

Symmetric but non-complementary: Gradient paradigmatic opposition in binding

Suzanne Lesage · Olivier Bonami

Abstract This paper relies on experimental data on the interpretation of Estonian proforms to argue for an overhaul of Binding Theory. First, we show that classical binding principles are unable to capture the distribution of nonreflexive proforms, which must be locally free in finite clauses but may be bound in embedded infinitives. Second, we provide evidence that possessives exhibit a symmetrical distribution: while the proportion of local antecedents for possessive reflexives varies depending on the syntactic context, it matches the proportion of nonlocal antecedents for antireflexives. This is strong evidence for the existence of substantial grammatical constraints on binding of a gradient nature. Third, we propose a 2×2 typology of systems of binding constraints, which can be symmetric or asymmetric and categorical or gradient. We provide empirical evidence that all four types are attested.

Keywords Binding Theory · Reflexive · Possessive · Experimental · Estonian

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1 Introduction: possessives and binding theory

REFLEXIVE PROFORMS are anaphoric expressions with an affinity towards local antecedents: for instance, *herself* in (1a) needs to be bound by the subject of the embedded clause. They contrast with what we call ANTIREFLEXIVE PROFORMS, which have the opposite affinity: witness the binding potential of *her* in (1b).¹

¹Generative literature since **chomsky1981lectures** uses ANAPHOR as a cover term for reflexives and reciprocals, and PRONOMINAL for what we call antireflexives, a reassignment of traditional grammatical labels leading to much confusion. As we will have nothing to say on reciprocals in this paper, we adopt from **heine2005reflexive**; **gonzalez2020type** the term ANTIREFLEXIVE as a name for those proforms with binding properties opposite to

- (1) a. Mary_i was surprised that Eva_j was blaming herself_{*i/j/*k} for the accident.
 b. Mary_i was surprised that Eva_j was blaming her_{i/*j/k} for the accident.

Classical binding theory (**chomsky1981lectures**) regulates the distribution of reflexives and antireflexives through the separate but complementary principles A and B: reflexives must be bound by a commanding expression in their binding domains, while antireflexives can't. An appropriate definition of binding domains that captures the whole distribution of each proform is thus a crucial ingredient of the theory. For English, the relevant binding domain for reflexives is taken to be what **burin2005binding** calls the SUBJECT DOMAIN, i.e. the smallest constituent containing the reflexive and either a subject or a possessive. This makes the correct predictions about the binding of *herself* in the following examples, where the binding domain is indicated in square brackets.

- (2) a. [Jane_i washes herself_i].
 b. [Jane_i saw a picture of herself_i].
 c. [Jane_i's picture of herself_i] is beautiful.

One of the main challenges facing classical binding theory is to account for situations of noncomplementarity in the distribution of reflexives and antireflexives.² Standard accounts (**chomsky1981lectures**; **kuno1987functional**; **hestvik1991subjectless**) rely on the idea that different proforms have qualitatively different binding domains. In particular, English antireflexives rely on the COARGUMENT DOMAIN, the smallest constituent containing the head assigning a semantic role to the proform and its arguments. As the coargument domain is, in some configurations, smaller than the subject domain, this correctly predicts an overlap between the distribution of English reflexives and antireflexives. This is the case in example (3), where *around* those of reflexives.

²Other challenges not discussed in this paper include what we call neutral proforms, i.e. proforms that can be either free or bound (**zribi1995emphatic**), exempt reflexives (**pollard1992anaphors**), long-distance reflexives (**dalrymple1993syntax**), logophors (**reuland2001anaphors**) as well as non-subject oriented forms such as Norwegian *ham selv* (**hellan1980anaphora**) (**hellan1988**) (**jakubowicz1984markedness**).

assigns a semantic role to its object but does not have a subject.

(3) [SD John_i looked [CD around himself_i/him_i]]

In this paper, we focus on POSSESSIVE reflexives and antireflexives, which raise important challenges for classical binding theory. Estonian is an example of a language with such types of proforms. In simple clauses, they exhibit the expected complementary distribution: reflexive *oma* must be bound by the local subject, while adnominal genitive pronouns such as the first-person singular *minu* and second-person singular *sinu*, as antireflexives, can't (EKG2; **metslang2013coding**), as we can see in (4).³

- (4) a. *Ma loe-n oma raamatut.*
 1SG.NOM read-1SG REFL.POSS book.PART
 'I read my book.'
- b. *Ma loe-n sinu raamatut.*
 1SG.NOM read-1SG 2SG.GEN book.PART
 'I read your book.'
- c. **Ma loe-n minu raamatut.*
 1SG.NOM read-1SG 1SG.GEN book.PART

In infinitive complement clauses, both reflexives and antireflexives may be bound by either the implicit embedded subject or the subject of the embedding clause.

- (5) a. *Ma_i luba-n sind_j PRO_j oma_{i/j}*
 1SG.NOM authorize-1SG 2SG.PART REFL.POSS
kredikaarti kasuta-da.
 credit_card.PART use-INF
 'I give you permission to use my/your credit card.'

