sentences, outside of the target illusion sentences.

The procedure for this experiment follows that of previous studies.

Results

The data analysis for this experiment mirrors that of previous studies, with the final contrast being between the two conditions containing relative clause *no*.

The results of Experiment 5 are presented graphically in Figure 1. The ungrammaticality contrast was significant ($p < .001$), the licensor absence contrast was significant with a ($p < .001$), but the illusion contrast was nonsignificant with a ($p > .45$), suggesting both tested illusion cases differ from the ungrammatical NPI containing sentence with no negation, but not from each other. Full model output can be found in Table 4.

To double check that the illusion pattern we see in Experiment 5 is different from the rest of the experiments, we conducted a pooled analysis of the data presented thus far. The regression model for the pooled analysis extends the models used to evaluate the previous experiments with the addition of a contrast coded interactive term that weights Experiments 1–4 each $-1/4$ and

Experiment 5 weighted 1, splitting up the experiments based on the observed illusion potential of the tested illusion case. If the Experiment 5 tested illusion behavior is different from the tested illusions from Experiments 1–4, we expect to see a significant interaction between the tested illusion contrast term from the previous models and this new experiment contrast term. A significant interaction here would indicate that the relationship between the attested and tested illusion in Experiment 5 is different from the attested and tested illusions in the other experiments. We indeed find a significant interaction such that the tested illusion condition is less likely to receive the acceptability boost indicative of NPI illusion in Experiments 1, 2, 3, and 4 ($\beta = -0.26$, $SE = 0.07$, $z = -3.87$, $p < .001$). We also find significant main effects for ungrammaticality ($\beta = -1.22$, $SE = 0.10$, $z = -12.74$, $p < .001$), licensor absence ($\beta = -0.51$, $SE = 0.08$, $z = -6.83$, $p < .001$), and the illusion contrasts ($\beta = -0.21$, $SE = 0.04$, $z = -5.25$, $p < .001$). These effects suggests that in all these experiments there are significant differences between grammatical and ungrammatical sentences, sentences with and without licensors, and sentences with the attested relative clause subject position *no* and the various tested illusion triggers. A main effect of the experiment contrast term is also found $\beta = -0.83$, $SE = 0.19$, $z = -4.34$, $p < .001$), reflecting the difference in the overall bias to respond yes between Experiment 5 and the other experiments. The interaction of ungrammaticality with the experiment contrast is not significant ($\beta = -0.24$, $SE = 0.17$, $z = -1.39$, $p < .001$), suggesting that the effect of ungrammaticality does not differ between Experiment 5 and Experiments 1–4. Licensor absence by the experiment contrast term is significant, however, reflecting the more pronounced difference between the licensor absent case and the illusion cases for Experiment 5 ($\beta = 0.30$, $SE = 0.12$, $z = 2.43$, $p < .05$). Full model output is presented in Table 5.

Discussion

The result of Experiment 5 and the subsequent pooled analysis strongly suggest that the embedded relative clause *no* element does not behave the same as the other tested illusion triggers from Experiments 1–4. In other words, it appears that both relative clause subject *no* and the more deeply embedded relative clause are able to trigger illusions. This result is not predicted by the feature percolation account, as the tested illusion triggers from Experiments 1–4 fail to give rise to the NPI illusion despite having a higher position in the clause. This result does conform to the predictions of cue-based approaches, however this approach does not predict the observed results of Experiments 1–4, as previously discussed. As a final point of investigation, we examined the

Table 3
Experiment 5 and 6 Item

Condition	Text
Matrix <i>no</i>	No senator who the farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Licensor absent	The senator who the farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Relative subject <i>no</i>	The senator who no farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Embedded <i>no</i>	The senator who believed no farmer to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Relative subject <i>not a single</i>	The senator who not a single farmer believed to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.
Embedded <i>not a single</i>	The senator who believed not a single farmer to be untrustworthy will <i>ever</i> vote yes on the smoking proposal.

Note. Bolded terms indicates the negative elements following the convention utilized through the examples in the article.

Table 4
By Experiment Models

Experiment	Term	β	SE	z	p
Experiment 1	Intercept	-0.50	0.18	-2.84	<.01
	Ungrammaticality	-1.81	0.18	-8.07	<.001
	Licensor absence	-0.25	0.12	-2.05	<.05
	Tested illusion	-0.32	0.09	-3.58	<.001
Experiment 2	Intercept	-0.17	0.24	-0.75	>.45
	Ungrammaticality	-0.97	0.19	-5.15	<.001
	Licensor absence	-0.33	0.14	-2.32	<.05
	Tested illusion	-0.36	0.10	-3.75	<.001
Experiment 3	Intercept	-0.88	0.17	-5.11	<.001
	Ungrammaticality	-1.65	0.26	-6.41	<.001
	Licensor absence	-0.23	0.16	-1.53	>.1
	Tested illusion	-0.21	0.11	-1.90	<.10
Experiment 4	Intercept	-0.89	0.34	-2.6	<.01
	Ungrammaticality	-0.68	0.17	-3.90	<.001
	Licensor absence	-0.47	0.19	-2.45	<.05
	Tested illusion	-0.19	0.10	-2.03	<.05
Experiment 5	Intercept	0.33	0.17	1.97	<.05
	Ungrammaticality	-0.89	0.17	-5.28	<.001
	Licensor absence	-0.80	0.14	-5.71	<.001
	Tested illusion	-0.05	0.07	-0.75	>.45
Experiment 6: Model 1	Intercept	-0.57	0.22	-2.51	<.05
	Ungrammaticality	-1.12	0.20	-5.52	<.001
	Licensor absence	-0.63	0.21	-3.01	<.01
	Tested illusion	-0.80	0.25	-3.18	<.01
	High	0.03	0.25	0.14	>.85
Experiment 6: Model 2	High: Tested illusion	-0.43	1.00	0.43	>.65
	Intercept	0.65	0.23	2.86	<.01
	No vs. Baseline	-1.96	0.31	-6.42	<.001
	Not a single vs. Baseline	-2.68	0.30	-8.91	<.001
	No contrast: Not a single contrast	0.98	0.30	3.28	<.01

processing of a compositionally negative quantificational phrase *not a single* to check if the ability to give rise to illusions is totally restricted to *no*.

Experiment 6

In this final experiment the critical manipulation is the use of the phrase *not a single* in both relative clause object and subject position. This exploration gives insight into a few important areas. First, we can determine whether the illusion is restricted to the word form *no*, because it is the only element observed to give rise to illusion so far, or whether illusion ability extends to other elements that are grammatically similar. Additionally, this investigation also allows us see whether a more complex phrase has any impact on the ability to give rise to illusions, as *not a*

single derives its negation by composing the negative element *not* with a the quantifying phrase *a single*. This differs from *no* which bundles its quantificational and negation properties into a single unit. As a final benefit, the design of this study allows for a replication of the finding of illusion in more deeply embedded position, with both embedded *no* and *not a single*.

Method

An initial 72 participants were recruited, although two were dropped from the analysis for identifying as nonnative speakers and one was dropped because of a glitch in data collection. All participants, regardless of data use, were compensated \$2 for their participation. The task itself was estimated to take around 20 min, although participants were allowed 1 hr to complete the task with the ability to pause during that time. The average completion time was about 35 min, including the reading of forms and any breaks taken.

The task materials consisted of 36 items with six conditions, the first four of which are the same as those of Experiment 5. To this we added two conditions with *not a single* in the relative clause subject position and a more deeply embedded position. In all cases the NPI *ever* immediately preceded the main clause verb and came directly after the auxiliary *will*. An example item is presented in Table 3 and full items appear in Appendix F.

Each participant rated a total of 116 sentences, consisting of 36 NPI sentences and 80 filler sentences. The filler sentences were similar in length and complexity to the NPI sentences.

Table 5
Pooled Analysis

Term	β	SE	z	p
Intercept	-0.48	0.11	-4.6	<.001
Ungrammaticality	-1.22	0.10	-12.74	<.001
Licensor absent	-0.51	0.08	-6.83	<.001
Tested illusion	-0.21	0.04	-5.25	<.001
Experiment	-0.83	0.19	-4.34	<.001
Grammaticality: Experiment	-0.24	0.17	-1.393	>.1
Licensor absence: Experiment	0.30	0.12	2.43	<.05
Tested illusion: Experiment	-0.26	0.07	-3.87	<.001

Fillers involved gender mismatch in reflexives and wh-extraction from relative clauses. Overall the items were balanced such that participants saw an equal mix of good and bad sentences, outside of the target illusion sentences.

The procedure for this experiment follows that of previous studies.

Results

Fixed factors were coded with the same Helmert contrast as prior experiments and an interacting contrast term for the height of the inaccessible licenser. The height term was weighted 0 for the matrix *no* and licenser absent conditions, weighted 1/4 for the *no* and *not a single* relative clause subject cases and $-1/4$ for the embedded *no* and *not a single* cases.

An additional model evaluated *no* and *not a single* to see whether they differed significantly in their difference from the ungrammatical baseline. This model included two interactive contrasts, one that compared *no* with the ungrammatical baseline and one that compared *not a single* with the ungrammatical baseline. These were weighted so that the grammatical baseline and the irrelevant illusion were weighted 0, the ungrammatical baseline was weighted 1, and the two illusion cases were weighted $-1/2$.

The results of Experiment 6 are presented graphically in Figure 1. In the first model the ungrammaticality contrast was significant ($p < .001$), the licenser absence contrast was significant ($p < .001$), the illusion contrast was significant ($p < .01$), but the height contrast and its interaction with illusion were both nonsignificant ($p > .85$, $p > .65$). In the second model the two contrasts *No* versus Baseline ($p < .001$) and *not a Single* versus Baseline ($p < .001$) were significant as well as their interaction ($p < .001$). Full model output can be found in Table 4.

Discussion

First, we see a replication of the effect seen for *no* in Experiment 5 here in Experiment 6. This along with the pooled analysis and lack of effects for the height term suggest very strongly that both relative clause subject and more deeply embedded positions allow for illusions at a similar rate. We also see evidence of an illusion for the phrase *not a single*, as evidenced by the significant effect for the contrast term comparing the *not a single* illusion conditions and the licenser absent condition in the second model. This should assuage us of any fear about a specific lexical effect for *no*.

Perhaps the most interesting piece of data comes from the second model. In this model we see that both *not a single* and *no* differ significantly from the baseline ungrammatical case, but also that the strength of this difference is weaker for *not a single*. There could be a few potential reasons for such a difference. The simplest is that there could be a baseline NPI licensing difference between the two, such that *not a single* is a less acceptable licenser across the board. In a follow-up rating task with a 2×2 design with sentences containing *no* or *not a single* and *ever* or no NPI, we found a main effect preference for *no*, but no significant interaction indicating a difference in

baseline NPI licensing ability. This simplest explanation appears unlikely in given the result of this follow up judgment experiment. Another possible explanation could be that the increased structural complexity of the quantifier phrase is interacting with the processing that triggers illusion such that the illusion becomes less likely for these elements.

General Discussion

In the experiments above we have attempted to provide a clearer understanding of the distribution of the NPI illusion phenomenon. By performing controlled investigations of potential illusion triggering candidates in the same methodology, we have shown that the boost in acceptability that characterizes the NPI illusion only occurs for *no* and *not a single* regardless of position in the relative clause.

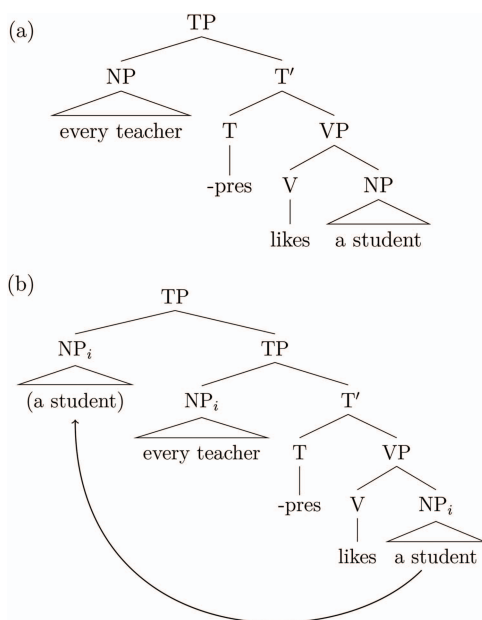
Returning to the existing explanations for the NPI illusion detailed in the introduction, these results pose challenges for each. For cue-based accounts, the primary challenge is capturing the limited distribution of NPI illusion triggers without losing the ability to account for the normal licensing of NPI. As previously discussed, if licensers like *no* and *haven't* license NPI through the same negation cue in single clause sentences, like (3a) and (3e), cue-based accounts would also predict that both elements would trigger illusion but this is not what we observed. Because illusion and standard licensing cases are inherently linked by shared features, changes to the feature set that impact the illusion triggering ability for the licensers like *didn't*, *did not*, *never* would result in unintended differences in the standard licensing cases such as (3e). For feature percolation accounts, the challenge is finding a way to explain why negation information from both the lowest and highest elements in the relative clause can percolate, but information from the medial elements, *didn't*, *not* and *never*, cannot. In a feature percolation account where the more embedded elements percolate less strongly, we would not predict the absence of an illusion for some element and the presence of an illusion for a more deeply embedded element. In a percolation account where structural position doesn't matter, we run into the issue of why *not* and other nonquantification elements do not appear to percolate and cause illusions. Explanations of this illusion that rely on the difference between licensing and rescuing face largely the same challenge as presented in the introduction: explaining the relationship between licensing, rescuing, and illusion in such a way that only a subset of the NPI licensers are able to give rise to illusion.

