An experimental look at the negative implications of exceptives

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1. Introduction

Since Keenan & Stavi (1986), exceptive phrases (EPs) like *but/except Luciano* have been taken to modify generalized quantifiers by subtracting their complements from the 'host' quantifier's domain. Thus, an EP entails a negatively-restricted relative clause (NRR).

(1) a. Every tenor but Luciano attended rehearsal. **EP**
  b. ($\vdash$) Every tenor who is not Luciano attended rehearsal. **NRR**
  $\equiv \forall x \in \textsc{tenor} - \{L\},\ \text{att-reh}(x)$

EPs additionally seem to communicate something about their complement sets, and much of the literature has been devoted to pinning down this content. Moltmann (1995, p.226) famously proposes the following **negative condition** (NC) for EPs:

(2) **Negative Condition.** Applying the predicate of a quantifier to the exceptions yields the opposite truth value from applying the predicate to the non-exceptions.

This produces a straightforward interpretation for (1a). Taking (1b) and (2) together, (1a) entails that the non-exceptions came to rehearsal, and Luciano (the exception) did not. It is less clear, however, how to interpret (1a) when the excepted set does not denote a singleton, but is provided instead by a more complex nominal – for instance, by a definite plural.

(3) Every singer except the tenors attended rehearsal.

Proponents of a strong NC effectively assign (3) a 'biconditional' interpretation, with all non-tenors attending rehearsal and no tenors attending (Moltmann, von Fintel 1993). This is reasonable for (3), but intuitions change when *every* is replaced by *no*. (4) does not seem to require that every tenor sang in key – only that some of them did. This amounts to a 'weak' interpretation of the NC (Hoeksema 1987, 1990, Peters & Westerståhl 2006).

(4) No singer except the tenors sang in key.
No non-tenor singer sang in key, and it's not that case that no tenor sang in key.
= *No non-tenor singer sang in key, and some tenor sang in key.*

Intuitions about exceptive meaning vary even more once we consider EPs with quantified complements, or EPs modifying non-universal quantifiers, (5a)-(5b).[1] Despite this diversity, there has been no systematic empirical study of the negative implications of exceptives.

(5) a. Every singer except at most two tenors attended rehearsal.
b. Most plants but the succulents need to be watered regularly.

This paper addresses one piece of the empirical puzzle. We report on an experiment targeting the negative implications of EPs with definite plural complements. Our results argue against semantically encoding a strong NC, but support a weak version excluding just contexts where the (unexcepted) host quantification holds. We find a graded pattern of acceptance in contexts where a weak NC holds but the strong does not, suggesting that intuitions towards a strong NC reflect pragmatic inferences. Our data also show a sharp divergence in negative implications with the quantifiers *every* and *no*. Our findings mirror results from a study of the exceptive conditional *unless* (Nadathur & Lassiter 2014), and raise questions about why positively- and negatively-quantified statements differ in this way.

2. The negative condition: alternatives and challenges

According to one line of analysis, EPs obey the NC by entailing a **uniqueness** clause (von Fintel 1993) requiring the EP-complement to be the unique smallest exception set to the host quantification. The effect is biconditional, as in (6b).

(6) a. $Q[A]\ \textsc{exceptive}\ C\ P := \underbrace{Q[A-C]P}_{\text{domain subtraction}}\ \&\ \underbrace{\forall S \subseteq A, Q[A-S]P \rightarrow C \subseteq S}_{\text{uniqueness}}$
b. Every singer but the tenors attended rehearsal. = (3)
Every non-tenor attended rehearsal, and any subset of singers whose complement all attended rehearsal must contain the set of tenors.

It is not (usually) possible to define a unique smallest exception set for a quantifier like *most*. As intended, uniqueness thus derives a **quantifier constraint** against *except*- and *but*-EPs co-occurring with non-universal quantifiers (Moltmann, p.227). Corpus examples from Garcia-Alvarez (2008) demonstrate that this constraint is not empirically borne out:

(7) a. Salvias are native to most continents except Australia.
b. Few except visitors will know that Czechoslovakia produces wine.

[1] The literature is divided on (5b)'s acceptability. Von Fintel and Moltmann claim that *except*- and *but*-EPs can only co-occur with universal quantifiers, but Garcia-Alvarez (2008) provides corpus data to the contrary.