³Some authors (**reuland2011anaphora**; **despic2015phases**) call *reflexive possessive* any possessive that is required to be bound, whether or not they contrast with an antireflexive. This leads to lumping together Estonian *oma*, which in most contexts is in complementary distribution with genitive proforms, and e.g. Mandarin Chinese *ziji-de*, which can always be replaced by the binding-agnostic possessive *ta-de*. We adopt a narrower usage, and will qualify a possessive as reflexive only when it contrasts with an antireflexive counterpart.

- b. Ma_i *luba-n* $sind_j$ PRO_j *minu_i*
 1SG.NOM authorize-1SG 2SG.PART 1SG.GEN
kredikaarti *kasuta-da*.
 credit_card.PART use-INF
 ‘I give you permission to use my credit card.’
- c. Ma_i *luba-n* $sind_j$ PRO_j *sinu_j*
 1SG.NOM authorize-1SG 2SG.PART 2SG.GEN
kredikaarti *kasuta-da*.
 credit_card.PART use-INF
 ‘I give you permission to use your credit card.’

The data so far is consistent with postulating that reflexive *oma* must be bound in the TENSE DOMAIN, as has been proposed for its Norwegian counterpart (**hellan1988**). However, there is no possible specification of a binding domain that will account for the distribution of antireflexives in both (4) and (5): the antireflexive can be bound by the local subject in an infinitive complement clause, but not in a finite clause.⁴ The classical formulation of binding principles, which are supposed to be valid across constructions, cannot capture this distribution. In the next section we further argue that, in situations like (5) where there is no categorical constraint on the use of a reflexive or antireflexive, there are still gradient preferences going in the direction of the binding principles.

2 Symmetric binding

This section describes the results of two experiments and analyses their results. These experiments document the interpretation of the Estonian reflexive and antireflexive possessives in contexts other than prototypical simple finite clauses. We propose a post hoc analysis, as the experiments were run with a different purpose. In both cases, participants read sentences and then answered a question eliciting the referent of the possessive form, with two semantically and morphologically plausible choices. We refer the reader to **lesage2021forces** and **Lesageefo22** respectively for a full description of experimental designs.

⁴The same pattern is found in other languages with reflexive possessives, including Czech (**Lesage22**), Danish (**lundquist2014mid**) and Swedish (**tingsell2007reflexivt**).

2.1 Experiment 1: Binding in embedded infinitives

Seventy-six native speakers of Estonian recruited on social media took part in the first experiment. They were asked to first read a sentence or a pair of sentences, and then fill a gap in second sentence rephrasing the sentence they had read (see 1). The experiment contained twenty-four items and thirty-six fillers. The experimental items had six conditions. The experiment had six conditions. Three ways of expressing the possessor were possible: reflexive, antireflexive, or no overt expression. There were also two syntactic contexts: the proform was either in an independent clause preceded by another clause containing a possible antecedent (6a), or in an embedded infinitive clause where the main clause contained a possible antecedent (6b). Conditions with unexpressed possessors are irrelevant to the present argument, and will thus be omitted. Sample materials are shown in Table 1.

- (6) a. *Paul on kõik läbi mõel-nud. Katrin*
 Paul.NOM be.3SG.PRS all through think-PPAST Katrin
jätab oma/tema dokumend-id registratuuri.
 leave3SG.PRS POSS document-PL.NOM reception.ILL
 ‘Paul made arrangements. Katrin will leave his/her documents at the reception.’
- b. *Paul lase-b Katrini-l oma/tema dokumendi-d*
 Paul.NOM let-3SG.PRS Katrin-ADE POSS document-PL.NOM
registratuuri jät-ta.
 reception.ILL leave-INF
 ‘Paul allowed Katrin to leave his/her documents at the reception.’

We expect reflexives and antireflexives to be in complementary distribution in simple clauses, as we have seen in (4): the reflexive must be interpreted as having the local subject (*Katrin*) as an antecedent and the antireflexive cannot be given this interpretation. In the experimental configuration, the only available antecedent for the antireflexive is the subject of the sentence preceding the sentence containing the possessive form (*Paul*). In nonfinite clauses, we expect the distribution of possessives not to be complementary, as we have seen in examples (5). More precisely, we hypoth-

Clause type	Proform	Example
Independent	Reflexive	<i>Paul on kõik läbi mõelnud. Katrin jätab oma dokumendid registratuuri.</i>
	Antirefl.	<i>Paul on kõik läbi mõelnud. Katrin jätab tema dokumendid registratuuri.</i> 'Paul made arrangements. Katrin will leave his/her documents at the reception.'
Infinitive	Reflexive	<i>Paul laseb Katrinil oma dokumendid registratuuri jätta.</i>
	Antirefl.	<i>Paul laseb Katrinil tema dokumendid registratuuri jätta.</i> 'Paul allowed Katrin to leave his/her documents at the reception.'
Sentence to fill		_____ dokumendid jäetakse registratuuri. 'Someone left _____'s documents at the reception.'

Table 1 Materials for experiment 1

esize that the reflexive still has a preference for the local subject (*Katrin*), and the antireflexive has a preference for the non-local subject (*Paul*).

