A QUD-based theory of quantifier conjunction with *but*

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Not just any two quantifiers can be conjoined by *but* in the subject position.

(1) a. **No** syntactician but **every** phonologist attended the plenary talk.
b. **No** syntactician but *****no**/??**few** phonologists attended the plenary talk.

Introduction

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> *to use* ***but*** *in this way, it seems necessary or at least preferable to* ***mix increasing and decreasing quantifiers*** *(p. 196)*

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Monotone increasing quantifiers: *every NP, many NP, at least two NP*

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(3) $[\![\text{every(man)(hula)}]\!] \sqsubseteq [\![\text{every(man)(dance)}]\!]$

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Monotone decreasing quantifiers: *no NP*, *few NP*, *at most two NP*

(4) $[\![\text{no(man)(dance)}]\!] \sqsubseteq [\![\text{no(man)(hula)}]\!]$

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Monotone decreasing quantifiers: *no NP, few NP, at most two NP*

(4) $[\![\text{no(man)(dance)}]\!] \sqsubseteq [\![\text{no(man)(hula)}]\!]$

Non-monotone quantifiers: *exactly n NP, an even number of NP*

(5) $[\![\text{exactly.2(man)(dance)}]\!] \not\models [\![\text{exactly.2(man)(hula)}]\!]$

Monotonicity

B&C's monotonicity account explains the judgments in (6):

(6) a. **No syntactician** ($\Downarrow$) but **every phonologist** ($\Uparrow$) attended the keynote.

b. **No syntactician** ($\Downarrow$) but *__no__/??__few phonologists__ ($\Downarrow$) attended the keynote.

Where the monotonicity of the quantifier DPs *differ*, the conjunction is acceptable.

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(8) a. **Few phoneticians** ($\Downarrow$) but **no pragmaticist** ($\Downarrow$) attended the keynote. $\gg\gg$

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Generalization 1: Matching monotonicity is OK for scale-mate quantifiers, so long as the weaker quantifier *precedes* the stronger one.

$$[\![\text{few}]\!] \sqsupseteq [\![\text{no}]\!], [\![\text{many}]\!] \sqsupseteq [\![\text{every}]\!]$$

Problem 2

B&C's mismatching-condition, *is not sufficient* (mismatching monotonicity is judged as not-OK sometimes):

(9) a. **At least two thirds of Democrats** ($\Uparrow$) but **fewer than half of Republicans** ($\Downarrow$) voted for the bill. $\gg\gg$

b. $^{??/*}$**At least a third of Democrats** ($\Uparrow$) but **fewer than half of Republicans** ($\Downarrow$) voted for the bill.

Generalization 2: Differing monotonicity is not OK if the quantifiers overlap in reference.

Monotonicity vs. overlap

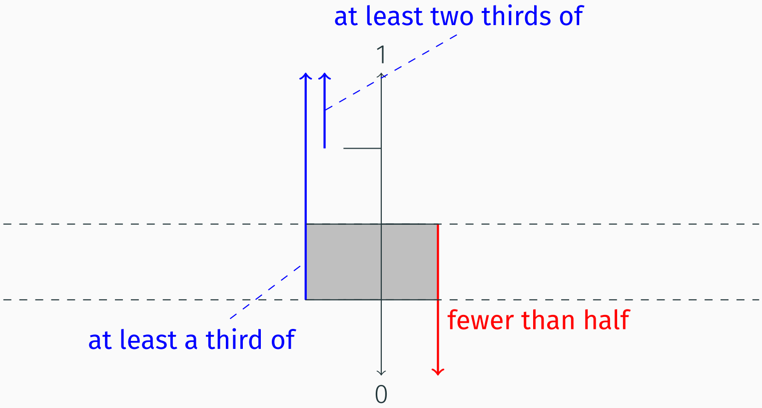

Fig. 1. Overlapping and non-overlapping determiners

Monotonicity vs. overlap

(10) a. **At least 2/3 of Democrats** ($\Uparrow$) but **fewer than half of Republicans** ($\Downarrow$) voted for the bill. $\gg\gg$

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Generalization 2: Differing monotonicity is not OK if the quantifiers overlap in reference.

—*'at least 2/3 of'* and *'fewer than half'* don't overlap, so *but*-conjunction is licensed.

—*'at least 1/3 of'* and *'fewer than half'* overlap on a scale of proportions, so *but*-conjunction is degraded.

The empirical picture

To summarize,

(11) **Generalization 1:** Matching monotonicity is OK for scale-mate quantifiers, so long as the weaker quantifier *precedes* the stronger one.

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Relevant factors

— Ordering of determiners
— Different vs. same monotonicity
— Overlapping vs. non-overlapping reference

Experiment 1: Ordering

Is there an effect from the order of determiners?

- Order matters for scale-mate quantifiers w/ matching monotonicity. Otherwise, order doesn't matter.

(13) a. Many girls ($\Uparrow$) but every boy ($\Uparrow$) skipped class.
b. ??Every girl but many boys skipped class.

