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Solving Hartman's puzzle: On the interaction of extraction and VP-ellipsis

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Overview

- VP-ellipsis is restricted by extraction: moving something out of VP makes VP-ellipsis impossible.
- Most successful analysis for embedded contexts: focus-semantic identity (Griffiths 2019)
- VPE and extraction seem to interact differently in matrix contexts (= Hartman's puzzle)
- 💡 New data: head movement parallelism does not play a role in ellipsis identity
- 💡 we can extend the focus-semantic account, solving much of Hartman's puzzle
- ? Remaining puzzle: unclear judgments/ missing data for adverbial questions

1 Extraction and VP-ellipsis

(1) *VP-ellipsis without extraction*
   a. Jo ate a muffin and Mo did ~~[$_{VP}$ eat a muffin]~~, too.
   b. Hanni was coming into the room just when Nanni was ~~[$_{VP}$ coming into the room]~~.

VP-ellipsis in English (and Braz. Portuguese, Scottish Gaelic, Thoms 2014) is restricted: if something is extracted out of the VP, VP-ellipsis is impossible, (2) and (3).

(2) A: Jo ate something.
   B: What did she [$_{VP}$ eat *t*]?
   B′: *What did she ~~[$_{VP}$ eat *t*]~~?

It's not about subject/object status, but about originating in the ellipsis site.[1] Subject movement can block ellipsis, too, (3).

(3) *Jo said a certain girl would come but I forget which girl she did ~~[$_{VP}$ say [$_{CP}$ *t* would come]]~~.

Rebinding Not all movements cause problems for ellipsis, only **rebinding** configurations.

(4) Rebinding
A trace in an elided phrase is bound by something outside of the elided phrase.
λx ... [$_{\text{ellipsis site}}$ ... x ...] (Takahashi & Fox 2005)

(5) *Jo ate something but I don't know what she did ~~[$_{VP}$ eat *t*]~~.

Non-rebinding allows ellipsis:

(6) Jo knows who Mary kissed and Mo does ~~[$_{VP}$ know who Mary kissed t]~~, too.

VP-ellipsis vs. sluicing: MaxElide Where VP-ellipsis (VPE) is blocked, sluicing (≈ TP-ellipsis) is still possible, (7).

(7) a. Jo said a certain girl would come but I forget which girl (*she did).
   b. Jo ate something, but I can't remember what (*she did).

This pattern is called a **MaxElide** effect (because older analyses proposed that you always have to delete as much material as possible and that a bigger ellipsis can block a smaller one).

[1] "Object" is to be understood as a shorthand for *element originating in the ellipsis site*; ,"subject" as *element originating outside of the ellipsis site.*

We won't talk much about sluicing anymore. The standard analysis is that sluicing is licensed under different conditions than VPE, so rebinding is not a problem for it (Weir 2014, Barros & Kotek 2018, Griffiths 2019).

Intervening Contrast The rebinding configuration can allow ellipsis again if there is a contrastively focused phrase that intervenes between the launching site of the movement and the landing site (Schuyler 2001, Takahashi & Fox 2005, Griffiths 2019).

(8) a. I know which camel Paul should ride, but I don't know which one you should [$_{VP}$ ~~ride *t*~~].
b. I know which puppies you can adopt but not which ones you should [$_{VP}$ ~~adopt *t*~~]. (Schuyler 2001)

The pattern in embedded clauses according to the literature Subject movement is compatible with VPE (not rebinding):

(9) Someone kissed Susan, but I don't know who did [$_{vP}$ *t* [$_{VP}$ ~~kissed Susan~~]]. (Hartman 2011:375)

Object movement is not compatible with VPE (rebinding), but ameliorated by focus:

(10) a. *Mary was kissing someone, but I don't know who she was [$_{VP}$ ~~kissing *t*~~].
b. I don't know who John will kiss, but I know who Mary will [$_{VP}$ ~~kiss *t*~~]. (Hartman 2011:371)

Adverbial movement is compatible with VPE (potentially not rebinding):

(11) John knows the prisoners escaped, but he doesn't know how they did [$_{VP}$ *t* [$_{VP}$ ~~escape~~]]. (Hartman 2011:372)

The pattern in matrix clauses according to the literature Subject movement is compatible with VPE (not rebinding):

(12) Someone solved the problem. Who did [$_{vP}$ *t* [$_{VP}$ ~~solve the problem~~]]? (Takahashi & Fox 2005:23)

Object movement is incompatible with VPE (rebinding), and **can't** be ameliorated by focus:

(13) a. Mary will eat something. *What will she [$_{VP}$ ~~eat *t*~~]?
b. Mary will kiss Bill. *Who will John [$_{VP}$ ~~kiss *t*~~]? (Hartman 2011:379, 386)

Adverbial movement is now incompatible with VPE, but can be ameliorated by focus:

(14) a. Susan practices yoga. *Where does she [$_{VP}$ ~~practice yoga~~]?
b. Mary woke up at 7am. When did John [$_{VP}$ ~~wake up~~]? (Hartman 2011:378, 385)

(15) Embedded

	no focus	with focus
subject	✓	✓
object	✗	✓
adjunct	✓	✓

(16) Matrix

	no focus	with focus
subject	✓	✓
object	✗	✗
adjunct	✗	✓

Hartman's puzzle

Why can't object movement be ameliorated by focus in matrix clauses, but adjunct movement can be?
Why is there this difference between embedded and matrix contexts for objects and adjuncts? (Hartman 2011, Messick & Thoms 2016)

Preview of the solution

1. There is a confounding factor in the object/matrix examples (contrastive topichood). If controlled for, object movement behaves the same in embedded and matrix clauses: it can be ameliorated by contrast under the right conditions.
2. Adjuncts can be ameliorated by contrast if the conditions for contrast are met. Many ungrammatical cases stem from a general ban on sprouting.
3. Adjuncts in embedded clauses have more possible sources for contrast than in matrix clauses.

2 MaxElide effects in embedded clauses

2.1 Licensing VP-ellipsis

Contrast in VP-ellipsis VP-ellipsis requires a certain balance between **parallelism** and **contrastiveness** between the antecedent constituent and the elliptical domain.

- Antecedent and elliptical domain have to be parallel:

(17) *Some brought roses, and lilies were [$_{VP}$ ~~brought~~] by others. (Merchant 2008:170)

- Newer lines of research suggest that antecedent and elliptical domain can't be too parallel; they have to contrast:

(18) *If John wins, he does [$_{VP}$ ~~win~~]. (Stockwell 2020:78)

- The requirements for contrast and parallelism have been used to explain Max-Elide effects (Griffiths 2019, Stockwell 2020).

Parallelism domain Parallelism and contrast are evaluated for certain constituents called Parallelism Domains (PDs).

(19) Parallelism Domain (Takahashi & Fox 2005, modified)
For ellipsis to be recovered in an ellipsis site E, there must exist a constituent β that reflexively dominates E and that satisfies the parallelism condition (20) This constituent is called the parallelism domain (PD).

- Normally, the PD can be as small as only VP or as big as the entire sentence.
- **Rebinding** has the effect of **limiting the PD** to extend to just below the landing site of wh-movement (Griffiths 2019, stipulation; see Griffiths 2019 and Charlow 2021 for discussion of independent evidence).

Parallelism condition for VP-ellipsis Parallelism and contrast are evaluated based on focus alternatives (Rooth 1992a,b).

(20) For a phrase X to be elided, X must be contained in a parallelism domain E that has an antecedent parallelism domain A such that
a. $[\![A]\!]^o \neq [\![E]\!]^o$, *contrast*
b. $[\![A]\!]^o \in [\![E]\!]^f$, and
c. $[\![E]\!]^o \in [\![A]\!]^f$ *reflexive focus membership*
(adapted from Griffiths 2019:575,590)

2.2 Deriving MaxElide

(21) *They've arrested someone, but I don't know who they did [$_{VP}$ ~~arrest *t*~~]
a. A: someone λy [$_{PD}$ they arrest y]
b. E: who λx [$_{PD}$ they arrest x]
c. $[\![A]\!]^o = \exists$y. they arrest y (∃-clo)
d. $[\![E]\!]^o = \exists$x. they arrest x (∃-clo)
e. ⚠ $[\![A]\!]^o = [\![E]\!]^o$

- Limiting the PD to below the λ-binder forces the variable inside E to be existentially bound. This makes it indistinguishable from the indefinite pronoun in A ⇒ no contrast
- (21) is bad for the same reason that (22) is bad: not enough contrast.

(22) *If John wins, he does.