Experimental results shown in Figure 1 confirm our assumptions: the distribution of reflexives and antireflexives is complementary in simple clauses. In infinitive complement clauses, the distribution is not complementary, but the proportion of local antecedents is still higher for reflexives than for antireflexives.⁵ A generalized linear mixed model⁶ trained only on possessives in infinitive clauses confirmed the statistical significance of the effect. Note that, as Figure 1 makes clear, most participants exhibit variation in their responses for infinitive clauses. Hence the effect is not driven by different subpopulations having different categorical preferences. Although this is not shown in the figure, we likewise observe that most items do not give rise to uniform responses across participants.

⁵A similar experiment on Czech gives rise to the same pattern (Lesage22).

⁶This model had participants' answer as the dependent variable. Fixed effects were the clause type, the possessive proform, as well as their interactions. Random intercepts were included for participant and item.

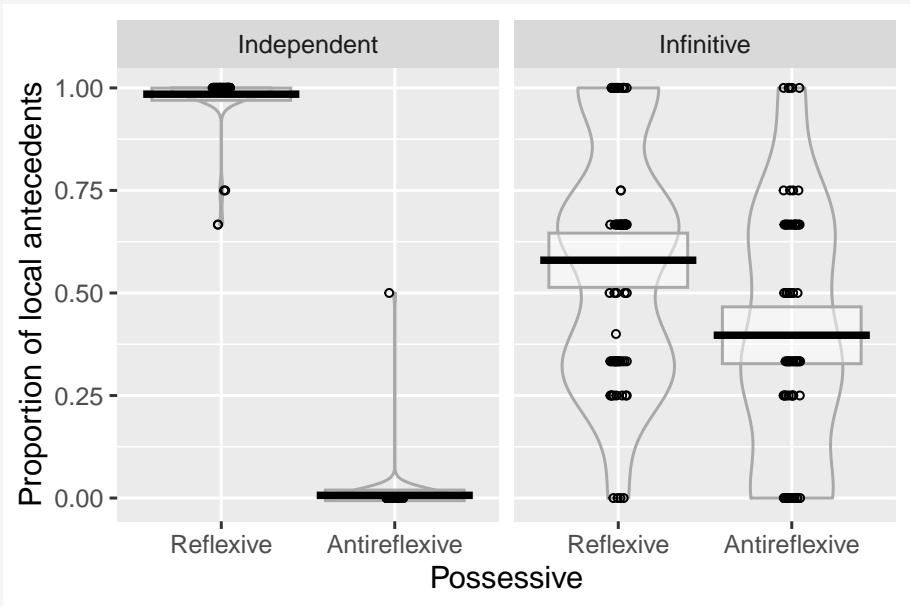


Figure 1 Main results of experiment 1. The horizontal line is the global mean, with the box around it specifying the 95% confidence intervals assuming a normal sampling distribution. Individual points indicate by-participant averages.

2.2 Experiment 2: Binding with non-canonical argument structure constructions

The second experiment focused on binding in a noncanonical argument structure construction, where a nominative argument realizes the stimulus and an allative argument realizes the the experiencer (7a). This construction is of particular interest in terms of binding: probably thanks to their ambiguous subject properties,⁷ both the arguments can bind either a reflexive or antireflexive possessive.⁸

In the experiment, we compared this construction to two different base-lines: sentences with a transitive verb and an allative argument expressing a beneficiary (7b), and sentences with a transitive psych verb, with a nominative argument expressing the experiencer and a partitive expressing the stimulus (7c). Note that the first baseline is parallel to the construction of interest in terms of the morphosyntactic case of the potential binders, while the second is parallel in terms of semantic roles.

- (7) a. **Katrin** *meeldi-s* **Pauli-le** [*oma/tema õnnetuse-ks*].
 Katrin.NOM appeal-3SG.PST Paul-ALL POSS misfortune-TR
 ‘Paul loved Katrin for his/her great misfortune.’
- b. **Paul** *laena-s* **Jaani-le** *ülikonna* [*oma/tema*
 Paul.NOM lend-3SG.PST Jaan-ALL suit POSS
õe pulma-de jaoks].
 sister.GEN wedding-PL.GEN for
 ‘Paul lent a suit to Jaan for his sister’s wedding.’
- c. **Katrin** *põlga-s* **Pauli** [*oma/tema sotsiaalse*
 Katrin.NOM despise-3SG.PST Paul.PART POSS social.GEN

⁷The nominative argument exhibits the canonical syntactic feature of the subject : it is the agreement trigger, it is the raising argument in a raising construction, and it is the deleted argument in impersonal constructions. On the other hand, the allative codes the most agentive argument, and it is preverbal in 88% of cases (**metslang2013coding**), which in Estonian is the default position for subjects, as least when they are topical. Both arguments can be coreferential with the implicit subject of a gerundive form.

⁸There are other non-canonical constructions in Estonian in which the possessive’s binding is atypical (i.e. the reflexive possessive is bound by the oblique argument), but in those constructions the reflexive possessive cannot be bound by the subject and the antireflexive possessive cannot be bound by the oblique argument (**Lesageefo22**). They are not relevant for our point.

päritolu tõttu].

origine.GEN because

‘Katrin despised Paul because of his/her social class.’

