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Location, location, location: Anaphor selection in English locative prepositional phrases

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Abstract. This paper presents experimental work on the relative naturalness of subject-oriented reflexives (*herself*) and pronouns (*her*) in English locative prepositional phrases (e.g., *Michele set a glass next to her/herself*). Syntactic approaches to anaphor licensing have tended to focus on the lack of complementarity in such constructions; however, it has long been observed that preferences between forms may depend on verb meaning (change in location vs. perception vs. possession) and spatial relation (+contact vs. -contact), with very strong preferences reported in some cases. This study aims to clarify the extent to which these two factors shape anaphor choice. Results confirm that both play a significant role: reflexives are most natural in the expression of change in location and direct contact, while pronouns pattern oppositely. Importantly, preferences between forms are less stark than those found in constructions where syntactic constraints are assumed to render one form ungrammatical. I suggest that these findings favor an treatment of English anaphora that takes event structure into account.

Keywords. English anaphors; binding theory; reflexivity; syntax/semantics interface; experimental syntax/semantics; locative prepositional phrases; event structure

1. Introduction. In English, both reflexives (*herself*) and pronouns (*her*) can be used anaphorically[1] to refer to someone previously mentioned in a sentence. Research in the area of binding theory has centered the role of syntax in constraining anaphor choice, appealing to structural factors like locality, c-command, and coargumenthood. But purely structure-driven approaches face an interesting challenge when it comes to subject-oriented anaphors in locative prepositional phrases (LPPs). As illustrated in (1), both the reflexive and pronoun are permitted in LPPs, contrary to the complementarity predicted by classical Binding Theory (e.g., Chomsky 1981).

(1) Michele$_i$ set a glass next to her$_i$/herself$_i$.[2]

In treating such examples, the main focus within binding theory has been accounting for why either anaphor can be used, whether by defining syntactic constraints in such a way that both forms satisfy them (e.g., Hestvik 1991, Büring 2005), or by allowing exemption from them (e.g., Reinhart & Reuland 1993). However, observations and discussion in the literature suggest that anaphor choice is far from free in LPPs. Relative preferences have been shown to greatly depend on the meaning of the embedding verb – whether it expresses change in location, perception, or possession (Lees & Klima 1963, Hestvik 1991, Rooryck & Vanden Wyngaerd 2007,

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[1] For convenience, I use "anaphor" to refer to both reflexives and pronouns with sentence-mate antecedents. This usage departs from much of the literature on binding, including Chomsky (1981), where anaphors and pronouns are treated as comprising distinct categories.

[2] Here and throughout, I use subscript alphabetic indices to indicate intended coreference. I make no commitment to the syntactic reality of indices. For interesting discussion on this matter, see Reuland (2011).

Bassel 2018) – as well as the nature of the spatial relation expressed by the preposition – whether or not direct contact holds between figure and ground (Faltz 1977, Kuno 1987, van Hoek 1997, Wechsler 1997, Strahan 2006, Rooryck & Vanden Wyngaerd 2007, Lederer 2013). In some cases, reported contrasts are very strong, even categorical.

These are certainly not the only factors that have been proposed to play into English anaphor choice.[3] Because relevant examples can vary along several dimensions and are typically presented without context, it is hard to pin down effects stemming from verb meaning and spatial relation in particular. What's more, reported acceptability judgments often vary widely across works, even for structurally indistinguishable sentences, making it unclear how robust these effects really are.

This project aims to help clarify the empirical picture by experimentally testing the extent to which verb meaning and spatial relation determine relative preferences between subject-oriented reflexives and pronouns in sentences like (1). Results from two naturalness rating experiments reveal that both factors play a significant role: reflexives are most natural in the expression of change in location and direct physical contact, while pronouns show the opposite tendency. Importantly, contrasts between forms were never as stark as those observed for constructions where syntactic constraints are canonically assumed to render one of the forms ungrammatical. I will suggest that this pattern is best accounted for by incorporating aspects of event structure into our theory of English anaphor choice.

Section 2 offers more background on how English LPPs have figured into binding theory and introduces the puzzle posed by verb meaning and spatial relation. Experiments 1 and 2 are presented in Sections 3 and 4, followed by general discussion in Section 5. Section 6 concludes.

2. Background. Since Lees and Klima's seminal (1963) paper, the distribution of reflexives and pronouns has been a prominent topic within generative linguistics. Ample research has suggested that the choice between forms depends at least in part on the syntactic conditions in which the anaphor occurs. Formal binding theories following the tradition of Chomsky (1981) have focused on the impact of locality and c-command in constraining suitable antecedents for reflexives and pronouns, proposing syntactic binding principles like those in (2). Predicate-based theories, including those put forth by Pollard & Sag (1992) and Reinhart and Reuland (1993), have rather centered coargumenthood in their formulations of binding principles, as in (3).

(2) Antecedent-based binding principles
   a. Principle A: A reflexive must take a c-commanding antecedent within its local domain.
   b. Principle B: A pronoun must not take a c-commanding antecedent within its local domain.

(3) Predicate-based binding principles
   a. Principle A: A reflexive must be anteceded by a coargument.
   b. Principle B: A pronoun must not be anteceded by a coargument.

Binding theories take as their starting point environments within which the grammar renders one of the two forms unavailable. As a result, syntactic binding principles do well to capture cases of strict complementarity between reflexives and pronouns. This is for instance what we find in simple transitive sentences in English, as in (4).

(4) a. Michele$_i$'s brother congratulated her$_i$/*herself$_i$.
   b. Michele$_i$ congratulated *her$_i$/herself$_i$.

[3] A very rich line of inquiry explores the relationship between anaphor choice and point-of-view (see Pollard & Sag 1992 and citations therein.) For reasons of space, point-of-view will not be discussed in this paper.

In (4a), the reflexive is correctly predicted to be unavailable under either an antecedent-based or predicate-based formulation of Principle A: it is not c-commanded by its intended antecedent, *Michele*, nor is *Michele* a coargument. In (4b), the pronoun is correctly ruled out by Principle B: *Michele* is local, c-commanding, and a coargument.