Influence of focus

(23) I know who John will kiss and also who Mary will [$_{VP}$ ~~kiss *t*~~].
a. A: who λy [$_{PD}$ John will kiss y]
b. E: who λx [$_{PD}$ Mary will kiss x]
c. $[\![A]\!]^o = \exists$y. John kiss y (∃-clo)
d. $[\![E]\!]^o = \exists$x. Mary kiss x (∃-clo)
e. $[\![A]\!]^f$ = {∃y. John kiss y, ∃y. Mary kiss y, ∃y. Susi kiss y,... }
f. $[\![E]\!]^f$ = {∃y. John kiss x, ∃y. Mary kiss x, ∃y. Susi kiss x,... }
g. $[\![A]\!]^o \neq [\![E]\!]^o$ and $[\![A]\!]^o \in [\![E]\!]^f$ and $[\![E]\!]^o \in [\![A]\!]^f$ ⇒ Parallelism condition satisfied, VP-ellipsis can be licensed (Griffiths 2019)

When focus has no effect

(24) *Mary kissed a hipster, but I don't know who John did [$_{VP}$ ~~kiss *t*~~].
(Lasnik & Park 2013)

- Griffiths (2019): problem is the **lack of reflexive focus membership**
- A has the structure of a contrastive topic configuration (i.e., it is an answer to a sister-question of the embedded question: What about Mary? Who did Mary kiss?)
- Focus alternatives for contrastive topic configurations are sets of sets of propositions (Büring 2003, Constant 2014):

(25) $[\![\text{Mary}_{CT}$ kissed a hipster$_F]\!]^f$ = {{ x kissed y | y ∈ D_e}| x ∈ D_e}
{{Mary kissed a hipster, Mary kissed a punk, Mary kissed a rocker,...}
{John kissed a hipster, John kissed a punk, John kissed a rocker,...}}

But the focus value of E is just a set of propositions, as before.
That makes A and E non-focus-alternatives of each other ⇒ VPE can't be licensed.

Summary: MaxElide effects in embedded clauses There are two reasons why VP-ellipsis can fail to be licensed:

- **Not enough contrast**.
This is the case in rebinding without contrastive focus (**She kissed someone, but I don't know who she did*). Rebinding limits the parallelism domain. That makes $[\![A]\!]^o$ and $[\![E]\!]^o$ identical.

- **Not enough parallelism**.
  This is the case in the *hipster*-sentences. Contrastive topichood leads to non-reflexive focus alternatives.

	Embedded	
	no focus	with focus
subject	✓	✓
object	✗	✓/✗
adjunct	✓	✓

3 Matrix clauses: comparing semantic and syntactic parallelism

3.1 Empirical basis

Intervening contrast has no effect in matrix clauses:

(26) Mary kissed someone.
  a. *Who did she [$_{VP}$ ~~kiss *t*~~]?
  b. *Who did John [$_{VP}$ ~~kiss *t*~~]?

Is there anything that makes rebinding possible in matrix clauses?

⇒ Yes: contrastive focus and (descriptively) parallel movement

(27) a. Who did Bill kiss and who did John [$_{VP}$ ~~kiss *t*~~]?
  b. What has he told you? Well, what hasn't he [$_{VP}$ ~~told me *t*~~]?
(Messick & Thoms 2016)

Parallel head movement

- Hartman (2011), Messick & Thoms (2016) argue that the presence of T-to-C movement in matrix questions is relevant for parallelism: if there is a parallel movement dependency in A, VP-ellipsis becomes possible.
- Evidence comes from varieties of English with the opposite movement patterns:

(28) a. *Mary will leave, but I dont know when will she.
  b. A: Mary will leave. B: When she will? *Indian Vernacular English*

- Stockwell (2020) makes a similar claim: According to his judgments, parallel head movement alone can ameliorate adverbial questions:

(29) a. John eats cheese. (Really?) *When does he?
  b. Boy, does John eat cheese! (Really?) When does he? (Stockwell 2020:183)

Problems with the observations about movement 1. Hartman (2011), Messick & Thoms (2016) don't distinguish between head- and wh-movement.

- (27) could be good because of parallel wh-movement, or parallel wh- *and* parallel head movement.
- Extrapolating from Griffiths (2019), we could also imagine that the movement itself isn't the relevant factor, but the creation of an information-structurally parallel antecedent, i.e., another question.

2. We don't know if movement parallelism is really only restricted to matrix contexts.

- Messick & Thoms (2016) argue that parallel movement is needed in matrix clauses, but it looks like it might also be needed for short embedded movement. The baseline data aren't really clear:
- There are suspiciously few minimal pairs and a lot of contradictory judgments.