(14) a. Every girl ($\Uparrow$) but no boy ($\Downarrow$) skipped class.
b. No girl but every boy skipped class.

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- 2 × 2 factorial design crossing SAME/DIFFMONO & ORDER
- 4 conditions, 18 critical items, Latin square design
- equal number of fillers
- 4 point Likert scale judgment task
- 24 English native speaker participants

Results

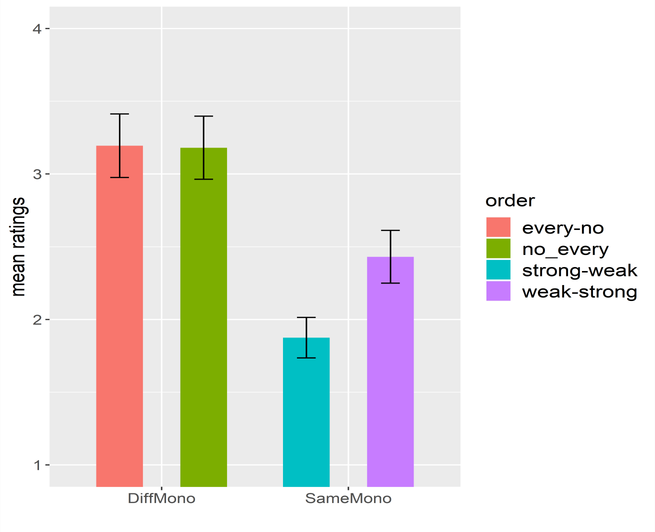

Fig. 2. Results of experiment 1. Error bars represent standard error.

Experiment 2: Overlap vs. Same/diff. monotonicity

Table 1. Experimental stimuli

SameMono?	Overlap?	Example
Yes	Yes	*exactly two X but an even number of Y*
Yes	No	*exactly two X but an odd number of Y*
No	Yes	*at least* 1/3 *of X but fewer than half of Y*
No	No	*at least* 2/3 *of X but fewer than half of Y*

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- 2×2 factorial design crossing SameMono & Overlap
- 4 conditions, 16 critical items ($k = 4$), Latin-square design
- 16 fillers (8 grammatical, 8 ungrammatical)
- 4 point Likert scale judgment task
- 21 English native speaker participants

Results

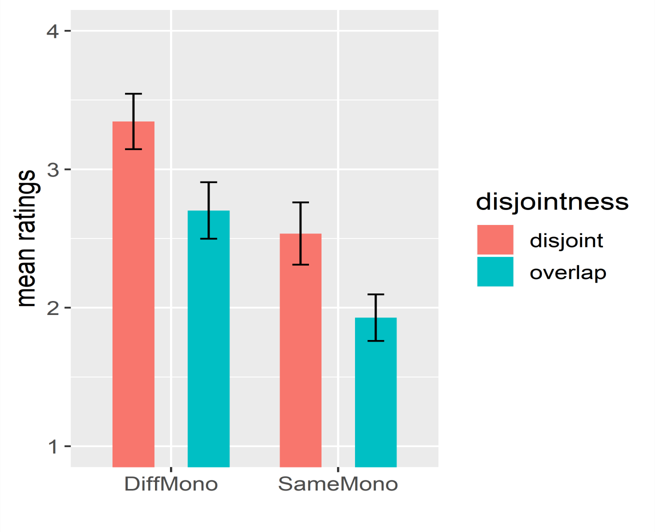

Fig. 3. Results of experiment 2. Error bars represent standard error.

Our experimental results suggest:

A. Conjoining scale-mate determiners (w/ matching monotonicity) is better when weaker Det precedes stronger Det.
   - *many X but every Y* $\ggg$ *every X but many Y*

B. Conjoining non-monotone Qs is better if Dets don't overlap.
   - *exactly 2 X but an odd no. of Y* $\ggg$ *exactly 2 X but an even no. of Y*

C. Conjoining Qs w/ mis-matched monotonicity is better if Dets don't overlap.
   - *at least* 2/3 *of X but fewer than half of Y* $\ggg$ *at least* 1/3 *of X but fewer than half of Y*

Disjointness

Our generalization focuses on the semantic properties of the determiners *sans* NP-description.

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Revised generalization:
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(15) for example, why is *no X but every Y* acceptable?

a. $[\![\textbf{no}]\!] = \{\langle P, Q\rangle : P \neq \emptyset,\ P \cap Q = \emptyset\}$
b. $[\![\textbf{every}]\!] = \{\langle P, Q\rangle : P \neq \emptyset,\ P \subseteq Q\}$
c. *therefore*, $[\![\textbf{every}]\!] \cap [\![\textbf{no}]\!] = \emptyset$

Disjointness

Why is determiner-disjointness relevant to *but*?

(16) Toosarvandani [5] on *but*:
Felicity condition on [S_L *but* S_R]: there is a QUD Q, such that

a. For some sub-question of Q, $\{\sigma, \neg\sigma\}$, $[\![S_L]\!] \models \sigma$.
b. For some sub-question of Q, $\{\tau, \neg\tau\}$, $[\![S_R]\!] \models \neg\tau$.