In addition to the construction type, we manipulated word order. In Estonian, word order is free but correlates strongly with information structure (tael1988), with the preverbal constituent normally constituting a topic. Thus we expect word order preferences to be unusual in the noncanonical argument structure condition of interest, where the oblique argument is a natural candidate for topicality.

Each item sentence in the experiment contained a possessive embedded in an oblique dependent of the verb, indicated by brackets in (7). Two arguments, indicated in boldface, are potential binders for the possessive. For each construction, type of possessive (reflexive vs. antireflexive) and word order (preverbal vs. postverbal subject) were manipulated. Sample materials are shown in Table 2.

Our assumptions were the following.

- Reflexives and antireflexives are in strict complementary distribution in canonical constructions (BenAll and ExpNom) regardless of word order.
- Reflexives and antireflexives are not in complementary distribution in non-canonical construction (ExpAll). In this type of construction, word order plays a role: the reflexive favors a preverbal antecedent while the antireflexive favors a postverbal antecedent.

Ninety-five native speakers of Estonian recruited on social media took part in a second experiment that focused on simple finite clauses. They were asked to read a sentence and to answer a question about the sentence they had read. This experiment contained twenty-four experimental items and twenty-five fillers. For the statistical analysis and the graphs, the nominative argument is considered to be the subject in the non-canonical construction.

As the descriptive statistics in Figure 2 illustrate, part of our assumptions are confirmed. We found a nearly complementary distribution in conditions where both the argument structure construction and the word order are canonical. If either argument structure or word order departs from

ARG-ST	Order	Example
NOM agent, ALL beneficiary (BenAll)	SX XS	<i>Paul laenas Jaanile ülikonna oma/tema õe pulmade jaoks.</i> <i>Jaanile laenas Paul ülikonna oma/tema õe pulmade jaoks.</i> 'Paul lent a suit to Jaan for his sister's wedding.'
Question		<i>Kelle õe pulmadedest on juttu?</i> Whose marriage is it about?
NOM experiencer, NOM stimulus (ExpNom)	SX XS	<i>Katrin põlgas Pauli oma/tema sotsiaalse päritolu tõttu.</i> <i>Pauli põlgas Katrin oma/tema sotsiaalse päritolu tõttu.</i> 'Katrin despised Paul because of his/her social class.'
Question		<i>Kelle sotsiaalse päritolust on juttu?</i> Whose social condition is in question?
PART stimulus, ALL experiencer (ExpAll)	SX XS	<i>Katrin meeldis Paulile oma/tema õnnetuseks.</i> <i>Paulile meeldis Katrin oma/tema õnnetuseks.</i> 'Paul loved Katrin for her/his great misfortune.'
Question		<i>Kelle õnnetusest on juttu?</i> Whose misfortune are we talking about?