Although there is certainly a range of potential remedies for each of these theories, we propose another alternative. Based on the distribution we see in these studies, it appears that illusion only occurs for D-quantifiers, like the tested cases of *no* and *not a single*. The specificity of the distribution invites the question of whether it is possible that these findings are due to the processing of such D-quantifiers, which in this case just happen to be negative, rather than the processing of negative elements or NPIs themselves. Based on the uniting feature of quantification, we contend that the NPI illusion is the product of an

application of quantifier raising.² Quantifier raising is a type of structural movement available to quantifiers that can result in differences in interpretation, by changing the position of the quantifiers in the sentence's underlying structure. In (11) there are two interpretations, one in which the sentence means that every teacher has a student who they like, and one in which the sentence means that there is a particular student who is liked by all teachers. In the first interpretation, the quantifiers appear in their original syntactic positions (12a). In the second interpretation, the lower quantifier *a student* has been covertly raised to a higher position at the top of the sentence via quantifier raising (12b). This allows the quantifiers to combine with the verb in a different order, thus providing a different interpretation.

11. Every teacher likes a student.

12.



When the parser encounters a scope sensitive element like an NPI, it needs to determine whether the NPI is in a dependency relationship with any of the previously encountered elements relevant for licensing. For quantifier raising to give rise to the illusory licensing effect, the quantifier in the relative clause must raise to a position which c-commands the NPI to produce the illusory licensing effect.

This model of illusion makes clear demands on the properties of quantifier raising, the behavior of the parser, and the role of the NPI within this context. First, we noted that to achieve the illusion interpretation the quantifier needs to raise out of the relative clause, which has been proposed under many accounts to be inescapable for quantifiers (Farkas, 1981; Hornstein, 1995; Larson & May, 1990; May, 1985). However, recent evidence from the interpretation of elliptical constructions suggests that comprehenders can access interpretations where the quantifier must have raised from within a finite clause (Syrett, 2015). There certainly could be other restrictions that result in a pattern such that quantifier raising appears to be a clause-bounded operation, however an outright ban on escape from tensed clauses appears to not be a feature of

quantifier raising, opening the door to a wider range of potential parsing decisions with respect to quantifiers.

Having established that escape from the relative clause appears to be possible through quantifier raising, the requirements for the implementation of this operation in the parser must be further defined. First it must be adopted that the sentence processing unit actively builds syntactic structures. This is critical, because quantifier raising does assume some form of structural representation to be operated on. With that said, we should ask next when is quantifier raising an available option to the parser? It has been proposed that quantifier raising as an operation available to the grammar is subject to some form of economy condition, a limit on when a quantifier can be raised, as a way to avoid endless loops of raising which do not serve to give new or valid interpretations (Fox, 1995; Fox & Fox, 2000). However directly implementing economy conditions in the parser makes a somewhat odd claim; that it can be determined, before a structure is built, what the properties of the structure are. Rather, it appears to be the case that economy conditions cannot be manifested directly in the parser with the same rules as the grammar. To know whether a structure resulting from quantifier raising yields a new interpretation, it first must be built and then evaluated semantically. Additionally, for the parser to feed the grammatical economy condition, the parser should actively attempt to build structures that could give rise to new interpretations. This leads us rather directly to the role of the NPI in illusion cases. For the parser to perform quantifier raising, it should first recognize that the current parse and the incoming material have the potential to give rise to a new interpretation. The NPI, as an element sensitive to the scope of other elements, combined with the presence of a previously encountered quantifier, signals that it might be possible for a new interpretation to be formed, if the scope relationship between the previously encountered quantifier and the NPI is changed upon raising. Because the only way to see whether a new interpretation is able to be formed is to conduct the raising and check the produced structure, the parser should then raise the quantifier and evaluate this new structure with respect to the scope relation between the moved quantifier and the triggering scope sensitive NPI. Of course, the ultimate ungrammaticality of an NPI illusion sentence also means that it must be the case that the parser eventually detects the fact that, in this instance, raising out of the relative clause is not allowed as part of an independent rule prohibiting the raising of negative elements (Collins, 2017). This means that we also need to assume that the parser is capable of building structures that ultimately do not conform to what is acceptable in the grammar.

Although this may seem to be an odd assumption, similar active processes have been proposed for the resolution of other depen-

² The use of quantifier raising not an entirely new suggestion in illusion processing, as previous accounts have attempted to explain some of the finer points of the distribution of agreement attraction through an appeal to quantifier raising (Den Dikken, 2001). Our proposal critically differs in that we suggest raising is an automatic and indiscriminate parsing application. For illusion cases, the quantifier raising that takes place is ungrammatical as a violation of constraints on the movement of negation (Collins, 2017). This ungrammaticality can be detected at a later point, as suggested by the short duration of the NPI illusion (Parker & Phillips, 2016). The proposal by Den Dikken attributes the lack of agreement attraction for certain elements in the relative clause to the fact they do not raise as a grammatical distinction, which is critically absent in our proposal.

dependencies and generating structures outside of those acceptable to a target grammar has been a long discussed issue in parsing (Kazana, Lau, Lieberman, Yoshida, & Phillips, 2007; Omaki et al., 2015; Phillips, 2006; Stowe, 1986). There are in fact a number of ways in which a parser can produce a structure that is ungrammatical, and a parser can do so for a number of reasons. In example (13) from Stowe (1986), it has been shown that the parser initially posits a gap after the verb *bring* before the bottom-up input confirms that this location for the gap is ungrammatical and that the gap must actually be located after *to*. Driving the parser to build this structure is the constraint that the parser attempts to resolve the wh-dependency as soon as possible, as maintaining open dependencies presents with some cost. In this case the parser built a plausible grammatical structure which was then revealed to be ungrammatical with later bottom up input, to follow a parsing constraint.

13. My brother wanted to know who Ruth will bring us home to at Christmas.

In the above case, it is very easy to imagine both the continuations in which the proposed gap is grammatical and ungrammatical. In the example in (14) from Phillips (2006), the parser has been shown to posit a gap after *expand*, which is inside of a subject island which typically cannot contain a gap. A gap in a subject island is, however, acceptable in a parasitic gap construction where another gap appears later in the sentence. In this case the parser appears to be committing to a ungrammatical structure, which can be rendered grammatical if an additional gap is found as more of the sentence is processed or reevaluated if no gap is discovered. This is a notable point about active dependency resolution, because parasitic gap structures, much like quantifier raising out of a relative clause, are infrequent but still must be accountable for under the standard operating mechanism for the resolution of dependencies. Another critical aspect of this process is that the parser posits the gap without knowledge of whether the gap produced will be rendered grammatical, because it operates without any knowledge of upcoming materials.

14. The school superintendent learned which schools the proposal to expand drastically and innovatively upon the current curriculum would overburden during the following semester.

As shown through the above examples, the parser can, by use of operations that exist in the grammar, produce an ungrammatical structure which will be ruled out in a later evaluative step on the basis of some other grammatical condition. We have also seen that less frequent structures, such as parasitic gaps, must also be able to be parsed under the same procedures which produce structures that are more common. With these assumptions, we can now articulate how the parser can produce the correct set of NPI illusions through the use of quantifier raising as part of an active scope dependency resolution system, necessary for the resolution of cases what quantifiers raise out of relative clauses.

When the parser encounters an element that is sensitive to the scope of other quantificational elements, like NPI, it triggers quantifier raising for quantifiers that were previously encountered. Much like the wh-element in examples (13–14) needs to identify the location of its gap, the NPI needs to establish a dependency with a negative element to be grammatical. In the case of our illusion sentences the quantified phrase, *no farmer*, raises out of

the relative clause to the higher matrix position. For the moment, the needs of the NPI appear to be satisfied as it is now c-commanded by a negative licenser, resulting in the processing boost that is the hallmark of NPI illusion. However, covert raising of negative elements is generally ungrammatical in English (Collins, 2017). As such, after the grammar evaluates the structure, these NPI illusion cases are deemed to be ungrammatical on the basis of this illicit movement. This split between the parsing step which raises the quantifier and satisfies the licensing conditions of the NPI and the reconciliation of this structure with other grammatical principles may also provide a avenue to address the fact that the NPI illusion is short-lived compared with other illusions, as the illusion is easily and necessarily resolvable in the course of ordinary processing under this model (Parker & Phillips, 2016).

What does this structure building and quantifier raising driven explanation have to say about the distribution of NPI illusion? First, this sort of explanation would not predict illusion for any of the negative elements that are not quantifiers. That is to say *didn't*, *did not*, *never*, and *doubt* are all expected to fail to give rise to illusion as there is no ability for these elements to be raised. It would also predict that any element that can be raised can also give rise to the illusion, including the more deeply embedded cases *no* and *not a single*. Finally, if raising becomes more difficult with quantificational elements that are more structurally rich, such a mechanism may even account for the reduced size of the illusion effect for *not a single*. As this proposal is structural in nature, it also extends a set of predictions about how other dependencies involving quantifiers are processed that may be investigated empirically.

Other polarity-sensitive elements would be predicted to give rise to illusions under the analysis presented above. Positive polarity items and tag questions both have been shown to produce illusions in the same environment as presented above, although because of the different relationship these elements have with negation these are illusions of ungrammatically (Orth, 2020; Orth, Yoshida, & Sloggett, 2020). We would also expect a lack of illusions in cases where the quantifying element is unable to undergo quantifier raising at all, analogous to the finite clause manipulation of Phillips (2006), although from the perspective of quantifier raising outlined above these must be cases where the element no long is eligible for quantifier raising rather than cases where the raising results in a rule violating structure. Beyond cases with polarity items, we might also expect raising to occur in cases with other scope sensitive elements such as pronouns. In particular, the relatively free raising of quantifiers needed to produce NPI illusion also may extend to account for the surprisingly easy processing of donkey sentences (Kush & Eik, 2019).

In this series of investigations we have determined that the NPI illusion is highly restricted in its distribution. Only negative quantifiers such as *no* and *not a single* were shown to give rise to the illusion, with other elements which can host NPI; *didn't*, *did not*, *never*, and NPI hosting verbs failing to give rise to the illusion. By evaluating the predictions of existing approaches in sentence processing we have demonstrated that current theories, left unamended, cannot account for the observed distribution of NPI illusion. To capture this distribution we offered a new account that employs structure building and quantifier raising, which can capture this illusion and makes its own predictions about the processing of other dependencies in similar configurations.

