

Wh-reciprocals, quantifier raising, and Binding Theory*

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1 Goals

- Establish a constellation of facts regarding a class of sentences I call *wh*-reciprocals:
 - (1) John and Mary wondered what each other would win.
- Demonstrate that *wh*-reciprocals are not marginal, and merit detailed investigation.
- Discuss some strong parallels between *wh*-reciprocals and the distribution of wide-scope *each NP* in embedded clauses.
- Argue that *wh*-reciprocals are licensed by quantifier raising (QR).

2 *Wh*-reciprocals: background

A central observation of Binding Theory (BT): English anaphors may not appear in the subject position of a finite clause.

- (2) a. **Himself_i* knew that Sally saw him_i.
b. *[Sally and John]_i knew that [each other]_i left.
- Attempts to explain the prohibition against finite subject anaphors have often required additional mechanisms beyond the basic conditions on the binding of anaphors.
 - The ‘anaphor agreement effect’ (Rizzi 1990)
 - Conditions on chain formation (Reinhart and Reuland 1993)
 - Morphological gaps (Brame 1977; Pollard and Sag 1992)

The exception: subject reciprocals *are* licensed in a systematic set of finite embedded *wh*-clauses.

- (3) [John and Mary]_i wondered [_{CP} what [each other]_i would win].
 - Sentences like (3) will be called ***wh*-reciprocals**.

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2.1 The empirical status of *wh*-reciprocals

- *Wh*-reciprocals were noted in the syntactic literature as early as Lebeaux (1983).
 - Though *wh*-reciprocals have been discussed in subsequent research, they have largely been dismissed as ‘marginal’ (e.g. Woolford 1999:261n).
 - But *wh*-reciprocals are well-attested in large balanced corpora...
 - Corpus of Contemporary American English (COCA; <http://www.americancorpus.org/>)
 - 400+ million words, including both spoken and written English, balanced for genre.
 - COCA contains (at least) 41 *wh*-reciprocals:
- (4) *Wh*-reciprocals found in COCA
- a. We can talk to each other or understand what **each other** did.
 - b. In a business world they had a lot of faith in what **each other** had to say.
 - c. How do you know we don’t feel what **each other**...
 - d. They never really listened to each other or cared that much about what **each other** said.
- ... and many speakers find *wh*-reciprocals fully acceptable.
 - An informal survey of 62 speakers of American English found that *wh*-reciprocals were rated nearly as good as control sentences (1 = unacceptable, 5 = perfect).
- (5) a. Maggie and Linda wondered what **each other** ate for breakfast. (Median = 4)
 b. Cooper and Emma wondered what **Alicia** sent to the mayor. (Median = 5)

2.2 Two core contrasts

Wh-reciprocals are more acceptable than corresponding examples that:

- Lack *wh*-movement in the embedded clause.¹
- (6) ??[Jacob and Ralph]_i knew [CP **that** [each other]_i lived in Boston]. (SURV)
- Contain an embedded subject *reflexive*.
- (7) *Katja_i found out [CP what **herself**_i won in the contest]. (SURV)
- The analysis developed here will focus on explaining these two contrasts.

¹Such examples are attested in COCA, but at a much lower rate than *wh*-reciprocals (*that each other* = 6; *whether each other* = 2; *if each other* = 0).

2.3 *Wh*-reciprocals are not logophors

Some instances of English anaphors have been analyzed as *logophors*, i.e. anaphors that are exempt from Condition A of BT (e.g. Pollard and Sag 1992; Reinhart and Reuland 1993).

- (8) Logophoric anaphors (Pollard and Sag 1992:264-5)
- a. [Kim and Sandy]_i knew that Computational Ichthyology had rejected [**each other**]_i's papers.
 - b. [Each student]_i was confident that the teacher would criticize everyone but **himself**_i.