Table 2 Materials for experiment 2

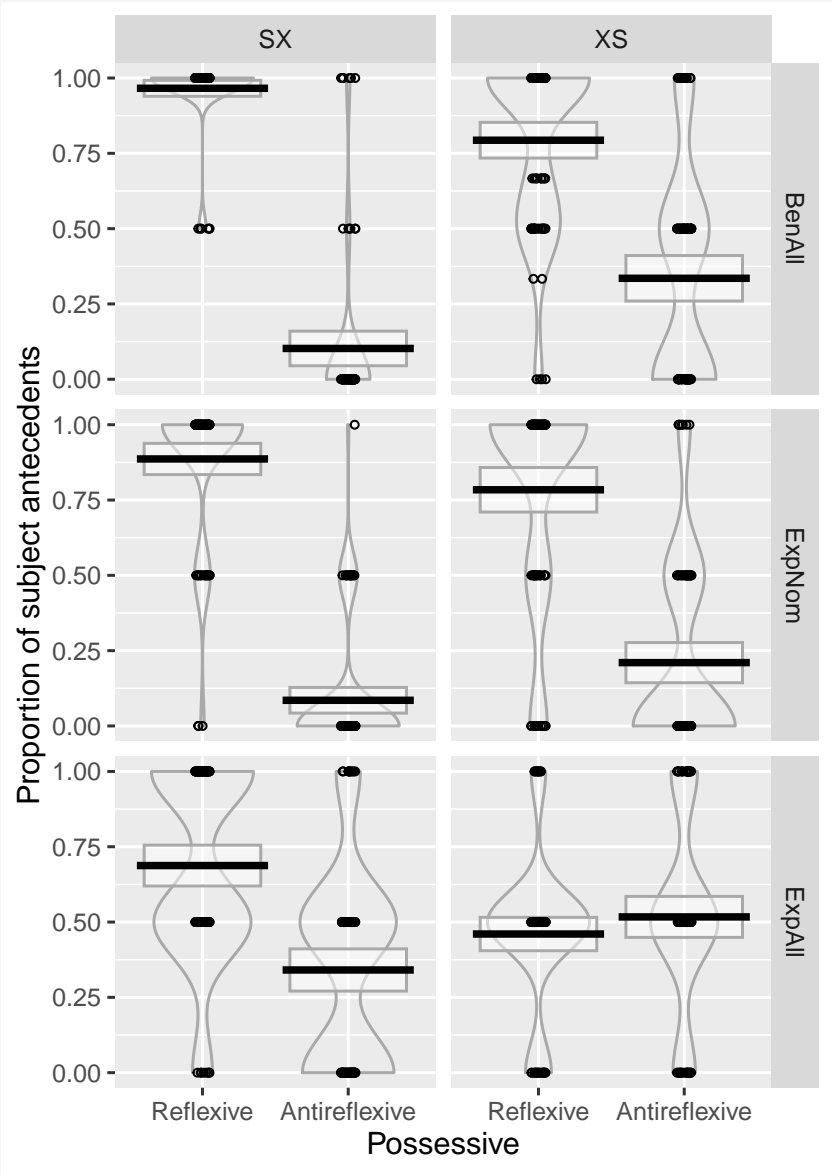


Figure 2 Main results of experiment 2.

the canon, the categorical distinction becomes a mere tendency. No difference of behavior between the two types of possessives is found when the sentence is noncanonical in both dimensions. A generalized mixed effects model confirmed the significance of the effect.⁹

Moreover, in Estonian, word order is free and strongly correlates with information structure (tael1988). This suggests that these results are not only due to syntax but are also influenced by semantic features. More broadly, we claim that binding theory must also integrate a non-syntactic dimension.

Note that the proportions of local subject antecedent in canonical configurations are more extreme in the first experiment than in the second one. It does not seem to us that this difference is attributable (only) to the type of constructions under scrutiny, but rather we think that the nature of the experimental task (answering an open question with a freeform response in experiment 1 and selecting an answer in a list in experiment 2) could lead to this difference.

2.3 Gradient paradigmatic opposition

The experimental results above lead to two striking generalizations. First, while the binding preferences of reflexives and antireflexives do not always lead to a complementary distribution, they are always symmetric: the proportion of choice of one antecedent for the reflexive matches the proportion of choice of the other for the antireflexive. The pattern in the results of experiment 1 or 2 could be the result of chance, but the fact that this pattern is repeated in different constructions of Estonian suggests that it is likely not accidental. In fact, a third experiment on Czech possessive reflexives found the same pattern again (Lesage22). Second, the strength of these preferences varies with the typicality of the syntactic configuration: preferences are maximal in simple finite clauses with a canonical word order and in canonical argument structure constructions; they are weaker for less typical clause types (nonfinite), argument structure constructions, or word orders; these preferences are even unperceivable if the configuration is atypical in more than one dimension.

The facts studied here must be handled by a theory of binding, since the

⁹The model we used had participants' answer as a dependent variable. Fixed effects were the construction type, the possessive proform, the word order as well as their interactions. Random intercepts were included for participant and item.

use of the proforms under scrutiny is regulated by categorical or *hard* constraints (i.e. reflexives and antireflexives are in strict complementary distribution) in most contexts. The same constraints apply in a non-categorical or *soft* way in other contexts. This is somewhat similar to what is shown in the work of **bresnan2001soft**: they observe that the same phenomenon that is regulated by hard grammatical constraints in certain languages manifests as probabilistic in other languages. Specifically, they studied the constraints implied by the hierarchy of person in passive constructions in Lummi and English. In the first language, the constraint is hard, whereas it is soft in the second. Furthermore, it is a striking fact that the classical Binding Theory perfectly deals with the distribution of the reflexive possessive¹⁰, whereas it fails to describe the use of the antireflexive possessive in non-canonical contexts. In other words, it is impossible to define a cross-construction domain in which the antireflexive possessive is free, as mentioned in section 1.

Add here a paragraph justifying that the facts at hand need to be handled by binding theory, and not to be treated as outside of syntax: (1) parallel with Bresnan et al.'s observation that one language's tendencies are another language's hard constraints; (2) inability of classical binding theory to deal with even with the categorical facts noted in Section 1 on the binding of possessive antireflexives in finite clauses vs. infinitives.

To account for this situation, it is tempting to appeal to the logic of paradigmatic opposition. We start from the many studies (**bouchard1983avoid**; **yadurajan1987reflexive**; **burzio1996role**; **burzio1998anaphora**; **Kiparsky2000rooryck2011dissolving**) arguing that the symmetric behavior of reflexive and antireflexive expressions should be accounted for with a single mechanism, rather than two independent principles. To this end they posit that the distribution of antireflexives is due to a blocking effect attributable to the Elsewhere Principle familiar from phonology and morphology (**Kiparsky73**; **anderson1992morphous**): antireflexive forms are used where reflexive forms are not available.

As elegant as it is, this formulation cannot deal with the present data,

¹⁰The reflexive possessive's binding domain is the finite clause and its antecedent can be either a nominative subject or an oblique in a non-canonical argument construction.

as it is crucially dependent on reflexives and antireflexives being not only paradigmatically opposed but in complementary distribution. Instead, we submit that an adequate account of binding constraints for Estonian possessives requires replacing binding principles with four ingredients:

- (8) a. A characterization of the BINDING DOMAIN for each reflexive proform. In any sentence, we call REFLEXIVE BINDING TARGETS (RBTs) all commanding referential expressions within the binding domain.
- b. A statement of the strength of reflexive binding preferences in different syntactic configurations.
- c. A paradigmatic pairing of each (collection of) reflexive proforms with matching antireflexive proforms.
- d. The SYMMETRIC BINDING PRINCIPLE (SBP), stating that:
In any syntactic configuration, reflexives and antireflexives display symmetric preferences for the binding of RBTs.