References

- Adger, D., & Quer, J. (1997). Subjunctives, unselected embedded questions, and clausal polarity items. *North Eastern Linguistic Society*, 27, 1–15.
- Baker, C. L. (1970). Double negatives. *Linguistic inquiry*, 1, 169–186.
- Barker, C. (2018). Negative polarity as scope marking. *Linguistics and Philosophy*, 41, 483–510.
- Chierchia, G. (2004). Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface. *Structures and beyond*, 3, 39–103.
- Chierchia, G. (2006). Broaden your views: Implicatures of domain widening and the “logicality” of language. *Linguistic inquiry*, 37, 535–590.
- Chierchia, G. (2013). *Logic in grammar: Polarity, free choice, and intervention*. Oxford, UK: Oxford University Press.
- Collins, C. (2017). A scope freezing effect with negated quantifier phrases. *Natural Language Semantics*, 25, 315–327.
- Collins, C., & Postal, P. M. (2014). *Classical NEG raising: An essay on the syntax of negation*. Cambridge, MA: MIT press.
- de Dios Flores, I., Muller, H., & Phillips, C. (2017, March). *Negative polarity illusions: Licensors that don't cause illusions, and blockers that do*. Poster presented at 30th Annual CUNY Conference on Human Sentence Processing, Cambridge, MA.
- Den Dikken, M. (2001). “Plurilinguals”, pronouns and quirky agreement. *The Linguistic Review*, 18, 19–41.
- Dillon, B., Mishler, A., Sloggett, S., & Phillips, C. (2013). Contrasting intrusion profiles for agreement and anaphora: Experimental and modeling evidence. *Journal of Memory and Language*, 69, 85–103.
- 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, Germany: De Gruyter.
- Drummond, A. (2013). *Ibex farm*. Retrieved from <http://spellout.net/ibexfarm>
- Eberhard, K. M., Cutting, J. C., & Bock, K. (2005). Making syntax of sense: Number agreement in sentence production. *Psychological Review*, 112, 531.
- Farkas, D. (1981). Quantifier Scope and Syntactic Islands. *Chicago Linguistic Society (CLS)*, 17, 59–66.
- Fauconnier, G. (1975). Polarity and the scale principle. *Chicago Linguistic Society*, 11, 188–199.
- Fox, D. (1995). Economy and scope. *Natural Language Semantics*, 3, 283–341.
- Fox, D., & Fox, D. (2000). *Economy and semantic interpretation*. Cambridge, MA: MIT Press.
- Franck, J., Vigliocco, G., & Nicol, J. (2002). Subject-verb agreement errors in French and English: The role of syntactic hierarchy. *Language and Cognitive Processes*, 17, 371–404.
- Gajewski, J. R. (2007). Neg-raising and polarity. *Linguistics and Philosophy*, 30, 289–328.
- Giannakidou, A. (2006). Only, emotive factive verbs, and the dual nature of polarity dependency. *Language*, 82, 575–603.
- Giannakidou, A. (2011). Negative and positive polarity items: Variation, licensing, and compositionality. In C. Maienborn, K. von Stechow, & P. Portner (Eds.), *Semantics: An international handbook of natural language meaning* (pp. 1660–1712). Berlin, Germany: De Gruyter.
- Giannakidou, A., & Etxeberria, U. (2018). Assessing the role of experimental evidence for interface judgment: Licensing of negative polarity items, scalar readings, and focus. *Frontiers in Psychology*, 9, 59.
- Gibson, E., Bergen, L., & Piantadosi, S. T. (2013). Rational integration of noisy evidence and prior semantic expectations in sentence interpretation. *Proceedings of the National Academy of Sciences of the United States of America*, 110, 8051–8056.
- Homer, V. (in press). Domains of polarity items. *Journal of Semantics*.
- Hornstein, N. (1995). *Logical form: From GB to minimalism*. London, UK: Blackwell.
- Israel, M. (2004). The pragmatics of polarity. In L. Horn & G. Ward (Eds.), *The handbook of pragmatics* (pp. 701–723). Hoboken, NJ: Wiley.
- Kadmon, N., & Landman, F. (1993). Any. *Linguistics and Philosophy*, 16, 353–422.
- Kazanina, N., Lau, E. F., Lieberman, M., Yoshida, M., & Phillips, C. (2007). The effect of syntactic constraints on the processing of backwards anaphora. *Journal of Memory and Language*, 56, 384–409.
- Klima, E. S. (1964). Negation in English. In J. A. Fodor and J. J. Katz (Eds.), *The structure of language* (pp. 246–324). Englewood Cliffs, NJ: Prentice Hall.
- Krifka, M. (1994). The semantics and pragmatics of weak and strong polarity items in assertions. *Semantics and Linguistic Theory*, 4, 195–219.
- Kush, D. W., & Eik, R. (2019). Antecedent accessibility and exceptional covariation: Evidence from Norwegian donkey pronouns. *Glossa: A Journal of General Linguistics*, 4, 1.
- Ladusaw, W. A. (1980). On the notion affective in the analysis of negative-polarity items. In P. Portner & B. H. Partee (Eds.), *Formal semantics: The essential readings* (pp. 457–470). Hoboken, NJ: Wiley.
- Ladusaw, W. A. (1992). Expressing negation. In *Semantics and Linguistic Theory*, 2, 237–260.
- Lahiri, U. (1998). Focus and negative polarity in Hindi. *Natural language Semantics*, 6, 57–123.
- Larson, R. K., & May, R. (1990). Antecedent containment or vacuous movement: Reply to Baltin. *Linguistic Inquiry*, 21, 103–122.
- Lasnik, H. (1972). *Analyses of negation in English* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.
- Lewis, R. L., & Vasishth, S. (2005). An activation-based model of sentence processing as skilled memory retrieval. *Cognitive Science*, 29, 375–419.
- Linebarger, M. C. (1987). Negative polarity and grammatical representation. *Linguistics and Philosophy*, 10, 325–387.
- May, R. (1985). *Logical form: Its structure and derivation*. Cambridge, MA: MIT press.
- Mendia, J. A., Poole, E., & Dillon, B. (2018). Spurious NPI licensing and exhaustification. *Semantics and Linguistic Theory*, 28, 233–250.
- Muller, H., & Phillips, C. (2018). Negative polarity illusions. In M. T. E. Viviane Deprez (Ed.), *Oxford handbook of negation* (pp. 656–676). New York, NY: Oxford University Press.
- Omaki, A., Lau, E. F., Davidson White, I., Dakan, M. L., Apple, A., & Phillips, C. (2015). Hyper-active gap filling. *Frontiers in Psychology*, 6, 384.
- Orth, W. (2020, March). *It's no just NPI, is it?* Poster presented at the 33rd Annual CUNY Conference on Human Sentence Processing, Amherst, MA.
- Orth, W., Yoshida, M., & Sloggett, S. (2020, March). *Illusions of ungrammaticality: Evidence from PPI*. Poster presented at the 33rd Annual CUNY Conference on Human Sentence Processing, Amherst, MA.
- Parker, D., & Phillips, C. (2016). Negative polarity illusions and the format of hierarchical encodings in memory. *Cognition*, 157, 321–339.
- Parker, D., Shvartsman, M., & Van Dyke, J. A. (2017). The cue-based retrieval theory of sentence comprehension: New findings and new challenges. In L. Escobar, V. Torrens, & T. Parodi (Eds.), *Language processing and disorders* (pp. 121–144). Newcastle: Comabridge Scholars Publishing.
- Patson, N. D., & Husband, E. M. (2016). Misinterpretations in agreement and agreement attraction. *The Quarterly Journal of Experimental Psychology*, 69, 950–971.
- Phillips, C. (2006). The real-time status of island phenomena. *Language*, 82, 795–823.
- Phillips, C., Wagers, M. W., & Lau, E. F. (2011). Grammatical illusions and selective fallibility in real-time language comprehension. *Experiments at the Interfaces*, 37, 147–180.
- Potsdam, E. (1997). NegP and subjunctive complements in English. *Linguistic Inquiry*, 28, 533–541.

- R Core Team. (2019). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <https://www.R-project.org/>
- Reinhart, T. M. (1976). *The syntactic domain of anaphora* (Doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.
- Santorini, B., & Kroch, A. (2007). *The syntax of natural language: An online introduction using the trees program*. Retrieved from <https://www.ling.upenn.edu/~beatrice/syntax-textbook>.
- Staub, A. (2010). Response time distributional evidence for distinct varieties of number attraction. *Cognition*, *114*, 447–454.
- Stowe, L. A. (1986). Parsing wh-constructions: Evidence for on-line gap location. *Language and Cognitive Processes*, *1*, 227–245.
- Syrett, K. (2015). QR out of a tensed clause: Evidence from antecedent-contained deletion. *Ratio*, *28*, 395–421.
- Szabolcsi, A. (2004). Positive polarity–negative polarity. *Natural Language & Linguistic Theory*, *22*, 409–452.
- Tanner, D., Nicol, J., & Brehm, L. (2014). The time-course of feature interference in agreement comprehension: Multiple mechanisms and asymmetrical attraction. *Journal of Memory and Language*, *76*, 195–215.
- Van Dyke, J. A., & Lewis, R. L. (2003). Distinguishing effects of structure and decay on attachment and repair: A cue-based parsing account of recovery from misanalyzed ambiguities. *Journal of Memory and Language*, *49*, 285–316.
- Vasishth, S., Brüssow, S., Lewis, R. L., & Drenhaus, H. (2008). Processing polarity: How the ungrammatical intrudes on the grammatical. *Cognitive Science*, *32*, 685–712.
- Von Stechow, K. (1999). NPI licensing, Strawson entailment, and context dependency. *Journal of Semantics*, *16*, 97–148.
- Wagers, M. W., Lau, E. F., & Phillips, C. (2009). Agreement attraction in comprehension: Representations and processes. *Journal of Memory and Language*, *61*, 206–237.
- Xiang, M., Dillon, B., & Phillips, C. (2009). Illusory licensing effects across dependency types: ERP evidence. *Brain and 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*, 708.

Appendix A

Experiment 1 Materials

1. Relative No: The senator who no farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
1. Relative Didn't: The senator who didn't believe the farmer to be untrustworthy will ever vote yes on the smoking proposal.
1. Matrix No: No senator who the farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
1. Licensor Absent: The senator who the farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
2. Relative No: The hunter who no fisherman believed to be respectable will ever shoot a brown bear.
2. Relative Didn't: The hunter who didn't believe the fisherman to be respectable will ever shoot a brown bear.
2. Matrix No: No hunter who the fisherman believed to be respectable will ever shoot a brown bear.
2. Licensor Absent: The hunter who the fisherman believed to be respectable will ever shoot a brown bear.
3. Relative No: The artist who no curator remembered from the gallery will ever make a bronze sculpture.
3. Relative Didn't: The artist who didn't remember the curator from the gallery will ever make a bronze sculpture.
3. Matrix No: No artist who the curator remembered from the gallery will ever make a bronze sculpture.
3. Licensor Absent: The artist who the curator remembered from the gallery will ever make a bronze sculpture.
4. Relative No: The professor who no dean remembered from the conference will ever win a teaching award.
4. Relative Didn't: The professor who didn't remember the dean from the conference will ever win a teaching award.
4. Matrix No: No professor who the dean remembered from the conference will ever win a teaching award.
4. Licensor Absent: The professor who the dean remembered from the conference will ever win a teaching award.
5. Relative No: The soldier who no general invited to the task force will ever earn a combat medal.
5. Relative Didn't: The soldier who didn't invite the general to the search party will ever earn a combat medal.

(Appendices continue)

5. Matrix No: No soldier who the general invited to the task force will ever earn a combat medal.
5. Licensor Absent: The soldier who the general invited to the task force will ever earn a combat medal.
6. Relative No: The reporter who no candidate invited to the press pool will ever break a major story.
6. Relative Didn't: The reporter who didn't invite the candidate to the press pool will ever break a major story.
6. Matrix No: No reporter who the candidate invited to the press pool will ever break a major story.
6. Licensor Absent: The reporter who the candidate invited to the press pool will ever break a major story.
7. Relative No: The pirate who no admiral recognized from the wanted poster will ever be arrested for stealing a ship.
7. Relative Didn't: The pirate who didn't recognize the admiral from the portrait will ever be arrested for stealing a ship.
7. Matrix No: No pirate who the admiral recognized from the wanted poster will ever be arrested for stealing a ship.
7. Licensor Absent: The pirate who the admiral recognized from the wanted poster will ever be arrested for stealing a ship.
8. Relative No: The thief who no detective recognized from the news report will ever be caught red handed.
8. Relative Didn't: The thief who didn't recognize the detective from the crime scene will ever be caught red handed.
8. Matrix No: No thief who the detective recognized from the news report will ever be caught red handed.
8. Licensor Absent: The thief who the detective recognized from the news report will ever be caught red handed.
9. Relative No: The lawyer who no criminal noticed approach the bench will ever run for governor.
9. Relative Didn't: The lawyer who didn't notice the criminal approach the bench will ever run for governor.
9. Matrix No: No lawyer who the criminal noticed approach the bench will ever run for governor.
9. Licensor Absent: The lawyer who the criminal noticed approach the bench will ever run for governor.
10. Relative No: The protester who no policeman noticed sneak past will ever support lower taxes.
10. Relative Didn't: The protester who didn't notice the policeman walk by will ever support lower taxes.
10. Matrix No: No protester who the policeman noticed sneak past will ever support lower taxes.
10. Licensor Absent: The protester who the policeman noticed sneak past will ever support lower taxes.
11. Relative No: The hostage who no kidnapper realized was a veteran will ever escape without being spotted.
11. Relative Didn't: The hostage who didn't realize the kidnapper was respectable will ever escape without being spotted.
11. Matrix No: No hostage who the kidnapper realized was a veteran will ever escape without being spotted.
11. Licensor Absent: The hostage who the kidnapper realized was a veteran will ever escape without being spotted.
12. Relative No: The pollster who no politician realized would predict the results will ever be unemployed
12. Relative Didn't: The pollster who didn't realize the politician would win will ever be unemployed.
12. Matrix No: No pollster who the politician realized would predict the results will ever be unemployed.
12. Licensor Absent: The pollster who the politician realized would predict the results will ever be unemployed.
13. Relative No: The actor who no director predicted would be a star will ever play a supporting role.
13. Relative Didn't: The actor who didn't predict the director would be famous will ever play a supporting role.
13. Matrix No: No actor who the director predicted would be a star will ever play a supporting role.
13. Licensor Absent: The actor who the director predicted would be a star will ever play a supporting role.
14. Relative No: The rancher who no cowboy predicted would have a good harvest will ever be hungry again.
14. Relative Didn't: The rancher who didn't predict the cowboy would wrangle the bull will ever be hungry again.
14. Matrix No: No rancher who the cowboy predicted would have a good harvest will ever be hungry again.
14. Licensor Absent: The rancher who the cowboy predicted would have a good harvest will ever be hungry again.

(Appendices continue)

15. Relative No: The lender who no banker recommended for home loans will ever raise interest rates.
15. Relative Didn't: The lender who didn't recommend the banker for asset management will ever raise interest rates.
15. Matrix No: No lender who the banker recommended for home loans will ever raise interest rates.
15. Licensor Absent: The lender who the banker recommended for home loans will ever raise interest rates.
16. Relative No: The agent who no tourist recommended for travel planning will ever suggest a boring trip.
16. Relative Didn't: The agent who didn't recommend the tourist go to Panama will ever suggest a boring trip.
16. Matrix No: No agent who the tourist recommended for travel planning will ever suggest a boring trip.
16. Licensor Absent: The agent who the tourist recommended for travel planning will ever suggest a boring trip.
17. Relative No: The painter who no sculptor said had a good eye will ever paint an impressionist sunset.
17. Relative Didn't: The painter who didn't say the sculptor had a good eye will ever paint an impressionist sunset.
17. Matrix No: No painter who the sculptor said had a good eye will ever paint an impressionist sunset.
17. Licensor Absent: The painter who the sculptor said had a good eye will ever paint an impressionist sunset.
18. Relative No: The bully who no student said was mean will ever get a scholarship to Northwestern.
18. Relative Didn't: The bully who didn't say the student was mean will ever get a scholarship to Northwestern.
18. Matrix No: No bully who the student said was mean will ever get a scholarship to Northwestern.
18. Licensor Absent: The bully who the student said was mean will ever get a scholarship to Northwestern.
19. Relative No: The patient who no trainer treated for a broken leg will ever give up on recovery.
19. Relative Didn't: The patient who didn't treat the trainer to dinner will ever give up on recovery.
19. Matrix No: No patient who the trainer treated for a broken leg will ever give up on recovery.
19. Licensor Absent: The patient who the trainer treated for a broken leg will ever give up on recovery.
20. Relative No: The victim who no doctor treated after a car accident will ever drive again.
20. Relative Didn't: The victim who didn't treat the doctor to lunch will ever drive again.
20. Matrix No: No victim who the doctor treated after a car accident will ever drive again.
20. Licensor Absent: The victim who the doctor treated after a car accident will ever drive again.
21. Relative No: The author who no reader knew from his oldest will ever buy books online.
21. Relative Didn't: The author who didn't know the reader from their previous meeting will ever buy books online.
21. Matrix No: No author who the reader knew from his oldest novel will ever buy books online.
21. Licensor Absent: The author who the reader knew from his oldest novel will ever buy books online.
22. Relative No: The bailiff who no judge knew from the courthouse will ever commit a crime.
22. Relative Didn't: The bailiff who didn't know the judge from the courthouse will ever commit a crime.
22. Matrix No: No bailiff who the judge knew from the courthouse will ever commit a crime.
22. Licensor Absent: The bailiff who the judge knew from the courthouse will ever commit a crime.