However, it has long been observed that the kind of complementarity found in (4) does not apply within English LPPs, where both forms can be used to refer back to the sentence subject (cf. (1) above). One solution is to posit that complementarity in fact does apply in LPPs, and that the appearance to the contrary arises from the availability of multiple syntactic parses. For instance, Chomsky (1981) suggests that the pronoun surfaces when the LPP projects a subject of its own[4] such that the sentence subject is syntactically non-local (5a), while the reflexive is required in the absence of a PP-internal subject (5b).[5]

(5) a. Michele$_i$ set a glass$_k$ [PRO$_k$ next to her$_i$/*herself$_i$].
b. Michele$_i$ set a glass next to *her$_i$/herself$_i$.

While this sort of solution provides a mechanical fix for LPPs, Chomsky (1981:291) questions whether a covert structural distinction is motivated independent of anaphor licensing.[6]

A more common solution is to suggest that LPPs in sentences like (1) do not project an internal subject, but that the syntax is simply free to generate either form. Maintaining antecedent-based approaches to binding, Hestvik (1991) and Büring (2005) propose asymmetrical binding domains for the reflexive and pronoun. Glossing over differences in these two proposals, the domain of the reflexive is argued to extend to the projection containing the nearest subject, as shown in (6a). On the other hand, the domain of the pronoun is confined to the prepositional phrase, even in the absence of a PP-internal subject, as in (6b).

(6) a. [Michele$_i$ set a glass next to herself$_i$].
b. Michele$_i$ set a glass [next to her$_i$].

Whereas Hestvik and Büring posit mutual satisfaction of binding principles to account for anaphor choice in LPPs, Reinhart and Reuland (1993) rather appeal to the possibility that, in some cases, binding principles do not apply. Pursuing a predicate-based theory, they argue that the reflexive requires a coargument antecedent only if its selecting predicate projects a syntactic subject; in the absence of a subject, the reflexive is exempt from syntactic constraints, its distribution determined instead by discourse factors such as point of view (cf. Pollard and Sag 1992). Non-complementarity between reflexives and pronouns in LPPs is therefore attributed to the absence of a PP-internal subject. In support of this proposal, the authors observe a contrast between anaphor licensing in LPPs on the one hand and in verb phrase complements on the other, the latter disallowing reflexives anteceded by the sentence subject as shown in (7b).[7]

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[4] Ample debate has concerned the precise syntactic category of this kind of subject-containing constituent, commonly known as a *small clause*. However, category label is irrelevant to the predictions made by formal binding conditions, which are broadly defined over structures containing subjects. For convenience, I will refer to the embedded subject posited for parses requiring the pronoun as "PP-internal."

[5] PRO is proposed as the PP-internal subject in Chomksy (1981) based on analogy with the covert subjects assumed for infinitive clauses in control constructions. The same licensing pattern could arise if the subject were rather a trace or copy left over from movement of the object from a PP-internal position to the matrix verb phrase as in (i) (cf. Ramchand 2007) or if the object was optionally parsed as strictly internal to the PP as in (ii) (cf. Hoekstra 1988).

(i) Michele$_i$ set a glass$_k$ [t$_k$ next to her$_i$/*herself$_i$]. (ii) Michele$_i$ set [a glass$_k$ next to her$_i$/*herself$_i$].

[6] Bassel (2018) proposes an account along these lines under which the structural distinction in (5) corresponds to a distinction between Place PPs and Path PPs. See Section 5 for further discussion of this approach.

[7] Acceptability markings included in cited examples are reproduced from the source material.

(7) (Reinhart & Reuland 1993:688)
   a. Max$_i$ rolled the carpet over himself$_i$.
   b. *Lucie$_i$ heard Max$_k$ praise herself$_i$.

Because they aim to explain non-complementarity, binding-theoretic accounts of anaphor choice in LPPs do not directly predict preferences between forms. However, contrasts reported in several works suggest that preferences can vary significantly across LPPs, even in the absence of apparent structural differences. In some cases, complementarity has been shown to apply after all.

The minimal pairs in (8)-(10) show that preferences may depend on the kind of eventuality denoted by the embedding verb, in particular whether the verb expresses a change in location, perception, or contingent possession (see also Hestvik 1991).

(8) (Bassel 2018:53)
   a. The dog$_i$ dropped the blanket on *him$_i$/himself$_i$.
   b. The dog$_i$ felt the blanket on him$_i$/?himself$_i$.

(9) (Lees & Klima 1963:18)
   a. The men$_i$ threw a smokescreen around *them$_i$/themselves$_i$.
   b. The men$_i$ found a smokescreen around them$_i$/*themselves$_i$.

(10) (Rooryck & Vanden Wyngaerd 2007:78)
   a. The two-year-old$_i$ rubbed chocolate all over *her$_i$/herself$_i$.
   b. The two-year-old$_i$ had chocolate all over her$_i$/herself$_i$.

These examples suggest that the reflexive is most natural in sentences expressing a change in location ((8a), (9a), (10a)) whereas the pronoun is most natural in sentences that do not express a change in location ((8b), (9b), (10b)).

Preferences have elsewhere been shown to depend on the nature of the spatial relation expressed by the preposition, in particular whether it is one of direct physical contact, as illustrated in (11)-(12) (see also Kuno 1987, Van Hoek 1997).

(11) (Wechsler 1997:15)
   a. Corporal Crump$_i$ pinned the medal onto *him/himself$_i$.
   b. Corporal Crump$_i$ pinned the medal beside him/*himself$_i$.

(12) (Faltz 1977:107)
   a. Krag$_i$ the robot unscrewed a panel in his abdomen and placed a sandwich inside ?him$_i$/himself$_i$.
   b. Krag$_i$ the robot place a sandwich in front of him$_i$/?*himself$_i$.

These examples suggest that the reflexive is most natural when contact holds between figure and ground (e.g., between the sandwich and Krag) whereas the pronoun is most natural in the absence of contact.