Wh-reciprocals are not logophoric:

- (i) Logophoric anaphors can be licensed over a distance (see (8)), but *wh*-reciprocals cannot.
- (9) a. *[Maggie and Curt]_i thought Jasmine read what [each other]_i wrote.
b. *We_i knew he would understand what [each other]_i wanted. (Bruening 2006)
- (ii) Logophoricity doesn't explain why embedded subject *reflexives* are prohibited.
- (10) *Jaime_i wondered [CP what himself_i damaged in the engine]. (SURV)
- The ungrammaticality of (10) cannot be attributed to the lack of morphologically nominative anaphors in English (*cf.* Brame 1977; Pollard and Sag 1992).
 - *wh*-reciprocals *do* contain (syntactically) nominative anaphors.²
 - (11) a. [John and Bill]_i knew what [each other]_i won at the fair.
b. John_i knew what he_i/*him_i won at the fair.
◦ Nominative *each other* is still subject to Condition A.
 - (12) a. *[Each other]_i left.
b. *Herself_i slept.
◦ Ungrammaticality of matrix subject reflexives and reciprocals should be given a unified explanation.

²Note further that Irish English actually allows subject reflexives in matrix clauses (though without a reflexive interpretation):

(i) Did **himself** come home yet? (Irish English; Jim McCloskey p.c.)

Nevertheless, sentences like (10) are also ill-formed in Irish English.

3 *Wh*-reciprocals are licensed by QR

What's so special about *each other*?

- Heim, Lasnik and May (1991): *each other* is both anaphoric *and* quantificational.
 - *each other* contains the universal (distributive) quantifier *each*.
 - *each other* must be locally bound like a reflexive.
- The quantificational character of *each other* explains why it requires a plural antecedent (Heim et al. 1991; McCloskey 2005).
 - (13) a. [The spies]_i suspected [each other]_i.
 b. *[The spy]_i suspected [each other]_i.

Key claim: since *each other* is quantificational, it is eligible to undergo quantifier raising (QR).

3.1 Binding *each other* by QR

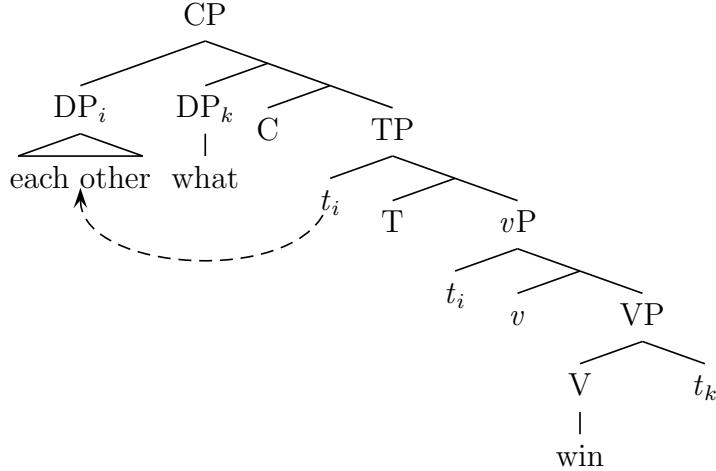
Proposal: in *wh*-reciprocals, *each other* undergoes covert QR to the edge of the embedded CP, and can then be bound from the matrix clause.

Local domain for Condition A: minimal TP/CP containing the anaphor.

- Immediately explains why subject reflexives are prohibited in finite embedded clauses.³
- (14) a. *Mary was deciding [_{CP} whether [_{TP} herself should leave]]. (Lebeaux 1983)
 b. *John didn't know [_{CP} what [_{TP} himself had done]]. *ibid.*
- What about *wh*-reciprocals?
 - Embedded subject reciprocals undergo covert QR to the edge of their immediately containing CP.
 - After QR, *each other* can be bound from outside the embedded clause.