(30) a. I know who Bill kissed *t* and who John did. (ok for all)
  b. It's clear that they could invite someone, but I don't know who they ever would. (ok for Schuyler 2001:7)
  c. Jan will eat a sandwich, but it's not clear what Marge will. (ok for Schuyler 2001:7)
  d. *Mary kissed a hipster, but I don't know who Bill did. (bad for Lasnik & Park 2013, Griffiths 2019)

Interim summary

- There is reason to believe that movement parallelism plays a role in matrix rebinding (and maybe even embedded rebinding).

⇒ Is parallelism in the antecedent enforced **directly** by a syntactic/LF parallelism constraint (Hartman 2011, Messick & Thoms 2016) or **indirectly** by focus membership calculation (Griffiths 2019)?

3.2 Experiment 1: syntactic vs. non-syntactic parallelism

Hypothesis: Syntactic parallelism is needed in addition to contrastive focus to license VPE in matrix rebinding configurations.
Method, participants:

- acceptability judgment, 1-7 Likert scale
- **2x2**: moved `element (obj, adv)` x presence of syntactic `parallelism` (head movement)
- within-subject Latin square: each participant judged 2 out of 4 lexicalizations, 4 controls (bare movement of OBJ/ADV), 10 fillers from the standard set (Gerbrich et al. 2019), 3 trial items = 19 sentences (median duration: 4:31min)

- 52 participants recruited on Prolific (paid č11,30/hr), questionnaire hosted on SoSciSurvey (Leiner 2025)
- 6 + 11 excluded → **35 entered analysis** (all native English speakers, almost all from Great Britain (England, Scotland, Wales))

(31) *Sample item set*

a. Who did Carl want Lindsay to invite, and also: who didn't he? *obj, parallel*

b. I wonder who Carl wanted Lindsay to invite. And also: who didn't he? *obj, non_parallel*

c. When did Carl want Lindsay to invite her parents, and also: when didn't he? *adv, parallel*

d. I wonder when Carl wanted Lindsay to invite her parents. And also: when didn't he? *adv, non_parallel*

- Long-distance wh-movement to ensure rebinding. Adverbial condition is ambiguous, but the low reading is the more natural one.
- Antecedent = question, with or without head movement
- All test items contained a contrast in polarity.

Exp. 1: predictions

- Under the embedded reading, adverbials and objects should show identical behavior.
- If there is a syntactic parallelism constraint, the `parallel` condition should be significantly better than the `non_parallel` one.
- If syntactic parallelism doesn't matter, all conditions should be equally good.

Experiment 1: results

(32)

ELEMENT	CONTRAST	*n*	*mean z-score*	*sd*	*median z-score*
adv	non_parallel	35	-0.242	0.532	-0.490
adv	parallel	35	-0.116	0.609	-0.24
obj	non_parallel	35	-0.192	0.672	-0.49
obj	parallel	35	-0.0626	0.622	-0.0704

- Equivalence testing: two one-sided *t*-test procedure (independent groups) with TOSTER (Lakens 2017, Caldwell 2022, R Core Team 2021)
- Comparing the `parallel` condition to the `non_parallel` one ⇒ the TOST equivalence test was significant ($t(138) = -2.174$, $p < 0.05$, alpha = 0.05, $\Delta L = -0.35$, $\Delta U = 0.35$).
- The null hypothesis test was not significant ($t(138) = 1.249$).

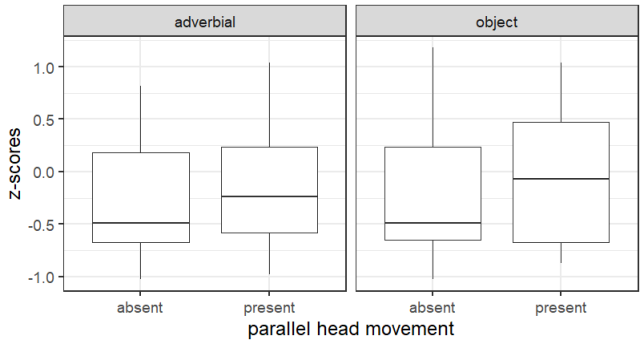

Figure 1: No influence of parallel head movement.

Experiment 1: summary ⇒ The conditions are statistically equivalent.
⇒ Reject the syntactic-parallelism hypothesis.

But: Floor effect?

3.3 Experiment 2: short parallel movements

⇒ Test with matrix object movement which account makes the right predictions.