While the examples above converge with respect to the general trends they suggest, they crucially differ with respect to the strength of the acceptability contrasts they ascribe. For example, looking at sentences that do not express a change in location, the reflexive is shown as acceptable in (10b), marginal in (8b), and ungrammatical in (9b). Similarly, for sentences that express direct contact, the pronoun is shown as ungrammatical in (11a) but marginal in (12a). What, then, should our theory of English anaphor licensing predict?

Some discrepancies in acceptability marking might reflect differences in the way these markings are used across authors. Others could arise from differences independent of verb meaning and spatial relation that may likewise have an effect on anaphor choice, such as the

definiteness of the direct object or the amount of material intervening between anaphor and antecedent. But notice in (13)-(14) that highly conflicting acceptability markings are also found for sentences that are structurally indistinguishable.

(13) a. John$_i$ pulled the duvet over *him$_i$/himself$_i$. (Haspelmath 2008:56)
b. John$_i$ pulled the blanket over him$_i$/himself$_i$. (Kuno 1987:66)
(14) a. Bubba$_i$ tossed the beer can behind him$_i$/*himself$_i$. (Wechsler 1997:15)
b. The dog$_i$ threw the bone behind him$_i$/himself$_i$. (Bassel 2018:60)

Part of the difficulty in interpreting such differences is that we have no access to the conditions under which these judgments were made. Most examples in the literature are presented without context, and it is not possible to reconstruct the situation or discourse the author or consultant had in mind. However, we know that context plays a role. For one thing, context in many cases determines whether or not direct contact holds: on (13b), Kuno (1987) observes that reflexive calls for a context in which the blanket is touching John rather than over a comforter. Context also matters with respect to point of view (cf. Pollard & Sag 1992), the potential for referential ambiguity, and the predictability of subject coreference, all of which may bear on anaphor choice.

Finally, differences in acceptability markings may very well reflect sincere differences in judgments. It has long been acknowledged that judgments tend to vary when it comes to anaphor choice in English LPPs, especially in sentences that really do seem to allow both forms. We must therefore be particularly wary of building a theory around one or two examples.

In short, before we set out to account for anaphor choice in English LPPs, it is necessary to clarify the preference patterns we aim to capture. Two prior studies lend empirical support to the impact of spatial relation. Strahan (2006) finds a relationship between contact and anaphor choice in Australian English in an online questionnaire that asked participants to pick a scene best matching sentence and to pick a sentence best matching scene. However, this study was limited to four sentences, all expressing change in location. Lederer's (2013) corpus study of British English reveals that reflexives are relatively more frequent in LPPs expressing surface contact (*on, on top of*) than in LPPs compatible with expression of more distant relations (e.g., *next to*), but verb meaning was not considered, and contextual factors were not controlled. To the best of my knowledge, no prior experimental work explores the impact of verb meaning.

In the sections that follow, I present two naturalness rating experiments that directly compared the relative naturalness subject-oriented reflexives and pronouns in LPPs while varying both verb meaning and spatial relation.

3. Experiment 1. The goal of Experiment 1 was to test whether and to what extent the relative naturalness of subject-oriented reflexives and pronouns in English LPPs depend on two factors:

- Verb type, namely whether the verb expresses contingent possession (*have*), perception (*perception*), or change in location (*motion*);
- Relation type, namely whether the LPP expresses direct contact between figure and ground (+*contact*) or not (-*contact*).

3.1. DESIGN. 18 sets of 12 sentences were created by crossing verb type, relation type, and anaphor (*reflexive* vs. *pronoun*) as shown in Table 1. All target sentences had the structure NP$_1$-V-NP$_2$-PP; direct objects (NP$_2$) were always indefinite, comprising a determiner and head noun. Perception verbs included *see*, *notice*, and *feel*; motion verbs included *pour*, *pull*, *slide*, *throw*, *spill*, *shove*, *drag*, *wrap*, *set*, *glue*, *sprinkle*, *pin*, *push*, *gather*, *lay*, *tie*, *place*, *drape*, and *stack*.

Prepositions tested in this survey included *on*, *next to*, *over*, *under*, *around*, *in front of*, *on top of*, and *behind*.

	+contact	-contact
have	Chloe had some glitter on her_i/$herself_i$.	Chloe had some glitter next to her_i/$herself_i$.
perception	Chloe noticed some glitter on her_i/$herself_i$.	Chloe noticed some glitter next to her_i/$herself_i$.
motion	Chloe poured some glitter on her_i/$herself_i$.	Chloe poured some glitter next to her_i/$herself_i$.

Table 1. Example of a sentence set used in Experiment 1

It should be noted that whereas verb type is determined entirely by the meaning the verb, relation type is not in most cases an inherent property of the preposition. Whether or not an LPP expresses direct contact rather depends on the situation being described.

Following Marty et al. (2020), minimal pairs of sentences were presented side-by-side to help draw out relative preferences between forms. As shown in the sample question in Figure 1, each sentence appeared above a slider bar with ends labeled 'less natural' and 'more natural.'

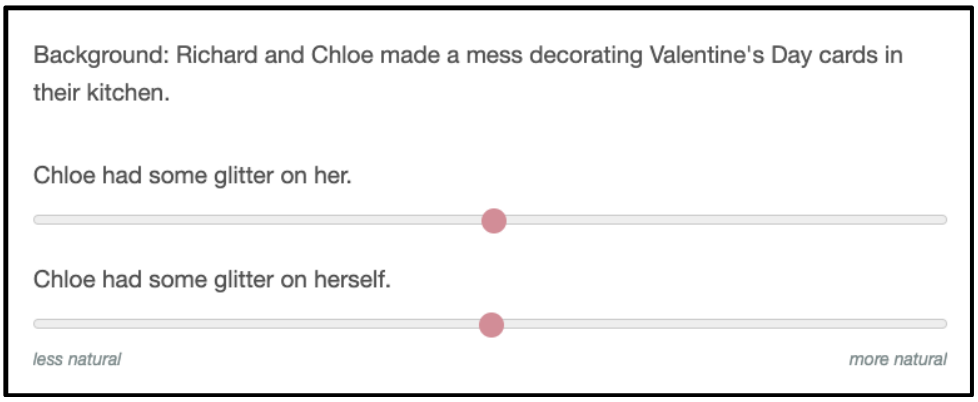

Figure 1. Example of a target question from Experiment 1. Minimal pairs of sentences were shown side-by-side with slider bars in brief supporting contexts.