— The two conjuncts must resolve sub-questions (see Büring [2], Rojas-Esponda [4]) of the current QUD, but with opposite polarity.

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(17) *What kinds of cakes do you sell?*

Do you sell carrot cake? *Do you sell chocolate cake?*

(18) We sell carrot cake **but** we $^{??}$(*don't*) sell chocolate cake.

Disjointness

***but*’s function**: to conjoin two partial resolutions of the current QUD with opposing polarity.

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The contrasting determiners and contrasting descriptions ensure the QUD contains the following polar questions:

(20) $$\left\{\begin{array}{c} \textit{Did every cat skateboard?} \\ \textit{Did no cat skateboard?} \\ \textit{Did every dog skateboard?} \\ \textit{Did no dog skateboard?} \end{array}\right\} \sqsubseteq \text{current QUD}$$

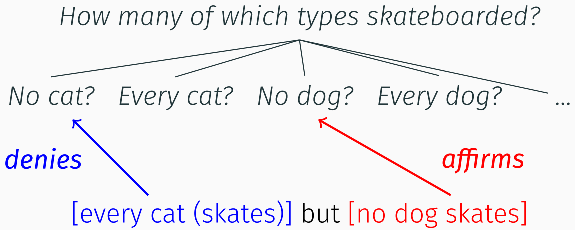
Disjointness

(21) EVERY^{F} cát but NO^{F} dòg skateboarded.

Example (21) signals the current QUD is structured at least partially as below:

— The two conjuncts resolve two sub-questions with opposite polarity answers, as required by *but*.

(22)



Disjointness

Why is there a *disjointness* condition on Dets conjoined by *but*?

(23) **Theorem**: *any pair of Dets with disjoint reference will satisfy the felicity condition of but*

Proof

Let D_α and D_β be *disjoint determiners*

a. For any X, Y, $D_\alpha(X)(Y) \models \neg D_\beta(X)(Y)$ and $D_\beta(X)(Y) \models \neg D_\alpha(X)(Y)$

b. $\therefore$ for any A, B, C, $D_\alpha(A)(C)$ affirms $D_\alpha(A)(C)?$
and $D_\beta(B)(C)$ denies $D_\alpha(B)(C)?$

c. $\therefore$ for any Q such that $D_\alpha(A)(C)?, D_\alpha(B)(C)? \preceq Q$,
"$D_\beta(A)(C)$ *but* $D_\alpha(B)(C)$" is defined

but-conjoining two semantically disjoint determiners ensures that the current QUD is resolved according to *but*'s felicity condition.

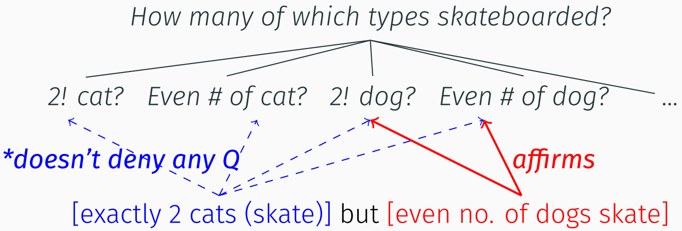
Disjointness

What goes wrong with non-disjoint determiners

(24) #**exactly two** cats but **an even number of** dogs skateboarded

Example (24) doesn't ensure that the QUD is resolved with opposing polarity.

(25)



The felicity condition of *but* fails!

— It is false that one conjunct affirms a sub-question, while the other denies a sub-question.

Ordering effects

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(26) Our working hypothesis:

a. uttered weak scalar items are pragmatically strengthened: *many* $\rightsquigarrow$ *many-&-not-all*, and

b. the LEFT conjunct must **deny** a sub-question, while the RIGHT must **affirm** a sub-question.

(27) a. *many-&-not-all*(X)(Y) negatively resolves Q: *every*(X)(Y)?

b. *every*(X)(Y) affirmatively resolves Q': *many*(X)(Y)?

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This hypothesis assumes weak determiners are strengthened in the utterance, but not within the QUD.

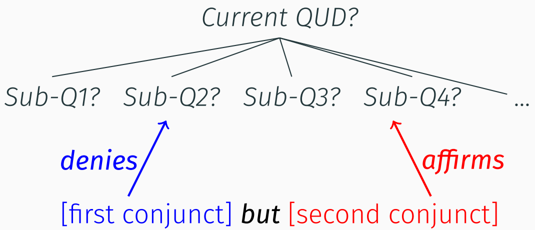
- See Chierchia [3] for the absence of strengthening in interrogative contexts.

Conclusion

The function of ***but***:

- signals the structure of the discourse → "how do we (partially) resolve the current QUD?"
- signals that its conjuncts (partially) resolve the current QUD with opposite polarities.

(28)



- Determiner disjointness yields better empirical coverage than B&C's *monotonicity-based theory* of *but*-conjunction.

Acknowledgements

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References

[1] Jon Barwise and Robin Cooper. Generalized quantifiers and natural language. *Linguistics and Philosophy*, 4(2):159–219, 1981.

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Judgment task Likert scale