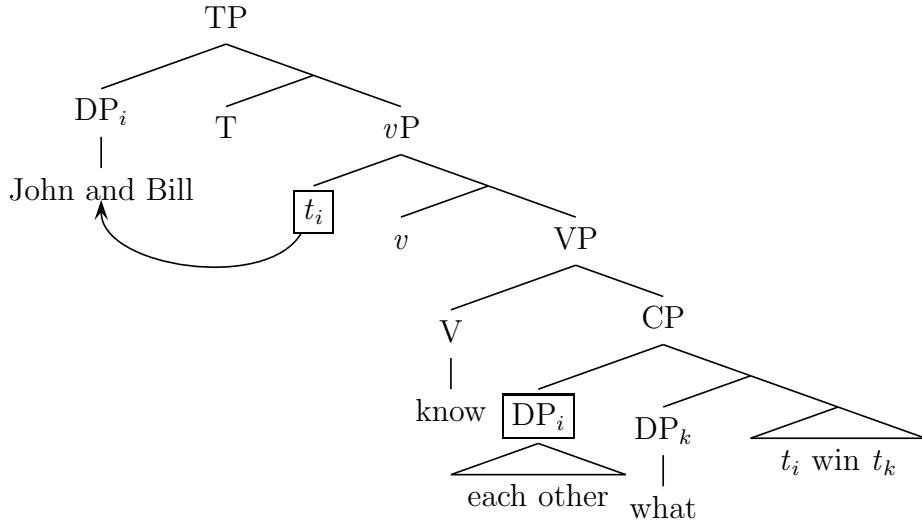
³Examples like (14a) are problematic for versions of BT that assume the local domain for Condition A is the minimal *strong* phase, i.e. phase with a filled specifier (Lee-Schoenfeld 2004; Quicoli 2008). In (14a), the specifier of the embedded CP is empty, yet the reflexive *herself* cannot be bound by the matrix subject (which presumably originates in [SPEC,vP], the next-highest phase).

- (15) Embedded subject reciprocals undergo QR to CP.⁴



After undergoing QR, *each other* can be bound within the matrix *vP*.

- (16) *each other* bound within matrix *vP* after QR (boxes indicate binding)



- Recent phase-based approaches to binding assume that the local domain for the binding domain of anaphors is no smaller than *vP*.
 - Minimal strong phase (e.g. Lee-Schoenfeld 2004; Quicoli 2008).
 - Any domain accessible to binding by *v* head (e.g. Kratzer 2009).

⁴If the local domain for Condition A is the minimal CP containing the anaphor, then QR must involve adjunction rather than movement to a specifier position (*cf.* Bruening 2001). Otherwise, after QR *each other* would still be contained within the embedded CP.

3.2 *Wh*-reciprocals and wide-scope *each NP*

Is there independent evidence for QR of *each other* in *wh*-reciprocals?

- Wide-scope readings of subject *each NP* are possible in embedded clauses, but only if *wh*-movement has occurred (Moltmann and Szabolcsi 1994; Krifka 2001; Fox 2000).

(17) [DP Some waiter] knows [CP that [DP each customer] will tip well]. (**each* ≫ *some*)

(18) [DP Some teacher] knows [CP what [DP each student] likes to read]. (✓ *each* ≫ *some*)

- Wide-scope subject *each NP* is found in *exactly* those embedded clauses that permit subject reciprocals.

(19) a. ??[Jamal and Dan]_i knew [CP that [each other]_i lived in Boston].
 b. [Jamal and Dan]_i knew [CP where [each other]_i lived in Boston].

Wh-reciprocals and wide-scope subject *each NP* have the same distribution in embedded clauses.

- Suggests that embedded wide-scope subject *each NP* and *wh*-reciprocals are licensed by the same mechanism: **QR**.⁵

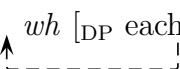
Why should QR of *each other/each NP* depend on *wh*-movement?

- *Scope Economy* (Fox 2000): optional QR is only licensed when it would lead to an interpretive difference.
- QR of *each other/each NP* is semantically vacuous unless it alters scope relations with another scope-bearing element, e.g. a *wh*-expression.

3.3 Obligatory QR and pair-list readings

This analysis entails that QR of *each other* is obligatory in *wh*-reciprocals.

Prediction: *each other* should always outscope the *wh*-expression in the embedded [SPEC,CP].

(20) [CP... DP_i ... [CP  wh [DP each other]_i ...]]

⁵The idea that *wh*-reciprocals might be licensed by having *each other* take scope over the embedded *wh*-expression is mentioned in passing in Moltmann and Szabolcsi (1994:386).

The scope *each NP* $\gg wh$ gives rise to pair-list readings of quantifiers (May 1985; Moltmann and Szabolcsi 1994; Krifka 2001).

- (21) What did each boy see?
- a. What is the x such that every boy saw x ? (*what* \gg *each*)
 - b. For every boy y , what did y see? (*each* \gg *what*)

Prediction is borne out: *wh*-reciprocals allow pair-list readings, but not single-answer readings.