Sentence pairs were preceded by one- or two-sentence background contexts intended to aid imaginability while constraining situation and discourse factors. Each context began by introducing two people, the second of whom served as the subject of the target sentence; stereotypically gendered names were used to ensure that pronouns were contextually unambiguous.

Along with 108 target questions, this survey included 8 control questions with sentence pairs such as *Evan burned him/himself* and *Evan's sister burned him/himself*, where syntactic constraints are predicted to permit only one form, as well as 22 filler questions with sentence pairs such as *Gavin lost his keys/Gavin lost keys*, which varied in some way other than anaphor choice. Controls provided a baseline against which ratings for target sentences could be compared; fillers provided participants with a reprieve from reflexives and pronouns.

3.2. RECRUITMENT AND PROCEDURE. 122 adult participants were recruited via Prolific Academic. Participants were prescreened for first language (English) and nationality (American) using Prolific demographic filters. At the beginning of the survey, participants were instructed that they would be asked to compare two ways of saying the same thing in a given context by rating how

natural each option sounds (further ensuring the intended interpretation of the pronoun). They were then shown three training trials, one in which both sentences were very natural, one in which both sentences were very unnatural, and one in which one sentence was more natural than the other. Following training, participants were randomly assigned to one of six question lists, each containing 18 target questions (1 per sentence set, 3 per condition) as well as 4 control questions and 22 filler questions. Questions were randomly presented within lists, and sentences were randomly flipped within questions.

3.3. PREDICTIONS. Based on prior literature, naturalness ratings for reflexives were predicted to be higher in motion conditions than in have or perception conditions, and to be higher in +contact conditions than in -contact conditions. The opposite was predicted for pronouns.

3.4. RESULTS. Prior to analysis, responses were Z-scored by participant to accommodate different uses of the slider bar. Figure 2 shows the distribution of ratings across target conditions.

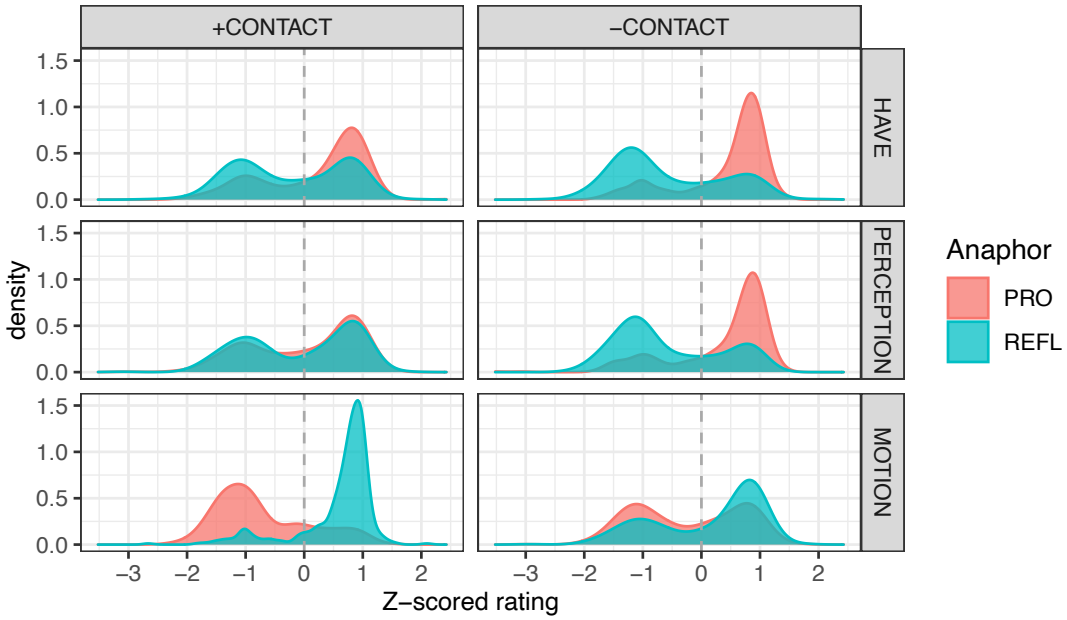

Figure 2. Distribution of Z-scored ratings in Experiment 1 across target conditions

Response patterns were very similar for have and perception conditions: pronouns tended to be rated as more natural than reflexives, and this preference was most pronounced when the relation type with -contact. In motion conditions, reflexives tended to be rated as more natural than pronouns, and this preference was most pronounced when the relation type was +contact. Overall, what emerges are strong preferences for the reflexive in the motion/+contact condition, strong preferences for the pronoun in the have/-contact and perception/-contact conditions, and more variable preferences in remaining conditions.

We used a linear mixed-effects regression model to analyze the dependence of Z-scored ratings on verb type, relation type, and anaphor type, with participant and item included as random effects. Statistical comparison revealed no significant differences between the have and perception conditions ($p>0.05$); have and perception were therefore collapsed into a single factor level (-motion) for subsequent analysis. Model comparison revealed the best-fit model to include interactions between verb type and anaphor ($\beta=1.44$, $p<0.001$) and between relation type and anaphor ($\beta=0.79$, $p<0.001$); inclusion of a three-way interaction did not significantly improve model fit ($p>0.2$).