2x2: `wh-movement` (present/absent) x `head movement` (present/ absent) in the antecedent

- Method same as above.
- 55 participants, 13 excluded → 42 entered analysis (all from UK, majority England)

(33) *Sample test items*

a. A: Who did Carl invite? B: And who didn't he? (+wh,+v)

b. A: I wonder who Carl invited. B: I want to know this: who didn't he? (+wh,-v)

c. A: Did Carl invite someone? B: Well, who didn't he? (-wh,+v)

d. A: Carl invited someone. B: Well, who didn't he? (-wh,-v)

Predictions:

- If syntactic parallelism matters,
  - either the +v conditions (33-a,c) should be significantly better than the -v conditions,

– or only the completely parallel condition should be good (33-a).

- If info-structural parallelism matters, the +wh conditions (33-a,b) should be better than the -wh conditions.

Experiment 2: results

(34)

WH	HEAD	*n*	*mean z-score*	*sd*	*median z-score*
-wh	-v	38	-0.528	0.528	-0.582
-wh	+v	39	-0.459	0.688	-0.556
+wh	-v	37	-0.33	0.738	-0.504
+wh	+v	39	-0.0085	0.811	0.111

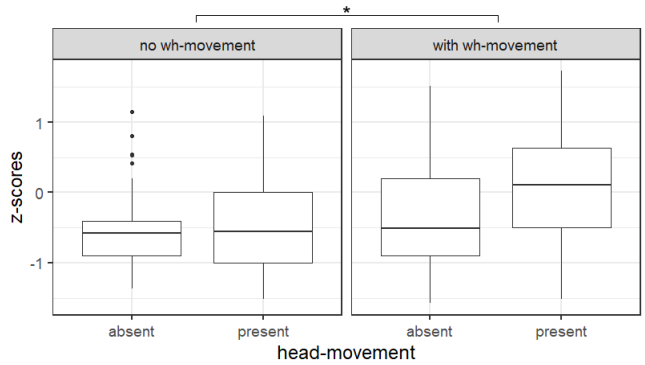

Figure 2: Influence of parallel wh-movement.

- linear mixed effects regression model (with lme4, lmerTest in R; Bates et al. 2015, Kuznetsova et al. 2017): `lmer(value ~ wh + head + (1|participant) + (1|item))`
- Main effect of wh-movement (β for +wh=0.395, std. error=0.1442, df=11.8343, t=2.735, p<0.05)
- Medium effect (Cohen's d=0.555); ≈38 observations: >80% power (Sprouse & Almeida 2017)
- Interaction of wh- and head movement was not significant.

Experiment 2: summary

- Only the condition with a parallel question in the antecedent was significant.
- Contrary to judgments in the literature, this study found no influence of parallel head movement on acceptability.
- The results of both experiments are completely in line with the non-syntactic contrast-based approach in Griffiths (2019): Object extraction + VPE **can** be ameliorated by contrastive focus, if the information-structural environment is right, even in matrix clauses.

⇒ These studies found evidence for the contrast-based approach, against the syntactic parallelism approach.

4 Analysis

4.1 Reframing the puzzle

- It looks like all **rebound elements** (objects, adverbs, subjects) **behave uniformly** in embedded and matrix contexts.
- VPE with them becomes grammatical if (i) there is intervening contrast making A and E contrastive, and (ii) A has a information-structural form such that its focus alternatives can be compared to E's focus alternatives.
- Matrix object movement can be okay if there is a suitable antecedent, similar to the *hipster*-sentences in embedded contexts.

Objects actually show the same pattern in embedded and matrix contexts:

(35) Embedded

	no focus	with focus
subject	✓	✓
object	✗	✓/✗
adjunct	✓	✓

(36) Matrix

	no focus	with focus
subject	✓	✓
object	✗	✓/✗
adjunct	✗	✓

We can plausibly assume that the reason for ✗ is the same in both environments: in-situ indefinite correlates lead to non-parallel focus alternatives, i.e., we can directly extend Griffiths (2019) to matrix clauses (for objects and unambiguously low adverbs).

4.2 Proposal

Adverbials The puzzle then shifts: why are non-rebound (high) adverbs bad in matrix clauses? They should pattern with non-rebound subjects.

(37) a. Someone called Bill. Who did [$_{vP}$ *t* ~~[$_{VP}$ call Bill]~~]?
b. Someone called Bill. *When did they [$_{VP}$ *t* ~~[$_{VP}$ call Bill]~~]?

Proposal: the reason is an independently motivated ban on sprouting in VPE, which also stems from the semantic parallelism condition

No sprouting in VPE Sprouting = ellipsis with remnants whose correlates are implicit. Ok in sluicing, bad in VPE, (38).