- (22) John and Bill knew what each other bought.
- a. $*\exists x: \text{John knew Bill bought } x \wedge \text{Bill knew John bought } x$. ($*wh \gg each$)
 - b. $\exists x: \text{John knew Bill bought } x \wedge \exists y: \text{Bill knew John bought } y$. ($\checkmark each \gg wh$)
- (23) A: John and Bill found out what each other saw at the aquarium.
 B1: Yeah, John saw a shark, and Bill saw an otter, right?
 B2: #Yeah, a trout, right?

A problem: single-answer reading (22a) is a special case of pair-list reading (22b) (i.e. it just happens to be the case that $x = y$).

But availability of pair-list reading (22b) shows that QR of *each other* is at least possible in *wh*-reciprocals.

3.4 Aggressively non-D-linked *wh*-expressions

Aggressively non-D-linked *wh*-expressions ('*wh* the hell') do not allow for pair-list interactions with universal quantifiers (den Dikken and Giannakidou 2002).

- (24) What the hell did everyone buy for Max? ($*every \gg what$)

So '*wh* the hell' expressions do not license QR of universal quantifiers (or QR is blocked; see den Dikken and Giannakidou 2002).

'*Wh* the hell' expressions also fail to license *wh*-reciprocals.

- (25) a. I wonder what the hell Dave bought at the store.
 b. ??We wonder what the hell each other bought at the store.
- (26) a. I don't know what the hell Dave found in the basement.
 b. ??We don't know what the hell each other found in the basement.

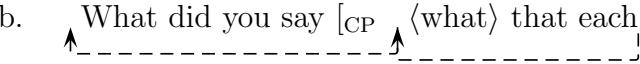
Consistent with the claim that *wh*-reciprocals are licensed under QR.

4 Further predictions

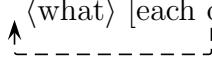
If *wh*-reciprocals are licensed by QR, then *wh*-reciprocals should be possible in every position that allows for wide-scope readings of *each NP*, provided a local antecedent is available.

4.1 QR over *wh*-traces

Wide-scope readings of universal quantifiers can be licensed by intermediate *wh*-traces (Fox 2000:65n):

- (27) a. What did you say that each boy bought?
- b.  (✓ *each* ≫ *what*)

Wh-reciprocals can also be licensed by intermediate *wh*-traces.

- (28) a. ?What did [Lupe and Adam]_i think [each other]_i baked for dessert? (SURV)
- b. ?What did [Lupe and Adam]_i think [CP  [each other]_i baked...?]?

4.2 Predicting non-parallelism for *each other* and *each NP*

Wide-scope *each NP* is also possible in several configurations that *do not* license *wh*-reciprocals.

(i) *Wh*-reciprocals are not licensed across two clause boundaries.

- (29) Someone knew [CP what Emma said [CP that each boy bought]].⁶ (✓ *each* ≫ *some*)

- (30) *[Kenji and Sean]_i knew [CP what Tom said [CP [each other]_i stole]]. (SURV)

(ii) *Wh*-reciprocals are not licensed in embedded object position.

- (31) I know which boy John introduced each girl to.⁷ (✓ *each* ≫ *which*)

- (32) *[Sonja and Kim]_i knew [CP who Carlos introduced [each other]_i to]. (SURV)

⁶Fox (2000:65n).

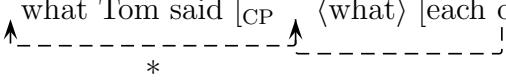
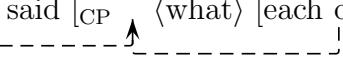
⁷Moltmann and Szabolcsi (1994:384).

4.2.1 Limiting QR of *each other*

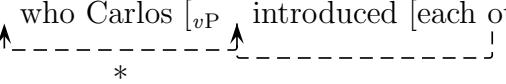
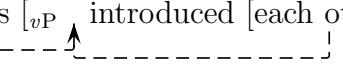
What might explain the breakdown in parallelism between *each other* and wide-scope *each NP*?

Proposal: *each other* can only undergo one instance of QR.

(i) *Wh*-reciprocals are not licensed across two clause boundaries.