Ratings for target conditions were also compared to ratings provided on control items, where one anaphor form is ruled out by syntactic constraints. First, ratings for +motion/+contact items, which showed a strong preference for the reflexive, were compared to ratings for sentences such as *Evan burned him(self)*, where the reflexive is required by Principle B. We find a significant interaction between condition (+motion/+contact vs. Principle B) and anaphor (β=-0.82 $p<0.001$). Subsetting by anaphor, we find that the reflexive received significantly lower ratings on +motion/+contact questions than on Principle B controls (β=-0.35, $p<0.001$) while the pronoun received significantly higher ratings on +motion/+contact questions than on Principle B controls (β=0.47, $p<0.001$). Second, ratings for -motion/-contact items, which showed a strong preference for the pronoun, were compared to ratings for sentences such as *Evan's sister burned him(self)*, where the pronoun is required by Principle A. We again find a significant interaction between condition (-motion/-contact vs. Principle A) and anaphor (β=-1.27, $p<0.001$). Pronouns received significantly lower ratings on -motion/-contact questions than on Principle A controls (β=-0.53, $p<0.001$) while reflexives received significantly higher ratings on -motion/-contact questions than on Principle A controls (β=0.74, $p<0.001$). Differences in mean ratings for reflexives and pronouns across target and control conditions are captured in Figure 3.

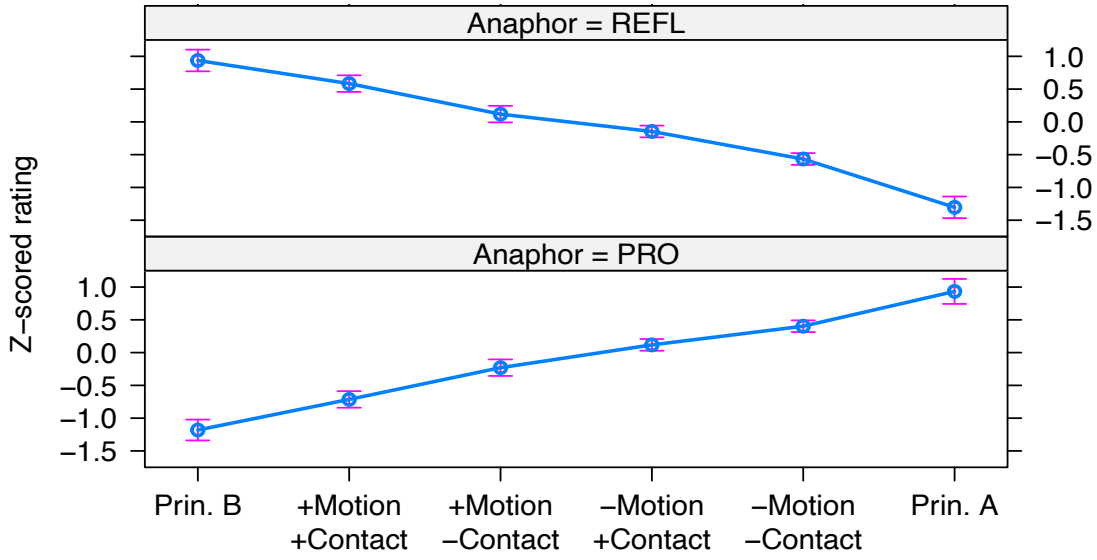

Figure 3. Mean ratings for reflexives (top) and pronouns (bottom) in Experiment 1 across target and control conditions

3.5. DISCUSSION. While judgments varied across participants, the trends that emerge from Experiment 1 align with our starting predictions. We find that preferences between subject-oriented reflexives and pronouns in LPPs are sensitive to both verb meaning and spatial relation: reflexives are most natural in the expression of change in location (motion) events and direct contact, and pronouns show the opposite pattern. Crucially, even for target conditions in which one form was overwhelmingly favored over other, contrasts between reflexive and pronoun were not as stark as those observed in control conditions.

Though participants had the option of rating both forms as equally natural, the side-by-side setup may have pushed participants to consistently rate one form higher than the other. Indeed, it will be noticed in Figure 2 that responses tended to cluster around one standard deviation from the mean even in conditions for which neither form was strongly favored overall. The bimodality

observed for both anaphors in the more variable conditions reflects a split in which form was preferred across participants as well as across particular items.

One pressing question that remains from this experiment is whether the spatial relation manipulation really tapped into an effect of physical contact on anaphor choice. As noted in Section 3.1, relation type is not always fixed by the semantics of the preposition. In many cases, whether or not contact is conveyed depends on the situation the sentence describes. However, only two of the eight prepositions – *around* and *over* – were tested in both +contact and -contact conditions. It is therefore possible that the effect of relation type reflects something about the particular prepositions used and not the nature of the spatial relation they express. Looking at responses for items with *around* and *over*, we find a significant interaction between relation type and anaphor for the former (β=-0.86, $p<0.001$) but not for the latter (β=-0.09, $p>0.5$). Hence, it is also possible that the intended manipulation may have worked on some questions but not others.

4. Experiment 2. The goal of Experiment 2 was two-fold. First, it aimed to validate the relation type manipulation from Experiment 1 by directly probing participants' inferences about whether or not direct contact holds between figure and ground. Second, it aimed to replicate Experiment 1 results with a smaller sample population.

4.1. DESIGN. Survey questions were adapted from Experiment 1. No changes were made to target sentences; parenthetical pronouns were added to background contexts to ensure correct gender association without relying on stereotypes. In addition to the side-by-side rating procedure used in Experiment 1, each question in this experiment contained a contact inference question. On target questions, participants were asked whether the object or material named by the direct object was touching the referent of the anaphor, as shown in Figure 4.