(38) a. Jane served dinner, but I don't know to who. *sluicing*
b. *This information was released, but Gorbachev didn't. *VPE*

- Proposal: sprouting is bad because A and E are not contrastive: *someone called Bill* is not sufficiently different from *someone called Bill at time x*.
- no overt correlate → no VPE

Adverbs vs. Objects

- MaxElide effects with adverbials are not as robust as with objects.
- You can find adverbial questions in the wild:

(39) If you haven't watched *Friday Night Lights*, why haven't you?
Grazia UK, 4 March 2025

- This variation is expected if the problem for adverbials is the availability of a contrasting correlate: the easier is it to accommodate one, the more acceptable VPE becomes (see Grant et al. 2012 for this argumentation for voice mismatches).

Adverbials in embedded contexts

- What about the matrix-embedded contrast for adverbials? They seem to be fine without overt correlates in embedded clauses, (40).

(40) The prisoners escaped, but I don't know how they did.

- Proposal: embedded contexts allow apparent sprouting because there is another source for contrast here: VERUM (Stockwell 2022, Hardt & Romero 2004, Romero & Han 2004)
- In non-rebinding, the parallelism domain can be arbitrarily large, i.e., it can include the embedding predicate or the high left periphery.
- Within this PD, there is potential for a contrast in polarity or intensionality, (41).

(41) a. A: [$_{PD}$ VERUM [the prisoners escaped (in manner)]]
b. B: [$_{PD}$ know [the prisoners escaped (in manner)]]

Subjects Where is the contrast in something like (42)?

(42) Someone called Bill. Who did?

- Here, too, the PD can encompass the entire clauses, including the NP-restrictor of the λ-binder.
- This allows a contrast in the denotation of A and E (A being a proposition, E a set of propositions).

Back to Objects: different types of indefinites

- Indefinite pronoun correlates are ungrammatical, (43), but its not clear if this can be explained in Griffiths' (2019) theory.

(43) *John kissed someone. I wonder who Mary did.

- For Griffiths (2019), *John* should be a contrastive topic, and *someone* a focus. This is doubtful: indefinite pronouns can't provide focus alternatives (they're non-chromatic in Postal's 2004 terms):

(44) a. What Edgar bought was *something/ ✓a boat.
b. Even *everyone/ ✓every man spoke Spanish.
c. Only *someone/ ✓some chimp spoke Spanish. (Postal 2004:140)

- But maybe that's enough: they can't provide focus alternatives, but the correlate wh-element can ⇒ mismatch in focus membership ⇒ no VPE licensing

Is CT the right notion?

- It's not clear whether contrastive topic-hood makes the right cut.
- The unambiguously good antecedents (in embedded and matrix clauses) are pretty strictly also *questions*.
- One contrast this analysis can't explain:

(45) a. Mary woke up at 7. When did John? CT, ok
b. *Mary kissed a hipster, but I don't know who John did. CT, bad

- Open data question: do all indefinite NPs behave the same? Do they all fall under the contrastive-topic-problem?

The solution to Hartman's puzzle

Why can't object movement be ameliorated by focus in matrix clauses?

⇒ It can be, with the right information structure in the antecedent.

Why is there this difference between embedded and matrix contexts for objects and adjuncts?

⇒ For objects, new experimental data reveal that the difference might not be real, though indefinites warrant further investigation.
⇒ Adverbs are ambiguous in their attachment height: low (rebinding) adverbs behave just like objects.
⇒ High adverbs require focus-parallelism in their PD. This is only restricted by an independent ban on sprouting.

All in all, a focus-alternatives-based approach can capture a lot of the data.

5 Conclusion

Conclusion Empirical contribution:

- Experiments show that the relevant level for parallelism is information structure, not syntax, even in matrix clauses.
- Experiments also suggest that objects show very similar patterns in matrix and embedded environments, allowing a uniform treatment.

Theoretical contribution:

- The results support a non-syntactic view of parallelism.
- We can extend the focus/contrast-based approach to matrix contexts successfully: objects fall out directly, adverbs need additional, independently motivated assumptions.
- This goes some way towards solving Hartman's puzzle.
- However, given these results, we lose the argument for *syntactic* head movement based on MaxElide effects.

Outlook

- Prev. literature treated all indefinites the same, but they can't be. Next step: a thorough comparison of acceptability between different type of indefinite correlates in matrix and embedded contexts to confirm the conclusions here.
- Some predictions of the analysis have to be checked: do adverbial questions improve with overt correlates?

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