- (33) a. *[Kenji and Sean]_i knew what Tom said [each other]_i stole.
- b. *[Kenji and Sean]_i knew [CP  what Tom said [CP  <what> [each other]_i stole]].
- *each other* must attach to the highest embedded CP in order to be bound from the matrix clause.
 - Locality conditions prevent *each other* from raising directly to the highest embedded CP (Fox 2000; Bruening 2001).
 - Licensing *each other* across two clause boundaries thus requires two instances of QR, one to each embedded CP.
 - The second instance of QR is illicit.

(ii) *Wh*-reciprocals are not licensed in embedded object position.

- (34) a. *[Sonja and Kim]_i knew who Carlos introduced [each other]_i to.
- b. *[Sonja and Kim]_i knew [CP  who Carlos [vP  introduced [each other]_i to]].
- Object quantifiers must undergo QR to *vP* to avoid type-clash and allow interpretation (Heim and Kratzer 1998; Fox 2000).
 - Since *each other* is quantificational, object *each other* obligatorily raises to *vP*.
 - QR to *vP* prevents *each other* from raising any further.

Regular (non-anaphoric) quantifiers freely undergo multiple instances of QR, as long as each application is independently licensed.⁸

- (35) a. Someone knows what you said that each boy bought. ($\checkmark \text{each} \gg \text{some}$)

- b. Someone knows [CP what you said [CP ⟨what⟩ that [each boy] bought]].

- (36) a. I know which boy John introduced each girl to. ($\checkmark \text{each} \gg \text{which}$)

- b. I know [CP which boy John [vP introduced [each girl] to]].

But **why** is *each other* restricted to a single instance of QR?

5 Why are *wh*-reciprocals (sometimes) degraded?

If *wh*-reciprocals are indeed well-formed for many speakers (see section 2.1), why have they been characterized as marginal in previous literature?

(i) An agreement puzzle

- *Wh*-reciprocals interact with subject-verb agreement in a non-uniform pattern.
 - Some *wh*-reciprocals are found with singular verb agreement...

- (37) *Wh*-reciprocals with singular verb agreement (COCA)

- a. Now they know what **each other is** doing.
- b. We have enough mutual respect to know where **each other resides**.

- ... but other *wh*-reciprocals are found with plural verb agreement.

- (38) *Wh*-reciprocals with plural verb agreement (COCA)

- a. We pretty much know what **each other are** going to do before it's done.
- b. We are all aware enough of what **each other need**.

- In some cases, verb agreement appears to be contingent on the plurality of the *wh*-expression (see also Kimball and Aissen 1971; Kayne 2000).

- (39) a. Sally and Ralph forgot **which medication** each other ?**was/*were** taking.
- b. Sally and Ralph forgot **which medications** each other ??**was/were** taking.

⁸Though *cf.* Bošković (2008) for arguments to the contrary.

- World knowledge may play a role.
- (40) a. ?The farmers know what **each other plants** in February.
 b. The farmers know what **each other plant** in February.
- The subtleties of determining verb agreement with *wh*-reciprocals may detract from their well-formedness.
 - Potential explanations:
 - The ‘anaphor agreement effect’ (Rizzi 1990; Woolford 1999).
 - Performance factors, such as constraints on working memory (Wagers et al. 2009).
 - Subject reciprocals are otherwise prohibited in finite clauses; speakers may simply not know whether *each other* triggers singular or plural agreement.
 - But agreement can’t be the whole story.
 - Survey controlled for agreement by using only past-tense verbs, with syncretism for singular/plural agreement.
 - *Wh*-reciprocals were still found to be somewhat degraded when compared with controls.

(ii) Variation in scope taking

- *Wh*-reciprocals require inverse, non-surface scope for *each other*.
- Within a speech community, speakers differ in their ability to assign inverse scope to quantifiers (e.g. Carden 1976; Gil 1982; Lasnik and Uriagereka 1988).
- Idiolectal and dialectal factors likely affect the acceptability of *wh*-reciprocals.

6 Conclusions

- *Wh*-reciprocals are well-formed for many speakers, though confounding factors like verb agreement can lead to degradation.
- *Wh*-reciprocals are fully compatible with recent Minimalist versions of Binding Theory: their acceptability is a direct consequence of the quantificational nature of *each other*.
- This analysis explains why embedded subject reciprocals are only mildly ungrammatical in the absence of *wh*-movement (e.g. (6)).
 - QR of *each other* depends on a previous instance of *wh*-movement.
 - Licensing subject reciprocals without prior *wh*-movement requires illicit scope taking.