The SBP is readily interpreted in probabilistic terms. In a situation where there is a single RBT e , as with Estonian *oma*, given some sentence frame with a slot containing a proform, the probability of choosing e as an antecedent if the proform is reflexive is the complement of the probability of choosing e if the proform is antireflexive:

$$(9) \quad P(e|\text{reflexive}) = 1 - P(e|\text{antireflexive})$$

In our two experiments, the experimental items provide two reflexive binding targets e and e' inside the sentence. In the absence of a context, participants are unlikely to consider an extra-sentential antecedent. Hence most of the probability mass will be assigned to the two intra-sentential candidate antecedents. This then leads to the symmetric distribution:

$$(10) \quad P(e|\text{refl.}) = 1 - P(e|\text{antirefl.}) \approx P(e'|\text{antirefl.}) = 1 - P(e'|\text{refl.})$$

Together these four ingredients provide a general account of gradient binding preferences allowing for an account of the Estonian data. Note that the theory as developed so far accomodates the challenging observations on binding domains for possessive antireflexives discussed in Section 1. Antireflexives do not have a binding domain per se, but have binding prefer-

ences matching those of the corresponding reflexive. Hence the behavior of possessive antireflexives follows from that of reflexives: in ((4)), there is a single reflexive binding target, and hence no possibility for an antireflexive to be bound; in ((5)), there are two reflexive binding targets splitting the probability mass, hence we correctly predict that antireflexives should be bindable by either.

Finally, while it is designed to account for gradient binding preferences, the theory also encompasses as a special case familiar classical binding theory effects, where the distribution between reflexive and antireflexive is complementary and the reflexive has only one possible antecedent. Consider the case of French object reflexive *se*, which always takes the local subject as antecedent, and antireflexive *le*, which never does. In such a situation, the Symmetric Binding Principle makes exactly the same predictions as rooryck2011dissolving’s account: if $P(e|\text{reflexive}) = 1$, then $P(e|\text{antireflexive}) = 0$.

- (11) a. *Paul_i se_{i/*j} lave.*
 Paul REFL wash.PRS.3SG
 ‘Paul washes.’
- b. *Paul_i le_{*i/j} lave.*
 Paul 3SG.M wash.PRS.3SG
 ‘Paul washes him.’
- c. *Paul_i demande à Pierre_j de se_{j/*i} présenter.*
 Paul ask.PRS.3SG to Pierre REFL introduce.INF
 ‘Paul asks Pierre to introduce himself.’
- d. *Paul_i demande à Pierre_j de le_{i/*j} présenter.*
 Paul ask.PRS.3SG to Pierre 3SG.M introduce.INF
 ‘Paul asks Pierre to introduce him.’

3 Toward a typology of binding constraints

3.1 Not all binding is symmetric

In the last section we argued that a principle of symmetric binding captures both the gradient binding properties of Estonian possessives and the categorical distribution of some reflexive/antireflexive pairs. Importantly though, not all reflexive/antireflexive pairs conform to the principle in all context. As a case in point, English reflexives and antireflexives do obey

	Categorical	Gradient
symmetric	French <i>le</i> and <i>se</i>	Estonian possessives
asymmetric	English <i>him</i> and <i>himself</i>	?

Table 3 Four configurations of binding constraints for pairs of proforms. ‘Categorical’ means that at least one of the two proforms under consideration either must or can’t be bound by the local subject in some syntactic context.

the principle in direct object position, but not when the pronoun occurs in the last of a series of complements, as in (12) (see **pollard1992anaphors**, **van1997syntax** and, for semantic explanations **jackendoff1972semantic**). Here the antireflexive can’t refer to the subject, hence $P(\textit{John}|\textit{him}) = 0$, but the reflexive has two possible binders, so that $P(\textit{John}|\textit{himself}) \neq 1$.

(12) John_{*i*} talks to Peter_{*j*} about himself_{*i/j/*k*}/him_{*k/*i/*j*}.

Likewise, pronouns in adjuncts do not conform to symmetric binding, as we already saw in (3). This time, the subject is the only possible antecedent for the reflexive, so that $P(\textit{John}|\textit{himself}) = 1$, but the antireflexive is not barred from taking the subject as an antecedent, so that $P(\textit{John}|\textit{him}) \neq 0$.

This cases clearly indicate that, while symmetric binding needs to be recognized as one type of binding constraint configuration, it does not account for the distribution of all reflexive/antireflexive pairs, and in fact fails to account for well-known cases correctly covered by classical binding theory.

3.2 Laying out a typology of binding constraints

At this point, we have witnessed three kinds of distributions of pairs of proforms. In the first kind, typified by French *se* and *le*, reflexive and antireflexive are in full complementary distribution. In the second kind, typified by Estonian possessives, the two proforms satisfy symmetric binding, with the rate of reference to RBTs not lower than 50% depending on the construction. In the third kind, typified by English, binding constraints are categorical but not symmetric. As a consequence, the two proforms are in complementary distribution in some contexts, but in others one of the two forms has a more constrained distribution than the other.