(Appendices continue)

23. Relative No: The traitor who no jury speculated was guilty will ever be let go.
23. Relative Didn't: The traitor who didn't speculate the jury was rigged will ever be let go.
23. Matrix No: No traitor who the jury speculated was guilty will ever be let go.
23. Licensor Absent: The traitor who the jury speculated was guilty will ever be let go.
24. Relative No: The player who no referee speculated was doping will ever have playing time.
24. Relative Didn't: The player who didn't speculate the referee was paid off will ever have playing time.
24. Matrix No: No player who the referee speculated was doping will ever have playing time.
24. Licensor Absent: The player who the referee speculated was doping will ever have playing time.
25. Relative No: The fireman who no arsonist assumed would respond will ever miss a service call.
25. Relative Didn't: The fireman who didn't assume the arsonist would respond will ever miss a service call.
25. Matrix No: No fireman who the arsonist assumed would respond will ever miss a service call.
25. Licensor Absent: The fireman who the arsonist assumed would respond will ever miss a service call.
26. Relative No: The skier who no snowboarder assumed would miss the season will ever skip a day with good snow.
26. Relative Didn't: The skier who didn't assume the snowboarder would miss the season will ever skip a day with good snow.
26. Matrix No: No skier who the snowboarder assumed would miss the season will ever skip a day with good snow.
26. Licensor Absent: The skier who the snowboarder assumed would miss the season will ever skip a day with good snow.
27. Relative No: The sailor who no pilot thought was a hotshot would ever be too busy showing off.
27. Relative Didn't: The sailor who didn't think the pilot was a hotshot would ever be too busy showing off.
27. Matrix No: No sailor who the pilot thought was a hotshot would ever be too busy showing off.
27. Licensor Absent: The sailor who the pilot thought was a hotshot would ever be too busy showing off.
28. Relative No: The poet who no singer thought was verbose would ever improvise in a performance.
28. Relative Didn't: The poet who didn't think the singer was verbose would ever improvise in a performance.
28. Matrix No: No poet who the singer thought was verbose would ever improvise in a performance.
28. Licensor Absent: The poet who the singer thought was verbose would ever improvise in a performance.
29. Relative No: The suspect who no investigator cleared of wrongdoing would ever trespass on government property.
29. Relative Didn't: The suspect who didn't clear the investigator of wrongdoing would ever trespass on government property.
29. Matrix No: No suspect who the investigator cleared of wrongdoing would ever trespass on government property.
29. Licensor Absent: The suspect who the investigator cleared of wrongdoing would ever trespass on government property.
30. Relative No: The scammer who no sheriff cleared of involvement would ever run another con.
30. Relative Didn't: The scammer who didn't clear the sheriff of involvement would ever run another con.
30. Matrix No: No scammer who the sheriff cleared of involvement would ever run another con.
30. Licensor Absent: The scammer who the sheriff cleared of involvement would ever run another con.
31. Relative No: The dancer who no teacher concluded was clumsy would ever perform center stage.
31. Relative Didn't: The dancer who didn't conclude the teacher was clumsy would ever perform center stage.
31. Matrix No: No dancer who the teacher concluded was clumsy would ever perform center stage.
31. Licensor Absent: The dancer who the teacher concluded was clumsy would ever perform center stage.

(Appendices continue)

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| <p>32. Relative No: The apprentice who no blacksmith concluded was talented would ever open a smithy.</p> <p>32. Relative Didn't: The apprentice who didn't conclude the blacksmith was talented would ever open a smithy.</p> | <p>32. Matrix No: No apprentice who the blacksmith concluded was talented would ever open a smithy.</p> <p>32. Licensor Absent: The apprentice who the blacksmith concluded was talented would ever open a smithy.</p> |
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Appendix B

Experiment 2 Materials

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| <p>1. Relative No: The senator who no farmer believed to be untrustworthy will ever vote yes on the smoking proposal.</p> <p>1. Relative Did Not: The senator who did not believe the farmer to be untrustworthy will ever vote yes on the smoking proposal.</p> <p>1. Matrix No: No senator who the farmer believed to be untrustworthy will ever vote yes on the smoking proposal.</p> <p>1. Licensor Absent: The senator who the farmer believed to be untrustworthy will ever vote yes on new smoking proposition.</p> <p>2. Relative No: The hunter who no fisherman believed to be respectable will ever shoot a brown bear.</p> <p>2. Relative Did Not: The hunter who did not believe the fisherman to be respectable will ever shoot a brown bear.</p> <p>2. Matrix No: No hunter who the fisherman believed to be respectable will ever shoot a brown bear.</p> <p>2. Licensor Absent: The hunter who the fisherman believed to be respectable will ever shoot a brown bear.</p> <p>3. Relative No: The artist who no curator remembered from the gallery will ever make a bronze sculpture.</p> <p>3. Relative Did Not: The artist who did not remember the curator from the gallery will ever make a bronze sculpture.</p> <p>3. Matrix No: No artist who the curator remembered from the gallery will ever make a bronze sculpture.</p> <p>3. Licensor Absent: The artist who the curator remembered from the gallery will ever make a bronze sculpture.</p> | <p>4. Relative No: The professor who no dean remembered from the conference will ever win a teaching award.</p> <p>4. Relative Did Not: The professor who did not remember the dean from the conference will ever win a teaching award.</p> <p>4. Matrix No: No professor who the dean remembered from the conference will ever win a teaching award.</p> <p>4. Licensor Absent: The professor who the dean remembered from the conference will ever win a teaching award.</p> <p>5. Relative No: The soldier who no general invited to the task force will ever earn a combat medal.</p> <p>5. Relative Did Not: The soldier who did not invite the general to the search party will ever earn a combat medal.</p> <p>5. Matrix No: No soldier who the general invited to the task force will ever earn a combat medal.</p> <p>5. Licensor Absent: The soldier who the general invited to the task force will ever earn a combat medal.</p> <p>6. Relative No: The reporter who no candidate invited to the press pool will ever break a major story.</p> <p>6. Relative Did Not: The reporter who did not invite the candidate to the press pool will ever break a major story.</p> <p>6. Matrix No: No reporter who the candidate invited to the press pool will ever break a major story.</p> <p>6. Licensor Absent: The reporter who the candidate invited to the press pool will ever break a major story.</p> |
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(Appendices continue)

7. Relative No: The pirate who no admiral recognized from the wanted poster will ever be arrested for stealing a ship.
7. Relative Did Not: The pirate who did not recognize the admiral from his portrait will ever be arrested for stealing a ship.
7. Matrix No: No pirate who the admiral recognized from the wanted poster will ever be arrested for stealing a ship.
7. Licensor Absent: The pirate who the admiral recognized from the wanted poster will ever be arrested for stealing a ship.
8. Relative No: The thief who no detective recognized from the news report will ever be caught red handed.
8. Relative Did Not: The thief who did not recognize the detective from the crime scene will ever be caught red handed.
8. Matrix No: No thief who the detective recognized from the news report will ever be caught red handed.
8. Licensor Absent: The thief who the detective recognized from the news report will ever be caught red handed.
9. Relative No: The lawyer who no criminal noticed approach the bench will ever run for governor.
9. Relative Did Not: The lawyer who did not notice the criminal had approached the bench will ever run for governor.
9. Matrix No: No lawyer who the criminal noticed approach the bench will ever run for governor.
9. Licensor Absent: The lawyer who the criminal noticed approach the bench will ever run for governor.
10. Relative No: The protester who no policeman noticed sneak past will ever support lower taxes.
10. Relative Did Not: The protester who did not notice the policeman walk by will ever support lower taxes.
10. Matrix No: No protester who the policeman noticed sneak past will ever support lower taxes.
10. Licensor Absent: The protester who the policeman noticed sneak past will ever support lower taxes.
11. Relative No: The hostage who no kidnapper realized was a veteran will ever escape without being spotted.
11. Relative Did Not: The hostage who did not realize the kidnapper was respectable will ever escape without being spotted.
11. Matrix No: No hostage who the kidnapper realized was a veteran will ever escape without being spotted.
11. Licensor Absent: The hostage who the kidnapper realized was a veteran will ever escape without being spotted.
12. Relative No: The pollster who no politician realized could predict the results will ever be unemployed
12. Relative Did Not: The pollster who did not realize the politician could win will ever be unemployed.
12. Matrix No: No pollster who the politician realized will predict the results will ever be unemployed.
12. Licensor Absent: The pollster who the politician realized could predict the results will ever be unemployed.
13. Relative No: The actor who no director predicted will be a star will ever play a supporting role.
13. Relative Did Not: The actor who did not predict the director will be famous will ever play a supporting role.
13. Matrix No: No actor who the director predicted will be a star will ever play a supporting role.
13. Licensor Absent: The actor who the director predicted will be a star will ever play a supporting role.
14. Relative No: The rancher who no cowboy predicted will have a good harvest will ever be hungry again.
14. Relative Did Not: The rancher who did not predict the cowboy will wrangle the bull will ever be hungry again.
14. Matrix No: No rancher who the cowboy predicted will have a good harvest will ever be hungry again.
14. Licensor Absent: The rancher who the cowboy predicted will have a good harvest will ever be hungry again.
15. Relative No: The lender who no banker recommended for home loans will ever raise interest rates.
15. Relative Did Not: The lender who did not recommend the banker for asset management will ever raise interest rates.
15. Matrix No: No lender who the banker recommended for home loans will ever raise interest rates.
15. Licensor Absent: The lender who the banker recommended for home loans will ever raise interest rates.

(Appendices continue)

16. Relative No: The agent who no tourist recommended for travel planning will ever suggest a boring trip.
16. Relative Did Not: The agent who did not recommend the tourist go to Panama will ever suggest a boring trip.
16. Matrix No: No agent who the tourist recommended for travel planning will ever suggest a boring trip.
16. Licensor Absent: The agent who the tourist recommended for travel planning will ever suggest a boring trip.
17. Relative No: The painter who no sculptor said had a good eye will ever paint an impressionist sunset.
17. Relative Did Not: The painter who did not say the sculptor had a good eye will ever paint an impressionist sunset.
17. Matrix No: No painter who the sculptor said had a good eye will ever paint an impressionist sunset.
17. Licensor Absent: The painter who the sculptor said had a good eye will ever paint an impressionist sunset.
18. Relative No: The bully who no student said was mean will ever get a scholarship to Northwestern.
18. Relative Did Not: The bully who did not say the student was mean will ever get a scholarship to Northwestern.
18. Matrix No: No bully who the student said was mean will ever get a scholarship to Northwestern.
18. Licensor Absent: The bully who the student said was mean will ever get a scholarship to Northwestern.
19. Relative No: The patient who no trainer treated for a broken leg will ever give up on recovery.
19. Relative Did Not: The patient who did not treat the trainer to dinner will ever give up on recovery.
19. Matrix No: No patient who the trainer treated for a broken leg will ever give up on recovery.
19. Licensor Absent: The patient who the trainer treated for a broken leg will ever give up on recovery.
20. Relative No: The victim who no doctor treated after a car accident will ever drive again.
20. Relative Did Not: The victim who did not treat the doctor to lunch will ever drive again.
20. Matrix No: No victim who the doctor treated after a car accident will ever drive again.
20. Licensor Absent: The victim who the doctor treated after a car accident will ever drive again.
21. Relative No: The author who no reader knew from his oldest will ever buy books online.
21. Relative Did Not: The author who did not know the reader from their previous meeting will ever buy books online.
21. Matrix No: No author who the reader knew from his oldest novel will ever buy books online.
21. Licensor Absent: The author who the reader knew from his oldest novel will ever buy books online.
22. Relative No: The bailiff who no judge knew from the courthouse will ever commit a crime.
22. Relative Did Not: The bailiff who did not know the judge from the courthouse will ever commit a crime.
22. Matrix No: No bailiff who the judge knew from the courthouse will ever commit a crime.
22. Licensor Absent: The bailiff who the judge knew from the courthouse will ever commit a crime.
23. Relative No: The traitor who no jury speculated was guilty will ever be let go.
23. Relative Did Not: The traitor who did not speculate the jury was rigged will ever be let go.
23. Matrix No: No traitor who the jury speculated was guilty will ever be let go.
23. Licensor Absent: The traitor who the jury speculated was guilty will ever be let go.
24. Relative No: The player who no referee speculated was doping will ever have playing time.
24. Relative Did Not: The player who did not speculate the referee was paid off will ever have playing time.
24. Matrix No: No player who the referee speculated was doping will ever have playing time.
24. Licensor Absent: The player who the referee speculated was doping will ever have playing time.