6.1 Further prospects

Are *wh*-reciprocals particular to English?

- The above analysis predicts that *wh*-reciprocals should be possible in a given language only if that language has a quantificational reciprocal.
 - German and Irish, which have non-quantificational reciprocals, do not allow *wh*-reciprocals.

- (42) *Hans und Wilhelm wussten, was einander gewonnen hatte.⁹
 Hans and Wilhelm know_{pst} what each-other won had
 'Hans and Wilhelm knew what each other had won.'

- (43) *Níor thuig siad caidé a dúirt a chéile.¹⁰
 NEG_{pst} understand they what C said each-other
 'They didn't understand what each other said.'

- Missing from the typology: another language that *does* have a quantificational reciprocal.

References

- Bošković, Željko. 2008. "On the operator freezing effect." In *Natural Language and Linguistic Theory* 26(2), 249–287.

Brame, Michael. 1977. "Alternatives to the Tensed S and Specified Subject Conditions." In *Linguistics and Philosophy* 1(3), 381–411.

Bruening, Benjamin. 2001. "QR obeys Superiority: Frozen scope and ACD." In *Linguistic Inquiry* 32(2), 233–273.

—. 2006. "What is the right Binding Theory?" Talk given at SUNY Stony Brook, September 29, 2006. Online version: <http://www.ling.udel.edu/bruening/home/RefSUNYHO.pdf>.

Carden, Guy. 1976. *English Quantifiers: logical structure and linguistic variation*. Academic Press, New York.

⁹Armin Mester, p.c.; Judith Fiedler, p.c.

¹⁰ Jim McCloskey, p.c.

- den Dikken, Marcel and Anastasia Giannakidou. 2002. "From Hell to Polarity: "Aggressively Non-D-Linked" Wh-Phrases as Polarity Items." In *Linguistic Inquiry* 33(1), 31–61.
- Fox, Danny. 2000. *Economy and semantic interpretation*. MIT Press, Cambridge, MA.
- Gil, David. 1982. "Quantifier scope, linguistic variation, and natural language semantics." In *Linguistics and Philosophy* 5(4), 421–472.
- Heim, Irene and Angelika Kratzer. 1998. *Semantics in Generative Grammar*. Blackwell, Oxford.
- Heim, Irene, Howard Lasnik and Robert May. 1991. "Reciprocity and plurality." In *Linguistic Inquiry* 22(1), 63–101.
- Kayne, Richard S. 2000. *Parameters and universals*. Oxford University Press, New York.
- Kimball, John and Judith Aissen. 1971. "I think, you think, he think." In *Linguistic Inquiry* 2(2), 241–246.
- Kratzer, Angelika. 2009. "Making a pronoun: Fake indexicals as windows into the properties of pronouns." In *Linguistic Inquiry* 40(2), 187–237.
- Krifka, Manfred. 2001. "Quantifying into question acts." In *Natural Language Semantics* 9(1), 1–40.
- Lasnik, Howard and Juan Uriagereka. 1988. *A course in GB syntax*. MIT Press, Cambridge, MA.
- Lebeaux, David. 1983. "A distributional difference between reciprocals and reflexives." In *Linguistic Inquiry* 14(4), 723–730.
- Lee-Schoenfeld, Vera. 2004. "Binding by phase:(Non-)complementarity in German." In *Journal of Germanic Linguistics* 16(2), 111–171.
- May, Robert. 1985. *Logical form: its structure and derivation*. MIT Press, Cambridge, MA.
- McCloskey, Jim. 2005. "Reciprocals, parts, and wholes." Ms., UC Santa Cruz. WebFest for Jorge Hankamer, ed. Sandra Chung, James McCloskey, and Nathan Sanders. Department of Linguistics, University of California, Santa Cruz. <http://ling.ucsc.edu/jorge>.
- Moltmann, Friederike and Anna Szabolcsi. 1994. "Scope interactions with pair-list quantifiers." In *Proceedings of NELS* 24(2), 381–395.
- Pollard, Carl and Ivan Sag. 1992. "Anaphors in English and the scope of binding theory." In *Linguistic Inquiry* 23(2), 261–303.
- Quicoli, A. Carlos. 2008. "Anaphora by phase." In *Syntax* 11(3), 299–329.
- Reinhart, Tanya and Eric Reuland. 1993. "Reflexivity." In *Linguistic Inquiry* 24(4), 657–720.
- Rizzi, Luigi. 1990. "On the anaphor-agreement effect." In *Rivista di linguistica* 2(1), 27–42.
- Wagers, Matthew, Ellen Lau and Colin Phillips. 2009. "Agreement attraction in comprehension: representations and processes." In *Journal of Memory and Language* 61, 206–237.
- Woolford, Ellen. 1999. "More on the anaphor agreement effect." In *Linguistic Inquiry* 30(2), 257–287.