One alternative to uniqueness is the **strong negative condition** (Peters & Westerståhl 2006); this allows us to sensibly interpret examples like (7a)-(7b). The strong NC gives (3) a biconditional interpretation, which is logically equivalent to the interpretation in (6).

(8) a. **Strong negative condition:** $Q[A]$ EXCEPTIVE $C\ P := Q[A-C]P\ \&\ Q[A\&C]\neg P$

b. Every singer but the tenors attended rehearsal. = (3)
$\equiv \forall x \in \text{SINGER} - \text{TENOR},\ \text{att-reh}(x)$ *domain subtraction*
$\&\ \forall x \in \text{SINGER} \cap \text{TENOR}, \neg\text{att-reh}(x)$ uniqueness
Every non-tenor attended rehearsal, and every tenor did not attend rehearsal.

However, we find natural examples which would be rendered contradictory by (7).

(9) No one except he and his accountants know [his worth]. He might not even know!

Hoeksema (1987) suggests that some EPs entail a weak version of the NC, requiring only that the host sentence is false. A weak NC derives the intuitive interpretation of (4).

(10) a. **Weak negative condition:** $Q[A]$ EXCEPTIVE $C\ P := Q[A-C]P\ \&\ \neg Q[A]P$

b. No singer except the tenors sang in key. = (4)
$\equiv \neg\exists x \in \text{SINGER} - \text{TENOR},\ \text{in-key}(x)$ *domain subtraction*
$\&\ \neg[\neg\exists x \in \text{SINGER} \cap \text{TENOR},\ \text{in-key}(x)]$ uniqueness
No non-tenor sang in key, and it is not the case that no singer sang in key.

Like uniqueness, the weak NC faces empirical challenges from non-universal host quantifiers. In (11), the strong NC is too strong, but the weak NC produces a peculiar interpretation that is oddly sensitive to the relative cardinalities of the locals and the non-locals.

(11) "[Andy Burt … noted that] few people except locals fish the reservoir … "

a. Strong: ?? *Few non-locals fish the reservoir, and few locals do not.*
b. Weak: ?? … *and it is not the case that few people fish the reservoir.*

We avoid this by replacing $\neg Q[A]P$ in (10a) with $\neg Q[A\&C]P$ (Peters & Westerståhl, p.302ff.).

(12) **Weak negative condition, version 2:**
$Q[A]$ EXCEPTIVE $C\ P := Q[A-C]P\ \&\ \neg Q[A\&C]P$

This change does not affect the interpretation of EPs under *every/no*, but generates a more plausible interpretation for (11): *"… and it's not the case that few locals fish the reservoir"*.

Our aim is to clarify the empirical situation surrounding the negative condition. Apparently conflicting judgments, each appropriate to certain types of examples but not others, have been used to support conflicting accounts. The present investigation is limited to EPs with definite plural complements (*the tenors*), which modify universal quantifiers. Table (13) indicates the predictions made for these EPs by various authors.[2]

(13) *Predictions by author*

Author	**Except/but** (with definite plurals)
Hoeksema (1987, 1990)	$Q[A-C]P$ + strong NC
von Fintel (1993)	$Q[A-C]P$ + uniqueness (strong)
(cf. Gajewski 2008/2013, Hirsch 2016)	
Peters & Westerståhl (2006)	either strong or weak (v.2), per context

3. Parallels with *unless*

Our study is motivated by parallels between EPs and *unless*-clauses. The literature on *unless* describes an intuition that *unless* asymmetrically entails *if not*, leading von Fintel (1992) to propose that *unless* combines the meaning of *if not* with a uniqueness clause.

(14) a. Every tenor attended rehearsal unless he was ill.
b. $\equiv \forall x \in \textsc{tenor}$ - $\textsc{ill}$, att-reh(x) (von Fintel)
$\& \; \forall S \subseteq \textsc{tenor}, \forall x \in \textsc{tenor} - S,$ att-reh$(x) \rightarrow \textsc{ill} \subseteq S$
$\sim$ *Every tenor who was not ill attended, and no tenor who was ill attended.*

Leslie (2009) identifies a mismatch between the interpretation of *unless* under *every* vs. *no*, arguing that *every-unless* conditionals entail a biconditional (equivalent to (14b)), while *no-unless* conditionals intuitively entail only the corresponding *no-if not* statement.