(Appendices continue)

25. Relative No: The fireman who no arsonist assumed will respond will ever miss a service call.
25. Relative Did Not: The fireman who did not assume the arsonist will respond will ever miss a service call.
25. Matrix No: No fireman who the arsonist assumed will respond will ever miss a service call.
25. Licensor Absent: The fireman who the arsonist assumed will respond will ever miss a service call.
26. Relative No: The skier who no snowboarder assumed will miss the season will ever skip a day with good snow.
26. Relative Did Not: The skier who did not assume the snowboarder will miss the season will ever skip a day with good snow.
26. Matrix No: No skier who the snowboarder assumed will miss the season will ever skip a day with good snow.
26. Licensor Absent: The skier who the snowboarder assumed will miss the season will ever skip a day with good snow.
27. Relative No: The sailor who no pilot thought was a hotshot will ever be too busy showing off.
27. Relative Did Not: The sailor who did not think the pilot was a hotshot will ever be too busy showing off.
27. Matrix No: No sailor who the pilot thought was a hotshot will ever be too busy showing off.
27. Licensor Absent: The sailor who the pilot thought was a hotshot will ever be too busy showing off.
28. Relative No: The poet who no singer thought was verbose will ever improvise in a performance.
28. Relative Did Not: The poet who did not think the singer was verbose will ever improvise in a performance.
28. Matrix No: No poet who the singer thought was verbose will ever improvise in a performance.
28. Licensor Absent: The poet who the singer thought was verbose will ever improvise in a performance.
29. Relative No: The suspect who no investigator cleared of wrongdoing will ever trespass on government property.
29. Relative Did Not: The suspect who did not clear the investigator of wrongdoing will ever trespass on government property.
29. Matrix No: No suspect who the investigator cleared of wrongdoing will ever trespass on government property.
29. Licensor Absent: The suspect who the investigator cleared of wrongdoing will ever trespass on government property.
30. Relative No: The scammer who no sheriff cleared of involvement will ever run another con.
30. Relative Did Not: The scammer who did not clear the sheriff of involvement will ever run another con.
30. Matrix No: No scammer who the sheriff cleared of involvement will ever run another con.
30. Licensor Absent: The scammer who the sheriff cleared of involvement will ever run another con.
31. Relative No: The dancer who no teacher concluded was clumsy will ever perform center stage.
31. Relative Did Not: The dancer who did not conclude the teacher was clumsy will ever perform center stage.
31. Matrix No: No dancer who the teacher concluded was clumsy will ever perform center stage.
31. Licensor Absent: The dancer who the teacher concluded was clumsy will ever perform center stage.
32. Relative No: The apprentice who no blacksmith concluded was talented will ever open a smithy.
32. Relative Did Not: The apprentice who did not conclude the blacksmith was talented will ever open a smithy.
32. Matrix No: No apprentice who the blacksmith concluded was talented will ever open a smithy.
32. Licensor Absent: The apprentice who the blacksmith concluded was talented will ever open a smithy.

(Appendices continue)

Appendix C

Experiment 3 Materials

1. Relative No: The senator who no farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
1. Relative Never: The senator who never believed the farmer to be untrustworthy will ever vote yes on the smoking proposal.
1. Matrix No: No senator who the farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
1. Licensor Absent: The senator who the farmer believed to be untrustworthy will ever vote yes on new smoking proposition.
2. Relative No: The hunter who no fisherman believed to be respectable will ever shoot a brown bear.
2. Relative Never: The hunter who never believed the fisherman to be respectable will ever shoot a brown bear.
2. Matrix No: No hunter who the fisherman believed to be respectable will ever shoot a brown bear.
2. Licensor Absent: The hunter who the fisherman believed to be respectable will ever shoot a brown bear.
3. Relative No: The artist who no curator remembered from the gallery will ever make a bronze sculpture.
3. Relative Never: The artist who never remembered the curator from the gallery will ever make a bronze sculpture.
3. Matrix No: No artist who the curator remembered from the gallery will ever make a bronze sculpture.
3. Licensor Absent: The artist who the curator remembered from the gallery will ever make a bronze sculpture.
4. Relative No: The professor who no dean remembered from the conference will ever win a teaching award.
4. Relative Never: The professor who never remembered the dean from the conference will ever win a teaching award.
4. Matrix No: No professor who the dean remembered from the conference will ever win a teaching award.
4. Licensor Absent: The professor who the dean remembered from the conference will ever win a teaching award.
5. Relative No: The soldier who no general invited to the task force will ever earn a combat medal.
5. Relative Never: The soldier who never invited the general to the search party will ever earn a combat medal.
5. Matrix No: No soldier who the general invited to the task force will ever earn a combat medal.
5. Licensor Absent: The soldier who the general invited to the task force will ever earn a combat medal.
6. Relative No: The reporter who no candidate invited to the press pool will ever break a major story.
6. Relative Never: The reporter who never invited the candidate to the press pool will ever break a major story.
6. Matrix No: No reporter who the candidate invited to the press pool will ever break a major story.
6. Licensor Absent: The reporter who the candidate invited to the press pool will ever break a major story.
7. Relative No: The pirate who no admiral recognized from the wanted poster will ever be arrested for stealing a ship.
7. Relative Never: The pirate who never recognized the admiral from his portrait will ever be arrested for stealing a ship.
7. Matrix No: No pirate who the admiral recognized from the wanted poster will ever be arrested for stealing a ship.
7. Licensor Absent: The pirate who the admiral recognized from the wanted poster will ever be arrested for stealing a ship.

(Appendices continue)

8. Relative No: The thief who no detective recognized from the news report will ever be caught red handed.
8. Relative Never: The thief who never recognized the detective from the crime scene will ever be caught red handed.
8. Matrix No: No thief who the detective recognized from the news report will ever be caught red handed.
8. Licensor Absent: The thief who the detective recognized from the news report will ever be caught red handed.
9. Relative No: The lawyer who no criminal noticed approach the bench will ever run for governor.
9. Relative Never: The lawyer who never noticed the criminal had approached the bench will ever run for governor.
9. Matrix No: No lawyer who the criminal noticed approach the bench will ever run for governor.
9. Licensor Absent: The lawyer who the criminal noticed approach the bench will ever run for governor.
10. Relative No: The protester who no policeman noticed sneak past will ever support lower taxes.
10. Relative Never: The protester who never noticed the policeman walk by will ever support lower taxes.
10. Matrix No: No protester who the policeman noticed sneak past will ever support lower taxes.
10. Licensor Absent: The protester who the policeman noticed sneak past will ever support lower taxes.
11. Relative No: The hostage who no kidnapper realized was a veteran will ever escape without being spotted.
11. Relative Never: The hostage who never realized the kidnapper was respectable will ever escape without being spotted.
11. Matrix No: No hostage who the kidnapper realized was a veteran will ever escape without being spotted.
11. Licensor Absent: The hostage who the kidnapper realized was a veteran will ever escape without being spotted.
12. Relative No: The pollster who no politician realized could predict the results will ever be unemployed
12. Relative Never: The pollster who never realized the politician could win will ever be unemployed.
12. Matrix No: No pollster who the politician realized could predict the results will ever be unemployed.
12. Licensor Absent: The pollster who the politician realized could predicted the results will ever be unemployed.
13. Relative No: The actor who no director predicted will be a star will ever play a supporting role.
13. Relative Never: The actor who never predicted the director will be famous will ever play a supporting role.
13. Matrix No: No actor who the director predicted will be a star will ever play a supporting role.
13. Licensor Absent: The actor who the director predicted will be a star will ever play a supporting role.
14. Relative No: The rancher who no cowboy predicted will have a good harvest will ever be hungry again.
14. Relative Never: The rancher who never predicted the cowboy will wrangle the bull will ever be hungry again.
14. Matrix No: No rancher who the cowboy predicted will have a good harvest will ever be hungry again.
14. Licensor Absent: The rancher who the cowboy predicted will have a good harvest will ever be hungry again.
15. Relative No: The lender who no banker recommended for home loans will ever raise interest rates.
15. Relative Never: The lender who never recommended the banker for asset management will ever raise interest rates.
15. Matrix No: No lender who the banker recommended for home loans will ever raise interest rates.
15. Licensor Absent: The lender who the banker recommended for home loans will ever raise interest rates.

(Appendices continue)

16. Relative No: The agent who no tourist recommended for travel planning will ever suggest a boring trip.
16. Relative Never: The agent who never recommended the tourist go to Panama will ever suggest a boring trip.
16. Matrix No: No agent who the tourist recommended for travel planning will ever suggest a boring trip.
16. Licensor Absent: The agent who the tourist recommended for travel planning will ever suggest a boring trip.
17. Relative No: The painter who no sculptor said had a good eye will ever paint an impressionist sunset.
17. Relative Never: The painter who never said the sculptor had a good eye will ever paint an impressionist sunset.
17. Matrix No: No painter who the sculptor said had a good eye will ever paint an impressionist sunset.
17. Licensor Absent: The painter who the sculptor said had a good eye will ever paint an impressionist sunset.
18. Relative No: The bully who no student said was mean will ever get a scholarship to Northwestern.
18. Relative Never: The bully who never said the student was mean will ever get a scholarship to Northwestern.
18. Matrix No: No bully who the student said was mean will ever get a scholarship to Northwestern.
18. Licensor Absent: The bully who the student said was mean will ever get a scholarship to Northwestern.
19. Relative No: The patient who no trainer treated for a broken leg will ever give up on recovery.
19. Relative Never: The patient who never treated the trainer to dinner will ever give up on recovery.
19. Matrix No: No patient who the trainer treated for a broken leg will ever give up on recovery.
19. Licensor Absent: The patient who the trainer treated for a broken leg will ever give up on recovery.
20. Relative No: The victim who no doctor treated after a car accident will ever drive again.
20. Relative Never: The victim who never treated the doctor to lunch will ever drive again.
20. Matrix No: No victim who the doctor treated after a car accident will ever drive again.
20. Licensor Absent: The victim who the doctor treated after a car accident will ever drive again.
21. Relative No: The author who no reader knew from his oldest novel will ever buy books online.
21. Relative Never: The author who never knew the reader from their previous meeting will ever buy books online.
21. Matrix No: No author who the reader knew from his oldest novel will ever buy books online.
21. Licensor Absent: The author who the reader knew from his oldest novel will ever buy books online.
22. Relative No: The bailiff who no judge knew from the courthouse will ever commit a crime.
22. Relative Never: The bailiff who never knew the judge from the courthouse will ever commit a crime.
22. Matrix No: No bailiff who the judge knew from the courthouse will ever commit a crime.
22. Licensor Absent: The bailiff who the judge knew from the courthouse will ever commit a crime.
23. Relative No: The traitor who no jury speculated was guilty will ever be let go.
23. Relative Never: The traitor who never speculated the jury was rigged will ever be let go.
23. Matrix No: No traitor who the jury speculated was guilty will ever be let go.
23. Licensor Absent: The traitor who the jury speculated was guilty will ever be let go.

(Appendices continue)

24. Relative No: The player who no referee speculated was doping will ever have playing time.
24. Relative Never: The player who never speculated the referee was paid off will ever have playing time.
24. Matrix No: No player who the referee speculated was doping will ever have playing time.
24. Licensor Absent: The player who the referee speculated was doping will ever have playing time.
25. Relative No: The fireman who no arsonist assumed will respond will ever miss a service call.
25. Relative Never: The fireman who never assumed the arsonist will respond will ever miss a service call.
25. Matrix No: No fireman who the arsonist assumed will respond will ever miss a service call.
25. Licensor Absent: The fireman who the arsonist assumed will respond will ever miss a service call.
26. Relative No: The skier who no snowboarder assumed will miss the season will ever skip a day with good snow.
26. Relative Never: The skier who never assumed the snowboarder will miss the season will ever skip a day with good snow.
26. Matrix No: No skier who the snowboarder assumed will miss the season will ever skip a day with good snow.
26. Licensor Absent: The skier who the snowboarder assumed will miss the season will ever skip a day with good snow.
27. Relative No: The sailor who no pilot thought was a hotshot will ever be too busy showing off.
27. Relative Never: The sailor who never thought the pilot was a hotshot will ever be too busy showing off.
27. Matrix No: No sailor who the pilot thought was a hotshot will ever be too busy showing off.
27. Licensor Absent: The sailor who the pilot thought was a hotshot will ever be too busy showing off.
28. Relative No: The poet who no singer thought was verbose will ever improvise in a performance.
28. Relative Never: The poet who never thought the singer was verbose will ever improvise in a performance.
28. Matrix No: No poet who the singer thought was verbose will ever improvise in a performance.
28. Licensor Absent: The poet who the singer thought was verbose will ever improvise in a performance.
29. Relative No: The suspect who no investigator cleared of wrongdoing will ever trespass on government property.
29. Relative Never: The suspect who never cleared the investigator of wrongdoing will ever trespass on government property.
29. Matrix No: No suspect who the investigator cleared of wrongdoing will ever trespass on government property.
29. Licensor Absent: The suspect who the investigator cleared of wrongdoing will ever trespass on government property.
30. Relative No: The scammer who no sheriff cleared of involvement will ever run another con.
30. Relative Never: The scammer who never cleared the sheriff of involvement will ever run another con.
30. Matrix No: No scammer who the sheriff cleared of involvement will ever run another con.
30. Licensor Absent: The scammer who the sheriff cleared of involvement will ever run another con.
31. Relative No: The dancer who no teacher concluded was clumsy will ever perform center stage.
31. Relative Never: The dancer who never concluded the teacher was clumsy will ever perform center stage.
31. Matrix No: No dancer who the teacher concluded was clumsy will ever perform center stage.
31. Licensor Absent: The dancer who the teacher concluded was clumsy will ever perform center stage.
32. Relative No: The apprentice who no blacksmith concluded was talented will ever open a smithy.
32. Relative Never: The apprentice who never concluded the blacksmith was talented will ever open a smithy.
32. Matrix No: No apprentice who the blacksmith concluded was talented will ever open a smithy.
32. Licensor Absent: The apprentice who the blacksmith concluded was talented will ever open a smithy.