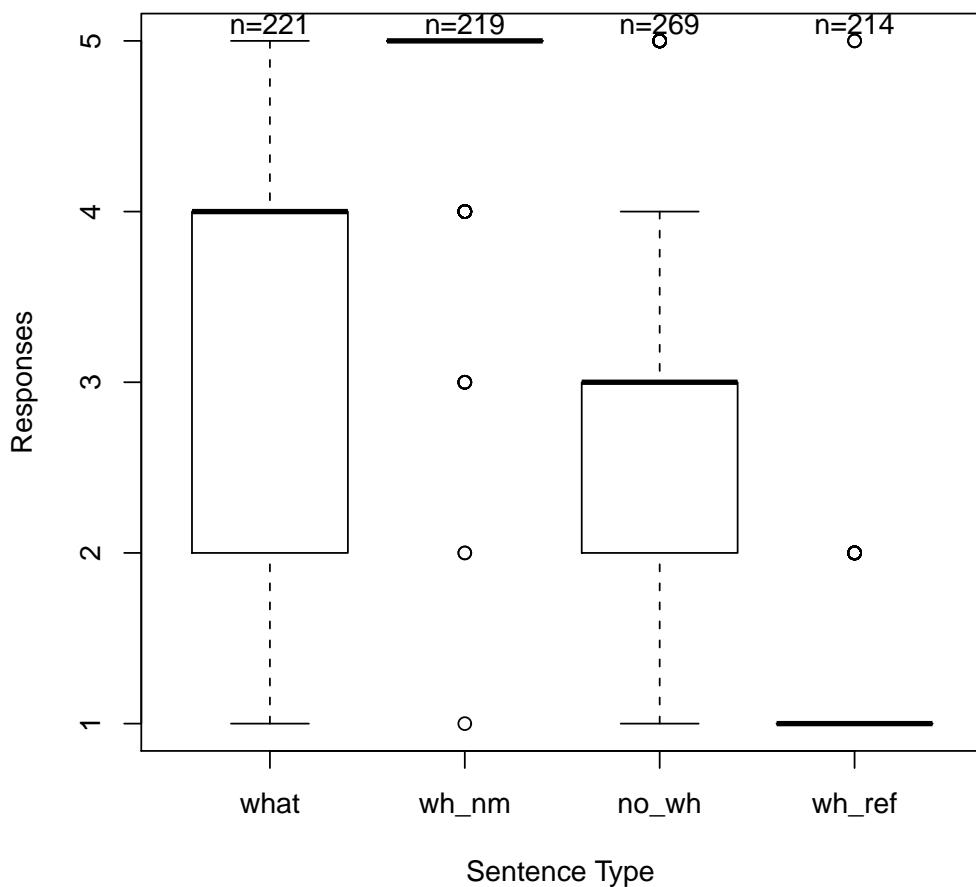
7 Appendix: survey results

- ‘nm’ = control with reciprocal replaced by name (see (6))
 ‘ref’ = control with reciprocal replaced by reflexive (see (7))
 ‘LQ’ = long-distance licensing with matrix question (see (28))
 ‘LD’ = long-distance licensing with declarative (see (30))
 ‘wh_isl’ = control with wh-island violation (Complex NP)

7.1 *Wh*-reciprocals and controls

	what	wh_nm	no_wh	wh_ref
Median	4	5	3	1
Mode	4	5	3	1
Mean	3.41	4.78	2.62	1.16
Min.	1	1	1	1
Max.	5	5	5	5