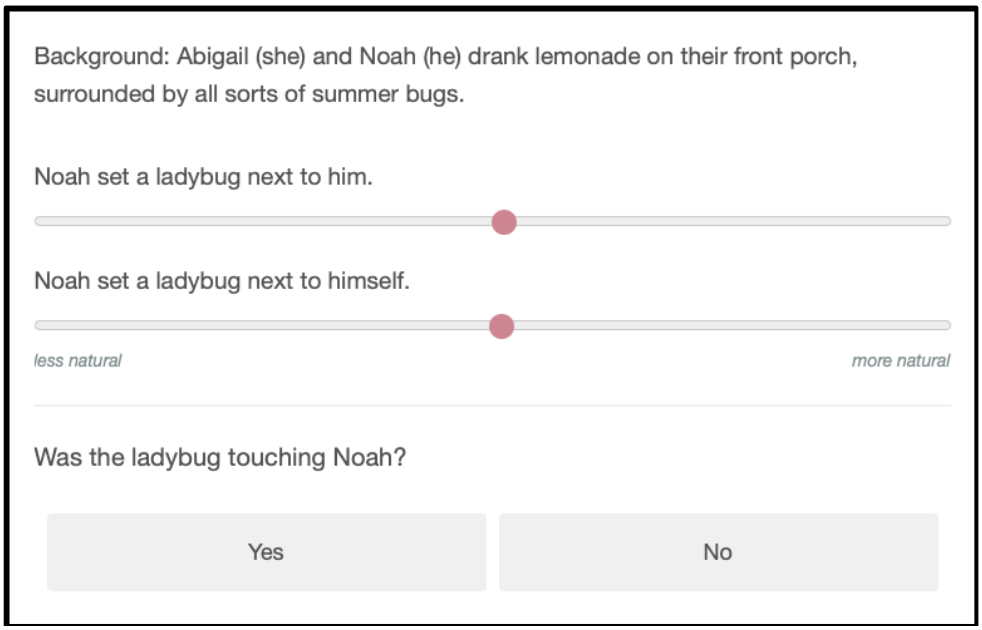

Figure 4. Example of a target question from Experiment 2. Each question included side-by-side rating and a yes/no question probing contact inferences.

Like Experiment 1, this survey also included 8 control questions and 22 filler questions, 6 of which also served as catch trials. Controls and fillers were minimally revised to make them amenable to inclusion of a contact inference question.

4.2. RECRUITMENT AND PROCEDURE. 34 adult participants were recruited via Prolific Academic, prescreened for first language (English), fluent language (English), and nationality (American) using Prolific demographic filters. As in Experiment 1, each participant saw 18 target questions (3 per condition) as well as 4 control questions and 22 filler questions. Questions were randomly presented, and sentences were randomly flipped within questions.

4.3. RESULTS. Prior to analysis, responses from two participants were excluded due to failure on catch trials, and responses from one participant were excluded due to survey error. Naturalness ratings were Z-scored by participant. The first goal of this survey was to validate the spatial relation manipulation. The percentage of 'yes' responses on contact inference questions are shown in Figure 5 for the six target conditions. Over 97.8% of questions in +contact conditions received 'yes' responses while 77.4% of questions in -contact conditions received 'no' responses, thus confirming the overall efficacy of the manipulation.

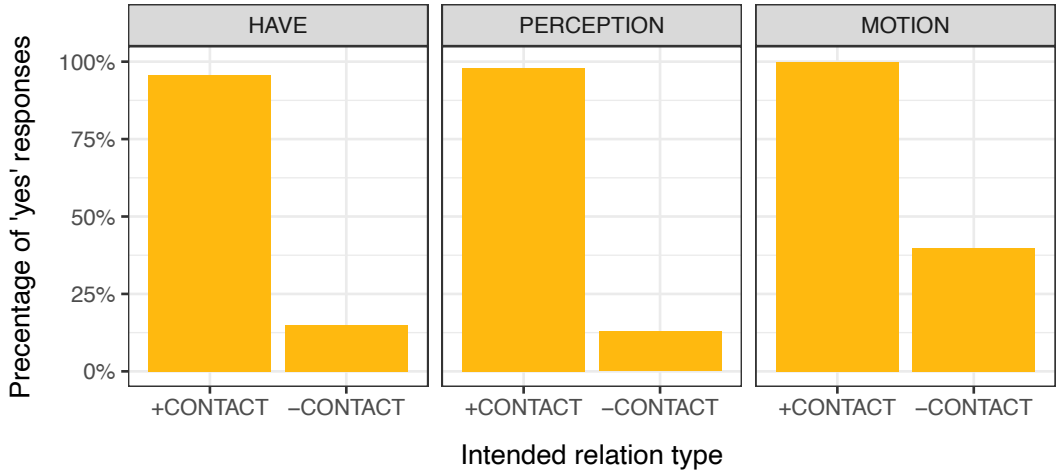

Figure 5. Percentage of 'yes' responses to the contact inference question in Experiment 2 across target conditions

Note that questions with the preposition *over* received a 'yes' response over 50% of the time in -contact conditions. In contrast, questions with *around* received a 'yes' response around 20% of the time in -contact conditions.

The second goal of this survey was to replicate the results from Experiment 1. As shown in Figure 6 on the following page, Experiment 2 naturalness ratings revealed the same overall preference pattern: the reflexive was again most natural in motion and +contact conditions, and the pronoun again patterned oppositely. These effects were confirmed using a linear mixed-effects regression analysis, which showed significant interactions between verb type and anaphor (β=1.84, $p<0.001$) and between relation type and anaphor (β=0.90, $p<0.001$).

4.4. DISCUSSION. The naturalness rating responses from Experiment 2 converge with those of Experiment 1. Furthermore, contact inference responses offer us confidence that the effect of relation type really does stem from the nature of the spatial relation expressed by the LPP rather than peculiarities of particular prepositions. Finally, comparison of the rate of 'yes' responses on questions with *around* and *over* offer an explanation as to why these two prepositions pulled apart in Experiment 1 (as well as in Experiment 2): sentences with *around* were by and large interpreted as intended, but sentences with *over* very often gave rise to inferences of direct contact on questions categorized as -contact. Future studies may aim to better control for contact by using picture or video stimuli (cf. Strahan 2006).