(Appendices continue)

Appendix D

Experiment 4 Materials

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| 1. Licensor Absent: The hunter who the fisherman remembered would go camping will ever shoot a bear with a bow. | 5. Licensor Absent: The hostage who the kidnapper believed would cry will ever manage to escape. |
| 1. Matrix No: No hunter who the fisherman remembered would go camping will ever shoot a bear with a bow. | 5. Matrix No: No hostage who the kidnapper believed would cry will ever manage to escape. |
| 1. Relative Verb: The hunter who the fisherman forgot would go camping will ever shoot a bear with a bow. | 5. Relative Verb: The hostage who the kidnapper doubted would cry will ever manage to escape. |
| 1. Relative No: The hunter who no fisherman remembered would go camping will ever shoot a bear with a bow. | 5. Relative No: The hostage who no kidnapper believed would cry will ever manage to escape. |
| 2. Licensor Absent: The congressman who the voter remembered would lie will ever vote for a budget increase. | 6. Licensor Absent: The investor who the lender believed would fold will ever make money on stocks. |
| 2. Matrix No: No congressman who the voter remembered will lie will ever vote for a budget increase. | 6. Matrix No: No investor who the lender believed would fold will ever make money on stocks. |
| 2. Relative Verb: The congressman who the voter forgot would lie will ever vote for a budget increase. | 6. Relative Verb: The investor who the lender doubted would fold will ever make money on stocks. |
| 2. Relative No: The congressman who no voter remembered would lie will ever vote for a budget increase. | 6. Relative No: The investor who no lender believed would fold will ever make money on stocks. |
| 3. Licensor Absent: The artist who the musician remembered would complain will ever win a creativity award. | 7. Licensor Absent: The soldier who the general believed would desert will ever report late for duty. |
| 3. Matrix No: No artist who the musician remembered would complain will ever win a creativity award. | 7. Matrix No: No soldier who the general believed would desert will ever report late for duty. |
| 3. Relative Verb: The artist who the musician forgot would complain will ever win a creativity award. | 7. Relative Verb: The soldier who the general doubted would desert will ever report late for duty. |
| 3. Relative No: The artist who no musician forgot would complain will ever win a creativity award. | 7. Relative No: The soldier who no general believed would desert will ever report late for duty. |
| 4. Licensor Absent: The scientist who the dean remembered would work hard will ever publish a bad paper. | 8. Licensor Absent: The candidate who the committee believed would succeed will ever have bad recommendations. |
| 4. Matrix No: No scientist who the dean remembered would work had will ever publish a bad paper. | 8. Matrix No: No candidate who the committee believed would succeed will ever have bad recommendations. |
| 4. Relative Verb: The scientist who the dean forgot would work hard will ever publish a bad paper. | 8. Relative Verb: The candidate who the doubted would succeed will ever have bad recommendations. |
| 4. Relative No: The scientist who no dean remembered would work hard will ever publish a bad paper. | 8. Relative No: The candidate who no committee believed would succeed will ever have bad recommendations. |

(Appendices continue)

9. Licensor Absent: The reader who the author agreed would understand will ever finish a novel.
9. Matrix No: No reader who the author agreed would understand will ever finish a novel.
9. Relative Verb: The reader who the author refuted would understand will ever finish a novel.
9. Relative No: The reader who no author agreed would understand will ever finish a novel.
10. Licensor Absent: The tourist who the vendor agreed would get lost will ever pay full price.
10. Matrix No: No tourist who the vendor agreed would get lost will ever pay full price.
10. Relative Verb: The tourist who the vendor refuted would get lost will ever pay full price.
10. Relative No: The tourist who no vendor agreed would get lost will ever pay full price.
11. Licensor Absent: The electrician who the plumber agreed would finish up will ever complete a job late.
11. Matrix No: No electrician who the plumber agreed would finish up will ever complete a job late.
11. Relative Verb: The electrician who the plumber refuted would finish up will ever complete a job late.
11. Relative No: The electrician who no plumber agreed would finish up will ever complete a job late.
12. Licensor Absent: The painter who the sculptor agreed would pay will ever create a masterpiece.
12. Matrix no: No painter who the sculptor agreed would pay will ever create a masterpiece.
12. Relative Verb: The painter who the sculptor refuted would pay will ever create a masterpiece.
12. Relative No: The painter who no sculptor agreed would pay will ever create a masterpiece.
13. Licensor Absent: The farmer who the rancher was disappointed would drive a tractor will ever plant soybeans.
13. Matrix No: No farmer who the rancher was disappointed would drive a tractor will ever plant soybeans.
13. Relative Verb: The farmer who the rancher was amazed would drive a tractor will ever plant soybeans.
13. Relative No: The farmer who no rancher was amazed would drive a tractor will ever plant soybeans.
14. Licensor Absent: The pirate who the admiral was disappointed would be a criminal will ever steal a ship.
14. Matrix No: No pirate who the admiral was disappointed would be a criminal will ever steal a ship.
14. Relative Verb: The pirate who the admiral was amazed would be a criminal will ever steal a ship.
14. Relative No: The pirate who no admiral was disappointed would be a criminal will ever steal a ship.
15. Licensor Absent: The salesman who the negotiator was disappointed would give up will ever make a good deal.
15. Matrix No: No salesman who the negotiator was disappointed would give up will ever make a good deal.
15. Relative Verb: The salesman who the negotiator was amazed would give up will ever make good deal.
15. Relative No: The salesman who no negotiator was disappointed would give up will ever make a good deal.
16. Licensor Absent: The client who the banker was disappointed would transfer will ever default on a loan.
16. Matrix No: No client who the banker was disappointed would transfer will ever default on a loan.
16. Relative Verb: The client who the banker was amazed would transfer will ever default on a loan.
16. Relative No: The client who no banker was disappointed would transfer will ever default on a loan.
17. No Licensor: The actor who the director confessed would get the part will ever be an understudy.
17. Matrix No: No actor who the director confessed would get the part will ever be an understudy.
17. Relative Verb: The actor who the director denied would get the part will ever be an understudy.
17. Relative No: The actor who no director confessed would get the part will ever be an understudy.

(Appendices continue)

18. Licensor Absent: The sponsor who the agent confessed would be small will ever sell branded shoes.
18. Matrix No: No sponsor who the agent confessed would be small will ever sell branded shoes
18. Relative Verb: The sponsor who the agent denied would be small will ever sell branded shoes.
18. Relative No: The sponsor who no agent confessed would be small will ever sell branded shoes.
19. Licensor Absent: The politician who the pollster confessed would lose will ever be slandered by the press.
19. Matrix No: No politician who the pollster confessed would lose will ever be slandered by the press.
19. Relative Verb: The politician who the pollster denied would lose will ever be slandered by the press.
19. Relative No: The politician who no pollster confessed would lose will ever be slandered by the press.
20. Licensor Absent: The populist who the governor confessed would sway voters will ever lose an election.
20. Matrix No: No populist who the governor confessed would sway voters will ever lose an election.
20. Relative Verb: The populist who the governor denied would sway voters will ever lose an election.
20. Relative No: The populist who no governor confessed would sway voters will ever lose an election.
21. Licensor Absent: The librarian who the curator was glad would manage the collection will ever write a book.
21. Matrix No: No librarian who the curator was glad would manage the collection will ever write a book.
21. Relative Verb: The librarian who the curator was surprised would manage the collection will ever write a book.
21. Relative No: The librarian who no curator was glad would manage the collection will ever write a book.
22. Licensor Absent: The protester who the guard was glad would go home will ever go to court.
22. Matrix No: No protester who the guard was glad would go home will ever go to court.
22. Relative Verb: The protester who the guard was surprised would go home will ever go to court.
22. Relative No: The protester who no guard was glad would go home will ever go to court.
23. Licensor Absent: The judge who the bailiff was glad would preside over the hearing will ever be late to work.
23. Matrix No: No judge who the bailiff was glad would preside over the hearing will ever be late to work.
23. Relative Verb: The judge who the bailiff was surprised would preside over the hearing will ever be late to work.
23. Relative No: The judge who no bailiff was glad would preside over the hearing will ever be late to work.
24. Licensor Absent: The criminal who the lawyer was glad would be charged will ever be found guilty.
24. Matrix No: No criminal who the lawyer was glad would be charged will ever be found guilty.
24. Relative Verb: The criminal who the lawyer was surprised would be charged will ever be found guilty.
24. Relative No: The criminal who no lawyer was glad would be charged will ever be found guilty.

(Appendices continue)

Appendix E

Experiment 5 Materials

1. Relative Subject No: The senator who no farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
1. Embedded No: The senator who believed no farmer to be untrustworthy will ever vote yes on the smoking proposal.
1. Matrix No: No senator who the farmer believed to be untrustworthy will ever vote yes on the smoking proposal.
1. Licensor Absent: The senator who the farmer believed to be untrustworthy will ever vote yes on new smoking proposition.
2. Relative Subject No: The hunter who no fisherman believed to be respectable will ever shoot a brown bear.
2. Embedded No: The hunter who believed no fisherman to be respectable will ever shoot a brown bear.
2. Matrix No: No hunter who the fisherman believed to be respectable will ever shoot a brown bear.
2. Licensor Absent: The hunter who the fisherman believed to be respectable will ever shoot a brown bear.
3. Relative Subject No: The artist who no curator remembered well enough to recognize ever make a bronze sculpture.
3. Embedded No: The artist who remembered no curator well enough to recognize will ever make a bronze sculpture.
3. Matrix No: No artist who the curator remembered well enough to recognize will ever make a bronze sculpture.
3. Licensor Absent: The artist who the curator remembered well enough to recognize will ever make a bronze sculpture.
4. Relative Subject No: The professor who no dean remembered fondly as a mentor will ever win a teaching award.
4. Embedded No: The professor who remembered no dean fondly as a mentor will ever win a teaching award.
4. Matrix No: No professor who the dean remembered fondly as a mentor will ever win a teaching award.
4. Licensor Absent: The professor who the dean remembered fondly as a mentor will ever win a teaching award.
5. Relative Subject No: The soldier who no general invited to curry favor will ever earn a combat medal.
5. Embedded No: The soldier who invited no general to curry favor will ever earn a combat medal.
5. Matrix No: No soldier who the general invited to curry favor will ever earn a combat medal.
5. Licensor Absent: The soldier who the general invited to curry favor will ever earn a combat medal.
6. Relative Subject No: The reporter who no candidate invited to the press pool will ever break a major story.
6. Embedded No: The reporter who invited no candidate to the press pool will ever break a major story.
6. Matrix No: No reporter who the candidate invited to the press pool will ever break a major story.
6. Licensor Absent: The reporter who the candidate invited to the press pool will ever break a major story.
7. Relative Subject No: The pirate who no admiral suspected of trickery will ever be arrested for stealing a ship.
7. Embedded No: The pirate who suspected no admiral of trickery will ever be arrested for stealing a ship.
7. Matrix No: No pirate who the admiral suspected of trickery will ever be arrested for stealing a ship.
7. Licensor Absent: The pirate who the admiral suspected of trickery will ever be arrested for stealing a ship.

(Appendices continue)

8. Relative Subject No: The thief who no detective suspected was watching will ever be caught red handed.
8. Embedded No: The thief who suspected no detective was watching will ever be caught red handed.
8. Matrix No: No thief who the detective suspected was watching will ever be caught red handed.
8. Licensor Absent: The thief who the detective suspected was watching will ever be caught red handed.
9. Relative Subject No: The lawyer who no criminal noticed approach the bench will ever run for governor.
9. Embedded No: The lawyer who noticed no criminal had approached the bench will ever run for governor.
9. Matrix No: No lawyer who the criminal noticed approach the bench will ever run for governor.
9. Licensor Absent: The lawyer who the criminal noticed approach the bench will ever run for governor.
10. Relative Subject No: The protester who no policeman noticed sneak past will ever support lower taxes.
10. Embedded No: The protester who noticed no policeman walk by will ever support lower taxes.
10. Matrix No: No protester who the policeman noticed sneak past will ever support lower taxes.
10. Licensor Absent: The protester who the policeman noticed sneak past will ever support lower taxes.
11. Relative Subject No: The hostage who no kidnapper realized was a veteran will ever escape without being spotted.
11. Embedded No: The hostage who realized no kidnapper was respectable will ever escape without being spotted.
11. Matrix No: No hostage who the kidnapper realized was a veteran will ever escape without being spotted.
11. Licensor Absent: The hostage who the kidnapper realized was a veteran will ever escape without being spotted.
12. Relative Subject No: The pollster who no politician realized could predict the results will ever be unemployed
12. Embedded No: The pollster who realized no politician could win will ever be unemployed.
12. Matrix No: No pollster who the politician realized could predict the results will ever be unemployed.
12. Licensor Absent: The pollster who the politician realized could predicted the results will ever be unemployed.
13. Relative Subject No: The actor who no director predicted will be a star will ever play a supporting role.
13. Embedded No: The actor who predicted no director will be famous will ever play a supporting role.
13. Matrix No: No actor who the director predicted will be a star will ever play a supporting role.
13. Licensor Absent: The actor who the director predicted will be a star will ever play a supporting role.
14. Relative Subject No: The rancher who no cowboy predicted will have a good harvest will ever be hungry again.
14. Embedded No: The rancher who predicted no cowboy will wrangle the bull will ever be hungry again.
14. Matrix No: No rancher who the cowboy predicted will have a good harvest will ever be hungry again.
14. Licensor Absent: The rancher who the cowboy predicted will have a good harvest will ever be hungry again.
15. Relative Subject No: The lender who no banker recommended for home loans will ever raise interest rates.
15. Embedded No: The lender who recommended no banker for asset management will ever raise interest rates.
15. Matrix No: No lender who the banker recommended for home loans will ever raise interest rates.
15. Licensor Absent: The lender who the banker recommended for home loans will ever raise interest rates.