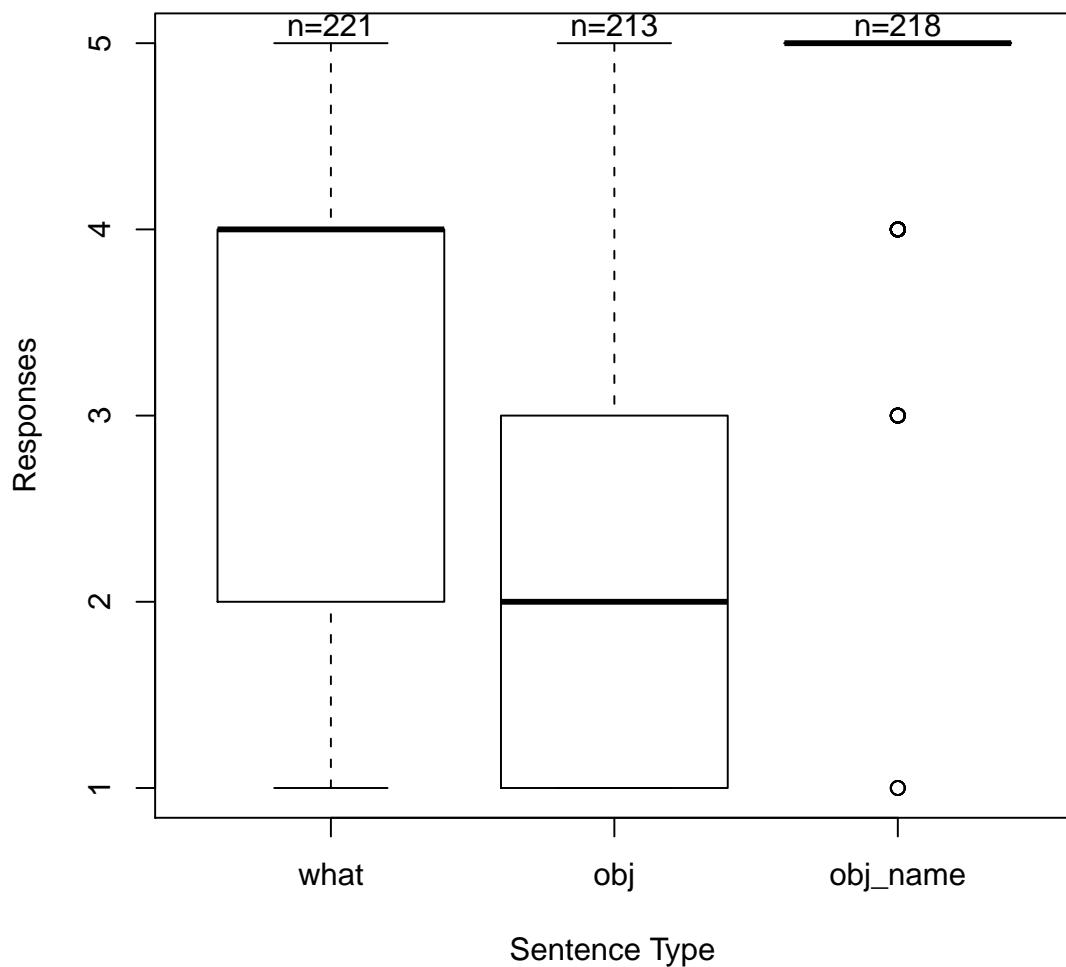
Wh-reciprocals: controls



7.2 Object *wh*-reciprocals

	what	obj	obj_name
Median	4	2	5
Mode	4	2	5
Mean	3.41	2.13	4.7
Min.	1	1	1
Max.	5	5	5

Wh-reciprocals: object position



7.3 Long-distance antecedents

	what	LQ	LD	LQ_nm	LD_nm	wh_isl
Median	4	3	2	5	5	1
Mode	4	2	2	5	5	1
Mean	3.41	2.88	2.04	4.60	4.4	1.49
Min.	1	1	1	2	1	1
Max.	5	5	5	5	5	5

Wh-reciprocals: long-distance antecedents