As Table 3 illustrates, comparison on the three types of systems suggests

that two dimensions have to be taken into account to describe the distribution of a pair of proforms: the symmetry of constraints (symmetric for French object pronouns and Estonian possessives, asymmetric for English pronouns), and the strength of the constraints (gradient in Estonian, categorical in French and English). This leaves an empty slot for a system that is neither categorical nor symmetric. In the next session we provide evidence that Estonian non-possessive pronouns fill that slot.

3.3 Experiment 3: Gradient asymmetric binding

We ran a third experiment about the interpretation of non-possessive pronouns in simple finite clauses and infinitive complement clauses. We chose this pair of proforms and contexts on the basis of informally collected speaker judgements. According to these, we have the expected complementary distribution in simple finite clauses: in (13), reflexive *endast* needs to be bound by the local subject, while antireflexive *temast* can't. On the other hand, in infinitive complement clauses, judgements are different: in (14), reflexive *endast* can readily be bound either by the local subject (*Paul*) or the matrix subject (*Katrin*), but speakers disagree on whether the local subject can bind antireflexive *temast*. This leads us to expect to find nonsymmetric binding constraints in infinitive complement clauses.

- (13) a. **Katrin_i** *avalda-s* *oma* *arvamus-t.* **Paul_j**
 Katrin.NOM open-3SG.PST REFL.POSS opinion-PART Paul.NOM
rääki-s *enda-st_{*i/j}* *liiga palju.*
 talk-3SG-PST REFL-ELA too much
 'Katrin gave her opinion. Paul talked too much about himself.'
- b. **Katrin_i** *avalda-s* *oma* *arvamus-t.* **Paul_j**
 Katrin.NOM open-3SG.PST REFL.POSS opinion-PART Paul.NOM
rääki-s *tema-st_{i/*j}* *liiga palju.*
 talk-3SG-PST 3SG-ELA too much
 'Katrin gave her opinion. Paul talked too much about her.'
- (14) a. **Katrin_i** *soovita-b* **Pauli-l_j** *töövestluse*
 Katrin.NOM advice-3SG.PRS Paul-ADE job.interview.GEN
jooksul mitte liiga palju enda-st_{i/j} *rääki-da.*
 during NEG too much REFL-ELA talk-INF2
 'Katrin advises Paul not to talk too much about her/himself'

- during the job interview.’
- b. **Katrin_i** *soovita-b* **Pauli-l_j** *töövestluse*
 Katrin.NOM advice-3SG.PRS Paul-ADE job.interview.GEN
jooksul mitte liiga palju tema-st_{i/??j} rääki-da.
 during NEG too much 3SG-ELA talk-INF2
 ‘Katrin advises Paul not to talk too much about her/??himself
 during the job interview.’

Sixty native speakers of Estonian recruited on Prolific¹¹ (mean age: 26,5 years, median age: 25) took part in this third experiment. They were paid 4€ and the experiment lasted 20 minutes on average. We manipulated two variables: the clause embedding (finite vs. infinitive) and the type of proform (reflexive vs. antireflexive). This experiment had four conditions, shown in the table 4. The experiment contained 20 experimental items and 43 fillers. The fillers consisted of pairs of sentences. The second sentence contained a proform referring to one element mentioned in the previous sentence. In some sentences, there were two semantically and morphologically possible antecedents for the proform (as exemplified in (15a)). For some other fillers, the proform in the second sentence had only one semantically possible antecedent (as exemplified in (15b)). The experiment started with three training items to allow participants to get used to the task. The sentence was followed by a question eliciting the referent of the proform. As in experiment 1, participants had to write the answer in a freeform text box.

- (15) a. **Andrus** *peit-is* **Jaani.** *To-l aja-l*
 Andrus.NOM hide-3SG.PST Jaan.GEN this-ADE time-ADE
ol-i ta sõdur.
 be-3SG.PST 3SG.NOM soldier
 ‘Andrus hid Jaan. At this time, he was soldier.’
- b. **Ma** *võt-s-in looma-de varjupaiga-st kassi,*
 1SG.NOM take-PST-1SG animal-GEN.PL shelter-ELA cat.GEN
mitte koera. Tema eest tule-b hoolitse-da.
 NEG dog.PART 3SG.GEN of need-3SG.PRS take_care-INF
 ‘I took from an animal shelter a cat, not a dog. It needs to take care of it.’

¹¹prolific.co

Clause type	Proform	Example
Independent	Reflexive	<i>Katrin avaldas oma arvamust. Paul rääkis endast liiga palju.</i>
	Antirefl.	<i>Katrin avaldas oma arvamust. Paul rääkis temast liiga palju.</i> 'Katrin gave her opinion. Paul talked too much about her/himself.'
Infinitive	Reflexive	<i>Katrin soovitab Paulil töövestluse jooksul mitte liiga palju endast rääkida.</i>
	Antirefl.	<i>Katrin soovitab Paulil töövestluse jooksul mitte liiga palju temast rääkida.</i> 'Katrin advises Paul not to talk too much about her/himself during the job interview.'
Question		<i>Kellest räägitakse/räägiti?</i> 'Who is being talked about?'