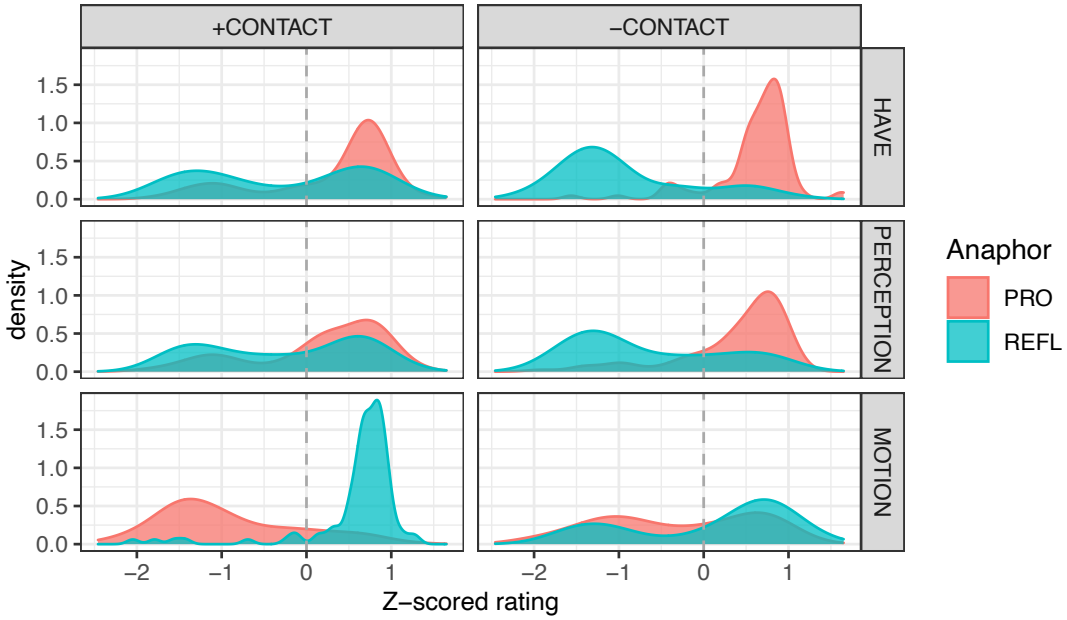

Figure 6. Distribution of Z-scored ratings in Experiment 1 across target conditions.

5. General Discussion. In line with contrasts reported in prior literature, results from Experiments 1 and 2 showed that relative preferences between subject-oriented reflexives and pronouns in English LPPs crucially depend on the meaning of the embedding verb and the nature of the spatial relation. With respect to verb meaning, we find that reflexives are best when the verb expresses a change in location (motion) while pronouns are best in the expression of other kinds of eventualities. With respect to spatial relation, reflexives are best when direct contact hold between figure and ground while pronouns are best in the absence of direct contact. This pattern in summarized in Table 2.

	+contact	-contact
have	Chloe had some glitter on ?her$_i$/?herself$_i$.	Chloe had some glitter next to ✓her$_i$/??herself$_i$.
perception	Chloe noticed some glitter on ?her$_i$/?herself$_i$.	Chloe noticed some glitter next to ✓her$_i$/??herself$_i$.
motion	Chloe poured some glitter on ??her$_i$/✓herself$_i$.	Chloe poured some glitter next to ?her$_i$/?herself$_i$.

Table 2. Examples showing the general preference pattern turned up in Experiments 1 and 2. '✓' marks strongly favored forms, '??' marks strongly disfavored forms, and '?' marks forms for which judgements were more gradient across participants and items.

At the same time, even for those conditions in which one form was generally favored over the other, contrasts in naturalness ratings differed significantly from those provided on sentences for which one form is predicted to be ungrammatical due to violation of binding principles. The outcome is thus a cline of more or less gradient preferences across LPP constructions. We might take this finding as endorsement of the commonly held view that anaphor choice in English LPPs falls beyond the purview of binding theory (e.g., Hestvik 1991, Reinhart & Reuland 1993, Büring 2005; cf. Section 2). But before we go all-in on this conclusion, it is worth considering whether categorial binding constraints might help explain the preference pattern we find.

Could Principle A play a role? Under any formulation of Principle A, we would predict reflexives anteceded by the sentence subject to be ungrammatical if the LPP projects a subject of its own, that is, if the LPP comprises a small clause. The fact that the reflexive was never wholly ungrammatical would suggest that the LPP was not obligatorily analyzed as a small clause in any condition. However, it could be that a small clause parse is optional, at least in some sentences.

Appeal to the availability of a small clause parse provides a tempting avenue for explaining the effect of verb meaning found in this study. In particular, the overall preference for the pronoun observed in -motion conditions could follow from the compatibility of those sentences with small clause complements. In contrast with change in location verbs, perception verbs and *have* can take what are generally regarded as clausal complements, as in (15).

(15) Michele had/saw [a seagull steal her sandwich].

If LPPs can likewise be analyzed as clausal when paired with perception verbs and *have*, then we would expect the reflexive to be ungrammatical with these verbs at least some of the time and, therefore, for the pronoun to receive relatively higher naturalness ratings on the whole, consistent with what we observe. Under the additional assumption that change in location verbs never embed small clause complements, this would also correctly predict the contrast between +motion and -motion conditions.

There are a couple of snags in this line of thinking. First, if LPPs are optionally parsed as small clauses, we would predict the reflexive to be ungrammatical whenever the small clause parse is enforced. However, small clauses diagnostics do not seem to differentiate between LPPs containing reflexives and LPPs containing pronouns. Judgments collected from four speakers of American English on the sentences in (16) suggest that LPPs can behave as small clauses with *see* regardless of anaphor choice: both forms allow pseudoclefting (16b), right-node-raising (16c), and *that* substitution (16d), while neither form allows intervention with a matrix adverbial (16e) (cf. Rothstein 2006).[8,9]

(16) a. Noah$_i$ saw a ladybug on ?him$_i$/himself$_i$.
b. What Noah$_i$ saw was a ladybug on ?him$_i$/himself$_i$.
c. Noah$_i$ felt, but didn't see, a ladybug on ?him$_i$/himself$_i$.
d. Noah$_i$ saw a ladybug on him$_i$/himself$_i$, and Abigail saw that, too.
(intended meaning: Abigail saw a ladybug on Noah)
e. *Context: Abigail and Noah drank lemonade on their front porch. A ladybug landed on Noah and rested there <u>for a very long time</u>. Noah saw the ladybug just before it flew away.*
*Noah$_i$ saw a ladybug briefly on him$_i$/himself$_i$.
(intended meaning: Noah briefly saw the ladybug)

It could be that these tests do not reliably pick out small clauses, even in the aggregate. In that case, independent evidence for small clause structure will need to be found elsewhere. It is also possible that these tests *do* diagnose small clauses, but that small clause status does not always

[8] All four speakers consulted preferred the reflexive over the pronoun in (16a) and (16b), and all four rejected (16e) under the intended reading regardless of anaphor. Three out of four preferred the reflexive in (16c) and (16d).

