

PPI Illusion Ignores Binding but is Facilitated by Reactivation  
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**Introduction:** NPis are lexical items (e.g. “ever”, “any”) which are grammatically licensed by a negative element in a structural relation, c-command [1], as seen in the contrast between (1) and (2). There exists an illusion of grammaticality for NPI, such that the relative acceptability of sentences like (3), where a negative element (**no**) does *not* c-command the NPI (**ever**), is higher than the ungrammatical counterpart (2) containing no negative element [2-3]. Positive Polarity Items (PPI) are lexical items (e.g. “still”, “somewhat”) which are ungrammatical in environments that can host NPI as shown in (1) and (2) [4-6]. PPI are subject to an illusion of ungrammaticality in the environment where NPI are subject to the illusion of grammaticality [7].

- (1) **No** hunter who the fisherman believed to be trustworthy will **ever/still\*** shoot a bear.
- (2) The hunter who the fisherman believed to be trustworthy will **ever\*/still** shoot a bear.
- (3) The hunter who **no** fisherman believed to be trustworthy will **ever\*/still?** shoot a bear.

PPI illusions are observed at the polarity item and are limited to negative elements which are also quantified expressions (e.g. “**no**”, “**not a single**”) [7-8]. In this series of studies, we aim to investigate if these illusions are sensitive to prior binding relationships involving the quantifier. We performed two experiments with a third follow-up experiment to be completed.

**Experiment 1:** To provide a negative quantified element that can generate illusions and bind a pronoun within the relative clause, we conducted a speeded acceptability judgment study with 71 participants comparing “**none of the NP**” and “**no NP**.” Participants viewed potential illusion sentences with these elements in the relative clause and baseline grammatical and ungrammatical controls following Orth Sloggett and Yoshida 2020. As shown in Table 1 and Figure 1, effects were found for grammaticality ( $\beta = 0.462$ ,  $t = 4.36$ ) and negative element presence ( $\beta = 0.244$ ,  $t = 2.73$ ). However, “**none of the NP**” and “**no NP**” were not statistically different, suggesting both phrases produce an illusion compared to the ungrammatical baseline.

**Experiment 2:** Having established the illusion generating ability of “**none of the NP**”, we conducted a maze task experiment with 39 participants to examine the role of established binding relationships in the PPI illusion [9-10]. The experiment employed a 2x2 gender mismatch paradigm, varying in negativity of the quantifier and pronoun gender as in (4).

- (4) The carpenter who  $\left\{ \begin{matrix} \text{none} \\ \text{one} \end{matrix} \right\}$  of the salesmen said believed  $\left\{ \begin{matrix} \text{him} \\ \text{her} \end{matrix} \right\}$  [about the tool] will **still**...

Log reaction time from the critical region “**still**” was analyzed using a deviation coded mixed effects model. With fixed terms for quantifier negativity and gender match and random intercepts for items and participants, we find that there is an interaction between the negativity of quantifier and the gender of the pronoun ( $\beta = 0.122$ ,  $t = 2.05$ ), such that a reading time penalty was observed when the quantifier was negative, and the pronoun matched the gender of the relative clause subject. Reading times of at the critical region visualized in Figure 2 and full model output is available in Table 2. The parser appears to be experiencing the PPI illusion of ungrammaticality, but only when the quantifier is binding the pronoun. Within a theory where the illusion is caused by the parser raising the relative clause quantifier to test for possible scope relations [8], this result suggests the parser performs raising recklessly without privileging existing binding relationships. One remaining question is why no illusion appears to occur when the quantifier is negative but does not bind the relative clause pronoun. This could be due to the distance between the negative quantifier and the polarity item, which has previously been shown to modulate the appearance of the NPI illusion [11]. If binding results in the reactivation of the quantifier, this could help preserve the negative quantifier in memory, allowing for the illusion to occur over greater distances than it otherwise would be able to.

**Experiment 3:** This follow-up experiment will test the role of distance utilizing items like (4), but with the manipulation being the gender of the pronoun and the presence of the prepositional phrase [about the tool]. In all sentences the relative clause quantifier will be negative, allowing us to observe if the binding relationship opens the possibility of a long-range PPI illusion.

[1] Ladusaw, W. A. (1980), [2] Drenhaus, H., Saddy, D., & Frisch, S. (2005), [3] Vasishth, S., Brüssow, S., Lewis, R. L., & Drenhaus, H. (2008), [4] Homer, V. (2012), [5] Giannakidou, A. (2011), [6] Szabolcsi, A. (2004), [7] Orth, W., Yoshida, M., & Sloggett, S. (2020A), [8] Orth, W., Yoshida, M., Sloggett, S. (2020B), [9] Boyce, V., Futrell, R., & Levy, R. P. (2020), [10] Forster, K. I., Guerrera, C., and Elliot, L. (2009), [11] Parker, D., & Phillips, C. (2016)

Table 1: Fixed effects from logistic mixed effects regression. Helmert coded contrasts included for grammaticality (-1, 1/3, 1/3,1/3), negative element presence (0, 1/2, 1/2, -1), and illusion “no” vs illusion “none” (0, -1, 1, 0). Maximally convergent random slopes were also included.

Term	Estimate	Std.Error	Z value
(Intercept)	0.45261	0.14750	3.069
Grammatical	0.46233	0.10610	<b>4.357</b>
Negative Element Present	0.24457	0.08974	<b>2.725</b>
IllusionAvsB	0.04581	0.06847	0.669

Table 2: Fixed effects from linear mixed effects regression of log reading time at the critical region. Conditions were deviation coded with negativity conditions coded (one 1/2, none -1/2) and gender match coded (Match 1/2, Mismatch -1/2). Random intercepts for participant and item were also included.

Term	Estimate	Std.Error	T value
(Intercept)	-0.004	0.032	-0.151
Negativity	0.004	0.026	0.136
Gender Match	0.033	0.026	1.245
Negativity: Gender Match	0.122	0.060	<b>2.045</b>

Figure 1: Proportion Acceptable NPI None/No Illusion

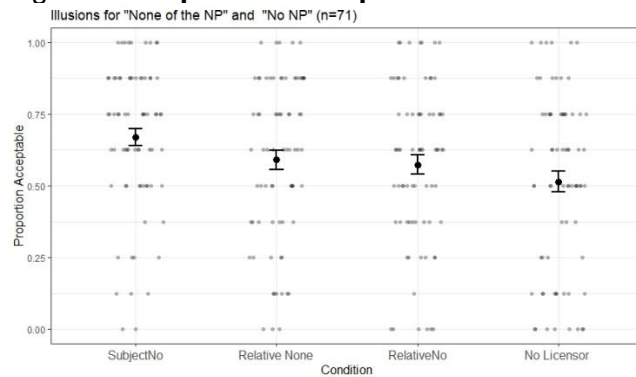


Figure 2: Reading Time at the Critical Region: PPI “Still”