Table 4 Materials for experiment "

Figure 3 confirms informal judgements. In simple finite clauses, reflexives and antireflexives are roughly in complementary distribution in simple clauses, although the reflexive was interpreted as free in a nontrivial number of cases (5%).¹² In infinitive complement clauses, the proportion of local antecedents is higher for reflexives than for antireflexives, as it was for possessives in Experiment 1. However the distribution is not symmetric: only 51% of reflexives are bound by the local subject, whereas 86% of antireflexives are bound by the matrix subject.

We have thus provided clear empirical evidence that binding constraints can be asymmetric and gradient at the same time, filling the last slot of the typology in Table 3.

¹²Surprisingly, this proportion is higher than what we found for reflexive possessive in experiment 1 (see Figure 1). This is unexpected, as binding constraints on non-possessives are generally stricter than those on possessives. Be that as it may, this does not affect the point at hand.

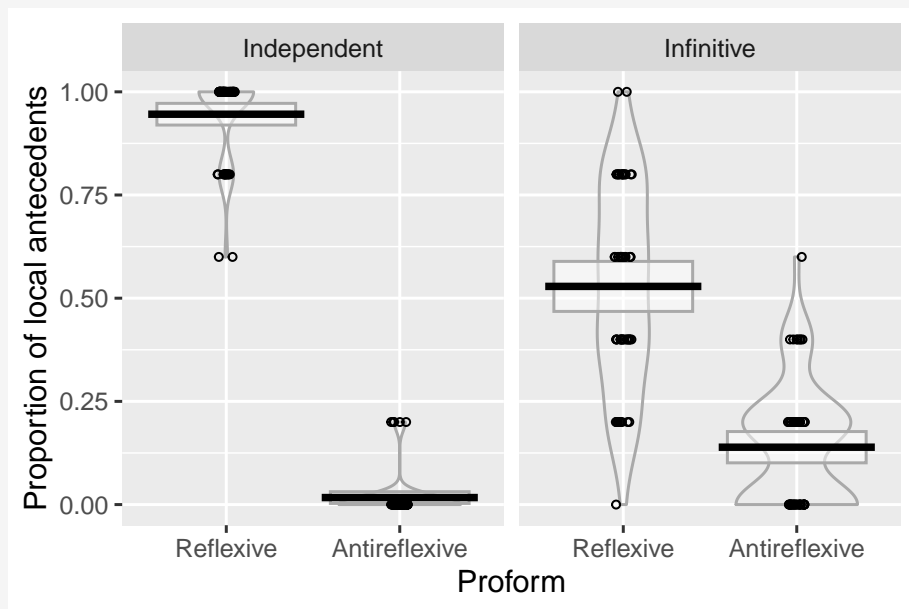


Figure 3 Main results of Experiment 3.

4 Conclusion

In this paper, we first showed that classical Binding Theory fails to describe the use of some proforms. More precisely, principle B does not capture the distribution of antireflexives in infinitive complement clauses in Estonian. We then showed that Estonian possessives exhibit symmetric binding: reflexive and antireflexive possessives exhibit complementary binding preferences. We sketched a version of binding theory encompassing a probabilistic symmetric binding principle, and accounting for both observations. Finally, we outlined a typology of systems of pairs of proforms on the basis of the kinds of binding constraints they fulfill: these can be symmetric or asymmetric, categorical or gradient. Classical Binding Theory focuses on categorical constraint alone, and reduces the symmetric/asymmetric distinction to whether the reflexive and antireflexive have the same binding domain. We provided empirical evidence from Estonian that the two kinds of systems of gradient binding constraints are attested, which calls for an overhaul of Binding Theory.

The present study opens up at least two avenues for future research.

First, we need to better understand the interplay between gradient bind-

ing constraints in production and comprehension. Because of its categorical nature, Classical Binding Theory is agnostic to production and comprehension: the same constraints are readily interpreted as dictating what form can be used to express the intended coreference, and which antecedents are available for a given form. As soon as we recognize gradient constraints, agnosticism is not warranted anymore: $P(\text{form}|\text{meaning})$ need not be the same as $P(\text{meaning}|\text{form})$. Production studies parallel to the comprehension experiments reported in this paper would be needed to find out whether production binding constraints match their comprehension counterparts. The corpus study reported in **syntaxfest** suggests that they don't: that study found that speakers seldom use an antireflexive bound by an allative experiencer, while experiment 2 found that the corresponding interpretation was more common.

Second, the relative strength of binding constraints warrants a more detailed look. Experiments 1 and 2 suggested that the more ordinary the syntactic context is, the stronger binding constraints are: simple finite clauses lead to stronger constraints than embedded infinitives; canonical transitive constructions lead to stronger constraints than noncanonical constructions with mixed subject properties; and default SX word order leads to stronger constraints than marked XS order. These binding preferences may be a consequence of the familiarity of speakers with different construction types: in the same way as more familiar items, like canonical simple clauses, lead to sharper acceptability judgements (**divjak2017role**), more familiar syntactic configurations lead to stronger preferences for binding.

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