(Appendices continue)

16. Relative Subject No: The agent who no tourist recommended for travel planning will ever suggest a boring trip.
16. Embedded No: The agent who recommended no tourist go to Panama will ever suggest a boring trip.
16. Matrix No: No agent who the tourist recommended for travel planning will ever suggest a boring trip.
16. Licensor Absent: The agent who the tourist recommended for travel planning will ever suggest a boring trip.
17. Relative Subject No: The painter who no sculptor said had a good eye will ever paint an impressionist sunset.
17. Embedded No: The painter who said no sculptor had a good eye will ever paint an impressionist sunset.
17. Matrix No: No painter who the sculptor said had a good eye will ever paint an impressionist sunset.
17. Licensor Absent: The painter who the sculptor said had a good eye will ever paint an impressionist sunset.
18. Relative Subject No: The bully who no student said was mean will ever get a scholarship to Northwestern.
18. Embedded No: The bully who said no student was mean will ever get a scholarship to Northwestern.
18. Matrix No: No bully who the student said was mean will ever get a scholarship to Northwestern.
18. Licensor Absent: The bully who the student said was mean will ever get a scholarship to Northwestern.
19. Relative Subject No: The patient who no trainer treated for a broken leg will ever give up on recovery.
19. Embedded No: The patient who treated no trainer to dinner will ever give up on recovery.
19. Matrix No: No patient who the trainer treated for a broken leg will ever give up on recovery.
19. Licensor Absent: The patient who the trainer treated for a broken leg will ever give up on recovery.
20. Relative Subject No: The victim who no doctor treated after a car accident will ever drive again.
20. Embedded No: The victim who treated no doctor to lunch will ever drive again.
20. Matrix No: No victim who the doctor treated after a car accident will ever drive again.
20. Licensor Absent: The victim who the doctor treated after a car accident will ever drive again.
21. Relative Subject No: The author who no reader knew to be verbose will ever buy books online.
21. Embedded No: The author who knew no reader to be verbose will ever buy books online.
21. Matrix No: No author who the reader knew to be verbose will ever buy books online.
21. Licensor Absent: The author who the reader knew to be verbose will ever buy books online.
22. Relative Subject No: The bailiff who no judge knew to be uncivil will ever commit a crime.
22. Embedded No: The bailiff who knew no judge to be uncivil will ever commit a crime.
22. Matrix No: No bailiff who the judge knew to be uncivil will ever commit a crime.
22. Licensor Absent: The bailiff who the judge knew to be uncivil will ever commit a crime.
23. Relative Subject No: The traitor who no jury speculated was guilty will ever be let go.
23. Embedded No: The traitor who speculated no jury was rigged will ever be let go.
23. Matrix No: No traitor who the jury speculated was guilty will ever be let go.
23. Licensor Absent: The traitor who the jury speculated was guilty will ever be let go.
24. Relative Subject No: The player who no referee speculated was doping will ever have playing time.
24. Embedded No: The player who speculated no referee was paid off will ever have playing time.
24. Matrix No: No player who the referee speculated was doping will ever have playing time.
24. Licensor Absent: The player who the referee speculated was doping will ever have playing time.

(Appendices continue)

25. Relative Subject No: The fireman who no arsonist assumed will respond will ever miss a service call.
25. Embedded No: The fireman who assumed no arsonist will respond will ever miss a service call.
25. Matrix No: No fireman who the arsonist assumed will respond will ever miss a service call.
25. Licensor Absent: The fireman who the arsonist assumed will respond will ever miss a service call.
26. Relative Subject No: The skier who no snowboarder assumed will miss the season will ever skip a day with good snow.
26. Embedded No: The skier who assumed no snowboarder will miss the season will ever skip a day with good snow.
26. Matrix No: No skier who the snowboarder assumed will miss the season will ever skip a day with good snow.
26. Licensor Absent: The skier who the snowboarder assumed will miss the season will ever skip a day with good snow.
27. Relative Subject No: The sailor who no pilot thought was a hotshot will ever be too busy showing off.
27. Embedded No: The sailor who thought no pilot was a hotshot will ever be too busy showing off.
27. Matrix No: No sailor who the pilot thought was a hotshot will ever be too busy showing off.
27. Licensor Absent: The sailor who the pilot thought was a hotshot will ever be too busy showing off.
28. Relative Subject No: The poet who no singer thought was verbose will ever improvise in a performance.
28. Embedded No: The poet who thought no singer was verbose will ever improvise in a performance.
28. Matrix No: No poet who the singer thought was verbose will ever improvise in a performance.
28. Licensor Absent: The poet who the singer thought was verbose will ever improvise in a performance.
29. Relative Subject No: The suspect who no investigator cleared of wrongdoing will ever trespass on government property.
29. Embedded No: The suspect who cleared no investigator of wrongdoing will ever trespass on government property.
29. Matrix No: No suspect who the investigator cleared of wrongdoing will ever trespass on government property.
29. Licensor Absent: The suspect who the investigator cleared of wrongdoing will ever trespass on government property.
30. Relative Subject No: The scammer who no sheriff cleared of involvement will ever run another con.
30. Embedded No: The scammer who cleared no sheriff of involvement will ever run another con.
30. Matrix No: No scammer who the sheriff cleared of involvement will ever run another con.
30. Licensor Absent: The scammer who the sheriff cleared of involvement will ever run another con.
31. Relative Subject No: The dancer who no teacher concluded was clumsy will ever perform center stage.
31. Embedded No: The dancer who concluded no teacher was clumsy will ever perform center stage.
31. Matrix No: No dancer who the teacher concluded was clumsy will ever perform center stage.
31. Licensor Absent: The dancer who the teacher concluded was clumsy will ever perform center stage.
32. Relative Subject No: The apprentice who no blacksmith concluded was talented will ever open a smithy.
32. Embedded No: The apprentice who concluded no blacksmith was talented will ever open a smithy.
32. Matrix No: No apprentice who the blacksmith concluded was talented will ever open a smithy.
32. Licensor Absent: The apprentice who the blacksmith concluded was talented will ever open a smithy.

(Appendices continue)

Appendix F

Experiment 6 Items

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| <ol style="list-style-type: none"> 1. Matrix No: No hunter who the fisherman believed to be trustworthy will ever shoot a bear. 1. Licensor Absent: The hunter who the fisherman believed to be trustworthy will ever shoot a bear. 1. Embedded No: The hunter who believed no fisherman to be trustworthy will ever shoot a bear. 1. Embedded Not a Single: The hunter who believed not a single fisherman to be trustworthy will ever shoot a bear. 1. Relative Subject No: The hunter who no fisherman believed to be trustworthy will ever shoot a bear. 1. Relative Subject Not A Single: The hunter who not a single fisherman believed to be trustworthy will ever shoot a bear. 2. Matrix No: No senator who the farmer believed to be respectable will ever vote yes on the smoking proposal. 2. Licensor Absent: The senator who the farmer believed to be respectable will ever vote yes on new smoking proposition. 2. Embedded No: The senator who believed no farmer to be respectable will ever vote yes on the smoking proposal. 2. Embedded Not a Single: The senator who believed not a single farmer to be respectable will ever vote yes on the smoking proposal. 2. Relative Subject No: The senator who no farmer believed to be respectable will ever vote yes on the smoking proposal. 2. Relative Subject Not A Single: The senator who not a single farmer believed to be respectable will ever vote yes on the smoking proposal. | <ol style="list-style-type: none"> 3. Matrix No: No artist who the curator remembered well enough to recognize will ever make a bronze sculpture. 3. Licensor Absent: The artist who the curator remembered well enough to recognize will ever make a bronze sculpture. 3. Embedded No: The artist who remembered no curator well enough to recognize will ever make a bronze sculpture. 3. Embedded Not a Single: The artist who remembered not a single curator well enough to recognize will ever make a bronze sculpture. 3. Relative Subject No: The artist who no curator remembered well enough to recognize will ever make a bronze sculpture. 3. Relative Subject Not A Single: The artist who not a single curator remembered well enough to recognize will ever make a bronze sculpture. 4. Matrix No: No professor who the dean remembered fondly as a mentor will ever win a teaching award. 4. Licensor Absent: The professor who the dean remembered fondly as a mentor will ever win a teaching award. 4. Embedded No: The professor who remembered no dean fondly as a mentor will ever win a teaching award. 4. Embedded Not a Single: The professor who remembered not a single dean fondly as a mentor will ever win a teaching award. 4. Relative Subject No: The professor who no dean remembered fondly as a mentor will ever win a teaching award. 4. Relative Subject Not A Single: The professor who not a single dean remembered fondly as a mentor will ever win a teaching award. |
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(Appendices continue)

5. Matrix No: No soldier who the general invited to curry favor will ever earn a combat medal.
5. Licensor Absent: The soldier who the general invited to curry favor will ever earn a combat medal.
5. Embedded No: The soldier who invited no general to curry favor will ever earn a combat medal.
5. Embedded Not a Single: The soldier who invited not a single general to curry favor will ever earn a combat medal.
5. Relative Subject No: The soldier who no general invited to curry favor will ever earn a combat medal.
5. Relative Subject Not A Single: The soldier who not a single general invited to curry favor will ever earn a combat medal.
6. Matrix No: No reporter who the candidate invited to the press pool will ever break a major story.
6. Licensor Absent: The reporter who the candidate invited to the press pool will ever break a major story.
6. Embedded No: The reporter who invited no candidate to the press pool will ever break a major story.
6. Embedded Not a Single: The report who invited not a single candidate to the press pool will ever break a major story.
6. Relative Subject No: The reporter who no candidate invited to the press pool will ever break a major story.
6. Relative Subject Not A Single: The reporter who not a single candidate invited to the press pool will ever break a major story.
7. Matrix No: No pirate who the admiral suspected of trickery will ever be arrested for stealing a ship.
7. Licensor Absent: The pirate who the admiral suspected of trickery will ever be arrested for stealing a ship.
7. Embedded No: The pirate who suspected no admiral of trickery will ever be arrested for stealing a ship.
7. Embedded Not a Single: The pirate who suspected not a single admiral of trickery will ever be arrested for stealing a ship.
7. Relative Subject No: The pirate who no admiral suspected of trickery will ever be arrested for stealing a ship.
7. Relative Subject Not A Single: The pirate who not a single admiral suspected of trickery will ever be arrested for stealing a ship.
8. Matrix No: No thief who the detective suspected for a while will ever be caught red handed.
8. Licensor Absent: The thief who the detective suspected for a while will ever be caught red handed.
8. Embedded No: The thief who suspected no detective for a while will ever be caught red handed.
8. Embedded Not a Single: The thief who suspected not a single detective for a while will ever be caught red handed.
8. Relative Subject No: The thief who no detective suspected for a while will ever be caught red handed.
8. Relative Subject Not A Single: The thief who not a single detective suspected for a while will ever be caught red handed.
9. Matrix No: No lawyer who noticed the criminal approach the bench will ever run for governor.
9. Licensor Absent: The lawyer who noticed the criminal approach the bench will ever run for governor.
9. Embedded No: The lawyer who noticed no criminal approach the bench will ever run for governor.
9. Embedded Not a Single: The lawyer who noticed not a single criminal approach the bench will ever run for governor.
9. Relative Subject No: The lawyer who no criminal noticed approach the bench will ever run for governor.
9. Relative Subject Not A Single: The lawyer who not a single criminal noticed approach the bench will ever run for governor.
10. Matrix No: No protester who the policeman noticed sneak past will ever support lower taxes.
10. Licensor Absent: The protester who the policeman noticed sneak past will ever support lower taxes.