[9] The tests in (16b-e) suggest that the direct object and LPP form a syntactic constituent. Other structural diagnostics that were considered include coordination, fragment answer, quantifier float (cf. Bowers 2001), and quantifier scope (cf. Lechner 2012). These, too, failed to show a clear distinction between reflexive and pronoun. Note, however, that except for quantifier float, these tests do not target the type of small clause structure shown in (5a), where PRO is the LPP-internal subject, nor the structure in (i) in fn. 5, where the subject is a trace of the direct object.

preclude antecedence by the sentence subject, contrary to the predictions of most versions of Principle A.[10] Much more work is needed on this question (and, potentially, different tests).

The second snag is that although change in location verbs are not compatible with verb phrase complements (nor adjectival or nominal small clause complements), they, too, have been argued to take a small clause complement – more specifically, an embedded predication structure corresponding to the result state (e.g., Hornstein & Lightfoot 1987, Hoekstra 1988, Marantz 1989, Bowers 2001, Folli & Harley 2006, Ramchand 2007, Gehrke 2008, Ahn 2015, Bassel 2018). While others have argued against small clause analyses of change in location complements (e.g., Rothstein 2006, Den Dikken 2010, Bruening 2018), the same can be said about verbal perception complements (Clark & Jäger 2000). I leave this issue to future research.

Even if Principle A were at the root of the effect of verb meaning on anaphor choice, it is not obvious that appeal to variable subject projection could likewise explain the effect of spatial relation. One would have to argue that small clause parses are more likely when the spatial relation is not one of direct contact; the difficulty is motivating why that would be the case.

What about Principle B? Drawing from data in English and Hebrew, Bassel (2018) suggests that Principle B effects arise when the LPP expresses the trajectory of motion (a *path*) rather than the endpoint of motion or a static location (a *place*) (cf. fn. 6). Importantly, it is argued that several prepositions, such as *on* and *around*, are compatible with both path and place interpretations. Under the assumption that path modifiers are only compatible with change in location verbs, this proposal could explain the overall preference found for the reflexive in +motion conditions, as well as the contrast between +motion and -motion conditions. However, the path/place distinction cannot straightforwardly account for the effect of spatial relation. We might stipulate that some of the prepositions included in -contact conditions do not permit path interpretations, but this could only explain the effect for change in location sentences; the commensurate effect of spatial relation in sentences that do not express a change in location (and, hence, are presumed to be incompatible with path LPPs to begin with) would require an entirely different source.

Another possibility is that, in some cases, the sentences with LPPs are parsed as in (17a), with verb, direct object, and preposition comprising a complex two-place predicate of which the anaphor and sentence subject are coarguments.[11] Such sentences would be structurally analogous to simple transitive sentences as far as Principle B is concerned. In line with this view, observe in (17b) that these elements can together be targeted by *do to* substitution, just like simplex transitive verbs.

(17) a. Chloe$_i$ [poured some glitter on] *her$_i$/herself$_i$.
b. What Chloe <u>did to</u> Max was <u>pour some glitter on</u> him.

This sort of parse would have to be restricted, even for LPPs within which the reflexive is highly preferred; otherwise, we would be no closer to understanding the effects found in this study. Notice that *do to* substitution is less natural in (18a), where direct contact does not hold between figure and ground. It is especially odd in (18b) with a perception verb.

(18) a. ??What Chloe <u>did to</u> Max was <u>pour some glitter next to</u> him.
b. ???What Chloe <u>did to</u> Max was <u>notice some glitter on</u> him.

[10] Varaschin (2021) presents a predicate-based account of reflexive licensing according to which locative pronouns do project a subject function – rendering a reflexive in its complement syntactically eligible for Principle A – but that Principle A is nevertheless violable because reflexive interpretations of locative prepositions are by and large semantically anomalous (e.g., someone cannot be next to themselves).

[11] See Ahn (2015) for a derivational approach to English reflexivization that is compatible with this kind of analysis.

We might therefore say that availability of a "Principle B" parse depends on the extent to which the sentence can be construed as conveying an interaction between the referent of the subject and the referent of the LPP complement. Indeed, the sentence in (17a) easily allows a paraphrase in which ground is rather expressed as the direct object (19).

(19) Chloe$_i$ covered *her$_i$/herself$_i$ with glitter.

However, once we go down this path, it is not clear whether we need to appeal to syntax at all.

Building on the insights of Kuno (1987) and Van Hoek (1997), I would like to suggest that LPP anaphor choice depends not on syntactic structure *per se*, but on event structure. Specifically, the conceptually closer the event structure is to that of "prototypical" reflexive events (i.e., events involving self-directed action), the better the reflexive relative to the pronoun. Relevant dimensions of event structure include the spatial trajectory of the event – whether it starts and ends in the same place (see Van Hoek 1997) – as well as the nature of its participants (cf. Kuno 1987 on the role of affectedness in English reflexive licensing). While space precludes further development of this idea here, I believe an analysis based on event structure has the potential to explain the relevance of verb meaning and spatial relation to LPP anaphor choice as well as the overall gradient preference pattern observed in the experiments presented above.

6. Conclusion. The experiments presented in this paper help clarify a previously cloudy corner of anaphor licensing, namely the choice between subject-oriented reflexives and pronouns in English LPPs. We find that preferences depend significantly on both verb meaning and spatial relation. In light of the results, I have proposed that anaphor choice in LPPs depends on event structure. This does not rule out the relevance of purely syntactic constraints to English anaphor licensing generally; future work may show that binding principles play a role in (some) LPP constructions, too. However, the preferences revealed in this study are a strong indication that our theories of English anaphora ought to take meaning into account.

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