(Appendices continue)

10. Embedded No: The protester who noticed no policeman sneak past will ever support lower taxes.
10. Embedded Not a Single: The protester who noticed not a single policeman sneak past will ever support lower taxes.
10. Relative Subject No: The protester who no policeman noticed sneak past will ever support lower taxes.
10. Relative Subject Not A Single: The protester who not a single policeman noticed sneak past will ever support lower taxes.
11. Matrix No: No hostage who the kidnapper realized was brave will ever escape without being spotted.
11. Licensor Absent: The hostage who the kidnapper realized was brave will ever escape without being spotted.
11. Embedded No: The hostage who realized no kidnapper was brave will ever escape without being spotted.
11. Embedded Not a Single: The hostage who realized not a single kidnapper was brave will ever escape without being spotted.
11. Relative Subject No: The hostage who no kidnapper realized was brave will ever escape without being spotted.
11. Relative Subject Not A Single: The hostage who not a single kidnapper realized was brave will ever escape without being spotted.
12. Matrix No: No pollster who realized no politician could predict the results will ever be unemployed.
12. Licensor Absent: The pollster who realized the politician could predict the results will ever be unemployed.
12. Embedded No: The pollster who realized no politician could predict the results will ever be unemployed.
12. Embedded Not a Single: The pollster who realized not a single politician could predict the results will ever be unemployed.
12. Relative Subject No: The pollster who no politician realized could predict the results will ever be unemployed.
12. Relative Subject Not A Single: The pollster who not a single politician realized could predict the results will ever be unemployed.
13. Matrix No: No actor who the director predicted would be a star will ever play a supporting role.
13. Licensor Absent: The actor who the director predicted would be a star will ever play a supporting role.
13. Embedded No: The actor who predicted no director would be a star will ever play a supporting role.
13. Embedded Not a Single: The actor who predicted not a single director would be a star will ever play a supporting role.
13. Relative Subject No: The actor who no director predicted would be a star will ever play a supporting role.
13. Relative Subject Not A Single: The actor who not a single director predicted would be a star will ever play a supporting role.
14. Matrix No: No rancher who the cowboy predicted would wrangle the bull will ever be hungry again.
14. Licensor Absent: The rancher who the cowboy predicted would wrangle the bull will ever be hungry again.
14. Embedded No: The rancher who predicted no cowboy would wrangle the bull will ever be hungry again.
14. Embedded Not a Single: The rancher who predicted not a single cowboy would wrangle the bull will ever be hungry again.
14. Relative Subject No: The rancher who no cowboy predicted would wrangle the bull will ever be hungry again.
14. Relative Subject Not A Single: The rancher who not a single cowboy predicted would wrangle the bull will ever be hungry again.
15. Matrix No: No lender who the banker recommended for home loans will ever raise interest rates.
15. Licensor Absent: The lender who the banker recommended for home loans will ever raise interest rates.
15. Embedded No: The lender who recommended no banker for home loans will ever raise interest rates.

(Appendices continue)

15. Embedded Not a Single: The lender who recommended not a single banker for home loans will ever raise interest rates.
15. Relative Subject No: The lender who no banker recommended for home loans will ever raise interest rates.
15. Relative Subject Not A Single: The lender who not a single banker recommended for home loans will ever raise interest rates
16. Matrix No: No agent who the concierge recommended for day planning will ever suggest a boring trip.
16. Licensor Absent: The agent who the concierge recommended for day planning will ever suggest a boring trip.
16. Embedded No: The agent who recommended no concierge for day planning will ever suggest a boring trip.
16. Embedded Not a Single: The agent who recommended not a single concierge for day planning will ever suggest a boring trip.
16. Relative Subject No: The agent who no concierge recommended for day planning will ever suggest a boring trip.
16. Relative Subject Not A Single: the agent who not a single concierge recommended for day planning will ever suggest a boring trip.
17. Matrix No: No painter who the sculptor said had a good eye will ever paint an impressionist sunset.
17. Licensor Absent: The painter who the sculptor said had a good eye will ever paint an impressionist sunset.
17. Embedded No: The painter who said no sculptor had a good eye will ever paint an impressionist sunset.
17. Embedded Not a Single: The painter who said not a single sculptor had a good eye will ever paint an impressionist sunset.
17. Relative Subject No: The painter who no sculptor said had a good eye will ever paint an impressionist sunset.
17. Relative Subject Not A Single: The painter who not a single sculptor said had a good eye will ever paint an impressionist sunset.
18. Matrix No: No bully who the student said was mean will ever get a scholarship to Northwestern.
18. Licensor Absent: The bully who the student said was mean will ever get a scholarship to Northwestern.
18. Embedded No: The bully who said no student was mean will ever get a scholarship to Northwestern.
18. Embedded Not a Single: The bully who said not a single student was mean will ever get a scholarship to Northwestern.
18. Relative Subject No: The bully who no student said was mean will ever get a scholarship to Northwestern.
18. Relative Subject Not A Single: The bully who not a single student said was mean will ever get a scholarship to Northwestern.
19. Matrix No: No patient who the trainer treated unkindly will ever give up on recovery.
19. Licensor Absent: The patient who the trainer treated unkindly will ever give up on recovery.
19. Embedded No: The patient who treated no trainer unkindly will ever give up on recovery.
19. Embedded Not a Single: The patient who treated not a single trainer unkindly will ever give up on recovery.
19. Relative Subject No: The patient who no trainer treated unkindly will ever give up on recovery.
19. Relative Subject Not A Single: The patient who not a single trainer treated unkindly will ever give up on recovery.
20. Matrix No: No victim who the doctor treated to lunch will ever drive again.
20. Licensor Absent: The victim who the doctor treated to lunch will ever drive again.

(Appendices continue)

20. Embedded No: The victim who treated no doctor to lunch will ever drive again.
20. Embedded Not a Single: The victim who treated not a single doctor to lunch will ever drive again.
20. Relative Subject No: The victim who no doctor treated to lunch will ever drive again.
20. Relative Subject Not A Single: The victim who not a single doctor treated to lunch will ever drive again.
21. Matrix No: No author who the reader knew to be verbose will ever buy books online.
21. Licensor Absent: The author who the reader knew to be verbose will ever buy books online.
21. Embedded No: The author who knew no reader to be verbose will ever buy books online.
21. Embedded Not a Single: The author who knew not a single reader to be verbose will ever buy books online.
21. Relative Subject No: The author who no reader knew to be verbose will ever buy books online.
21. Relative Subject Not A Single: The author who not a single reader knew to be verbose will ever buy books online.
22. Matrix No: No bailiff who the judge knew to be uncivil will ever commit a crime.
22. Licensor Absent: The bailiff who the judge knew to be uncivil will ever commit a crime.
22. Embedded No: The bailiff who knew no judge to be uncivil will ever commit a crime.
22. Embedded Not a Single: The bailiff who knew not a single judge to be uncivil will ever commit a crime.
22. Relative Subject No: The bailiff who no judge knew to be uncivil will ever commit a crime.
22. Relative Subject Not A Single: The bailiff who not a single judge knew to be uncivil will ever commit a crime.
23. Matrix No: No traitor who the jury speculated was dishonest will ever be let go.
23. Licensor Absent: The traitor who the jury speculated was dishonest will ever be let go.
23. Embedded No: The traitor who speculated no jury was dishonest will ever be let go.
23. Embedded Not a Single: The traitor who speculated not a single jury was dishonest will ever be let go.
23. Relative Subject No: The traitor who no jury speculated was dishonest will ever be let go.
23. Relative Subject Not A Single: The traitor who not a single jury speculated was dishonest will ever be let go.
24. Matrix No: No player who the referee speculated was paid off will ever have playing time.
24. Licensor Absent: The player who the referee speculated was paid off will ever have playing time.
24. Embedded No: The player who speculated no referee was paid off will ever have playing time.
24. Embedded Not a Single: The player who speculated not a single referee was paid off will ever have playing time.
24. Relative Subject No: The player who no referee speculated was paid off will ever have playing time.
24. Relative Subject Not A Single: The player who not a single referee speculated was paid off will ever have playing time.
25. Matrix No: No fireman who the arsonist assumed would respond will ever miss a service call.
25. Licensor Absent: The fireman who the arsonist assumed would respond will ever miss a service call.
25. Embedded No: The fireman who assumed no arsonist would respond will ever miss a service call.
25. Embedded Not a Single: The fireman who assumed not a single arsonist would respond will ever miss a service call.
25. Relative Subject No: The fireman who no arsonist assumed would respond will ever miss a service call.

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25. Relative Subject Not A Single: The fireman who not a single arsonist assumed would respond will ever miss a service call.
26. Matrix No: No skier who the snowboarder assumed would miss the season will ever skip a day with good snow.
26. Licensor Absent: The skier who the snowboarder assumed would miss the season will ever skip a day with good snow.
26. Embedded No: The skier who assumed no snowboarder would miss the season will ever skip a day with good snow.
26. Embedded Not a Single: The skier who assumed not a single snowboarder would miss the season will ever skip a day with good snow.
26. Relative Subject No: The skier who no snowboarder assumed would miss the season will ever skip a day with good snow.
26. Relative Subject Not A Single: The skier who not a single snowboarder assumed would miss the season will ever skip a day with good snow.
27. Matrix No: No sailor who the pilot thought was a hotshot will ever be too busy showing off.
27. Licensor Absent: The sailor who the pilot thought was a hotshot will ever be too busy showing off.
27. Embedded No: The sailor who thought no pilot was a hotshot will ever be too busy showing off.
27. Embedded Not a Single: The sailor who thought not a single pilot was a hotshot will ever be too busy showing off.
27. Relative Subject No: The sailor who no pilot thought was a hotshot will ever be too busy showing off.
27. Relative Subject Not A Single: The sailor who not a single pilot thought was a hotshot will ever be too busy showing off.
28. Matrix No: No poet who the singer thought was talented will ever improvise in a performance.
28. Licensor Absent: The poet who the singer thought was talented will ever improvise in a performance.
28. Embedded No: The poet who thought no singer was talented will ever improvise in a performance.
28. Embedded Not a Single: The poet who thought not a single singer was talented will ever improvise in a performance.
28. Relative Subject No: The poet who no singer thought was talented will ever improvise in a performance.
28. Relative Subject Not A Single: The poet who not a single singer thought was talented will ever improvise in a performance.
29. Matrix No: No suspect who the investigator cleared of wrongdoing would ever trespass on government property.
29. Licensor Absent: The suspect who the investigator cleared of wrongdoing would ever trespass on government property.
29. Embedded No: The suspect who cleared no investigator of wrongdoing would ever trespass on government property.
29. Embedded Not a Single: The suspect who cleared not a single investigator of wrongdoing would ever trespass on government property.
29. Relative Subject No: The suspect who no investigator cleared of wrongdoing would ever trespass on government property.
29. Relative Subject Not A Single: The suspect who not a single investigator cleared of wrongdoing would ever trespass on government property.
30. Matrix No: No scammer who the sheriff cleared of involvement will ever run another con.
30. Licensor Absent: The scammer who the sheriff cleared of involvement will ever run another con.
30. Embedded No: The scammer who cleared no sheriff of involvement will ever run another con.
30. Embedded Not a Single: The scammer who cleared not a single sheriff of involvement will ever run another con.
30. Relative Subject No: The scammer who no sheriff cleared of involvement will ever run another con.

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30. Relative Subject Not A Single: The scammer who not a single sheriff cleared of involvement will ever run another con.
31. Matrix No: No dancer who the teacher concluded was clumsy will ever perform center stage.
31. Licensor Absent: The dancer who the teacher concluded was clumsy will ever perform center stage.
31. Embedded No: The dancer who concluded no teacher was clumsy will ever perform center stage.
31. Embedded Not a Single: The dancer who concluded not a single teacher was clumsy will ever perform center stage.
31. Relative Subject No: The dancer who no teacher concluded was clumsy will ever perform center stage.
31. Relative Subject Not A Single: The dancer who not a single teacher concluded was clumsy will ever perform center stage.
32. Matrix No: No apprentice who the blacksmith concluded had potential will ever open a smithy.
32. Licensor Absent: The apprentice who the blacksmith concluded had potential will ever open a smithy.
32. Embedded No: The apprentice who concluded no blacksmith had potential will ever open a smithy.
32. Embedded Not a Single: The apprentice who concluded not a single blacksmith had potential will ever open a smithy.
32. Relative Subject No: The apprentice who no blacksmith concluded had potential will ever open a smithy.
32. Relative Subject Not A Single: The apprentice who not a single blacksmith concluded had potential will ever open a smithy.
33. Matrix No: No trucker who the analyst suggested was underperforming will ever retire early.
33. Licensor Absent: The trucker who the analyst suggested was underperforming will ever retire early.
33. Embedded No: The trucker who suggested no analyst was underperforming will ever retire early.
33. Embedded Not a Single: The trucker who suggested not a single analyst was underperforming will ever retire early.
33. Relative Subject No: The trucker who no analyst suggested was underperforming will ever retire early.
33. Relative Subject Not A Single: The trucker who not a single analyst suggested was underperforming will ever retire early.
34. Matrix No: No bellhop who the doorman suggested could work harder will ever help out after hours.
34. Licensor Absent: The bellhop who the doorman suggested could work harder will ever help out after hours.
34. Embedded No: The bellhop who suggested no doorman could work harder will ever help out after hours.
34. Embedded Not a Single: The bellhop who suggested not a single doorman could work harder will ever help out after hours.
34. Relative Subject No: The bellhop who no doorman suggested could work harder will ever help out after hours.
34. Relative Subject Not A Single: The bellhop who not a single doorman suggested could work harder will ever help out after hours.
35. Matrix No: No contractor who the architect proposed for the job will ever question the design choices.
35. Licensor Absent: The contractor who the architect proposed for the job will ever question the design choices.
35. Embedded No: The contractor who proposed no architect for the job will ever question the design choices.
35. Embedded Not a Single: The contractor who proposed not a single architect for the job will ever question the design choices.
35. Relative Subject No: The contractor who no architect proposed for the job will ever question the design choices.
35. Relative Subject Not A Single: The contractor who not a single architect proposed for the job will ever question the design choices.

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36. Matrix No: No manufacturer who the inventor proposed for production will ever miss a shipment.
36. Licensor Absent: The manufacturer who the inventor proposed for production will ever miss a shipment.
36. Embedded No: The manufacturer who proposed no inventor for production will ever miss a shipment.
36. Embedded Not a Single: The manufacturer who proposed not a single inventor for production will ever miss a shipment.
36. Relative Subject No: The manufacturer who no inventor proposed for production will ever miss a shipment.
36. Relative Subject Not A Single: The manufacturer who not a single inventor proposed for production will ever miss a shipment.

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