(15) No tenor attended rehearsal unless he was healthy.
$\sim$ *No tenor attended rehearsal if he was not healthy.* (Leslie)

Nadathur & Lassiter (2014) gives experimental evidence against a semantically biconditional *unless*, under *every* as well as *no*. Against Leslie, *no-unless* statements like (15) were reliably judged false in contexts where no tenor (healthy or not) attended rehearsal. Instead, we found an intermediate pattern of judgements in 'mixed' contexts (some but not all healthy tenors attended). This pattern showed a striking interaction with quantifier polarity: *no-unless* was more acceptable in mixed contexts than *every-unless*. In other words, biconditionality was never entailed, but was approximated more closely under *every*.

We interpreted these findings as support for an analysis in which *unless* is assertorically equivalent to *if not*, but encodes a presupposition against across-the-board contexts, where the sentence would have been true without the *unless*-clause. This prohibition parallels version 2 of the weak NC. We argued that the tendency towards a biconditional interpretation is derived pragmatically (from *conditional perfection*, Geis & Zwicky 1971).

[2]For reasons of space, we do not discuss accounts from Moltmann—who encodes a strong NC that handles EPs with quantified complements—and Garcia-Alvarez, who links exceptionality with generalization.

(16) $$Q[C]M \textit{ unless } R \begin{cases} \text{is a presupposition failure if } Q[C \cap R]M\text{; otherwise,} \\ \text{is true if and only if } Q[C-R]M. \end{cases}$$

Unless-clauses are more constrained than EPs, combinatorially speaking, but the parallel between (14)-(15) and universally-quantified exceptive statements is striking. Based on these similarities, we expect exceptive operators to pattern with *unless*; specifically, to show empirical support for a weak NC, revealing intuitions about a strong condition, where appropriate, to follow from pragmatic reasoning.

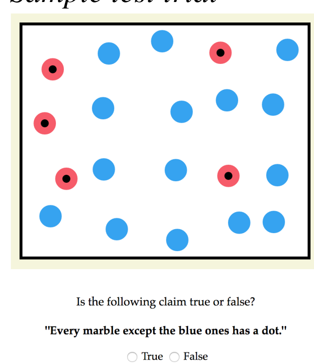
4. Experimental investigation

4.1 Design and method

The experiment is modeled on Nadathur & Lassiter (2014). We used the same displays and methods, but modified the linguistic stimuli to use exceptives instead of *unless*.

Participants were shown a display of 20 red and blue marbles. They were asked to judge a target sentence about the display as true or false (see (17) for a sample test trial). Test stimuli were universal (*every*) or negative universal (*no*) quantifications, modified by an NRR or a clause headed by *other than*, *except*, or *but*. The proportion of target-colour marbles with dots varied randomly from $\{0, 0.2, 0.4, 0.6, 0.8, 1\}$. In total, there were 48 test conditions.

(17) *Sample test trial*



For display variety, the target colour was randomly assigned to red or blue, and the ratio of target:non-target colour marbles varied randomly between {5:15, 10:10, 15:5}. Each test condition could therefore appear in one of 6 equivalent versions. All test conditions were accompanied by a display that satisfied the truth conditions of domain subtraction; we thus were able to target specifically the negative implications of EPs (and *other than*). [3]

(18) *Test stimuli*

a. Every/no marble *that is not [target colour]* has a dot. **NRR**
b. Every/no marble *other than the [target colour] ones* has a dot. **other-than**
c. Every/no marble *except the [target colour] ones* has a dot. **except**
d. Every/no marble *but the [target colour] ones* has a dot. **but**

Filler stimuli comprised conditionals, plain quantified statements, *there*-existentials, and statements with positively-restricted relative clauses (PRRs), and varied with respect to

[3] For the target sentences involving *other than, except,* and *but*, we also randomly varied the position of the EP between a 'high' condition (17) and a low position (e.g., *Every/no marble has a dot except the blue ones.*). The high and low conditions are collapsed in our results, as there was no detectable difference between them.

quantifier (*every, no*) and target colour (*red, blue,* neither). The full experiment can be viewed at `http://web.stanford.edu/~danlass/experiment/exceptives.html`.

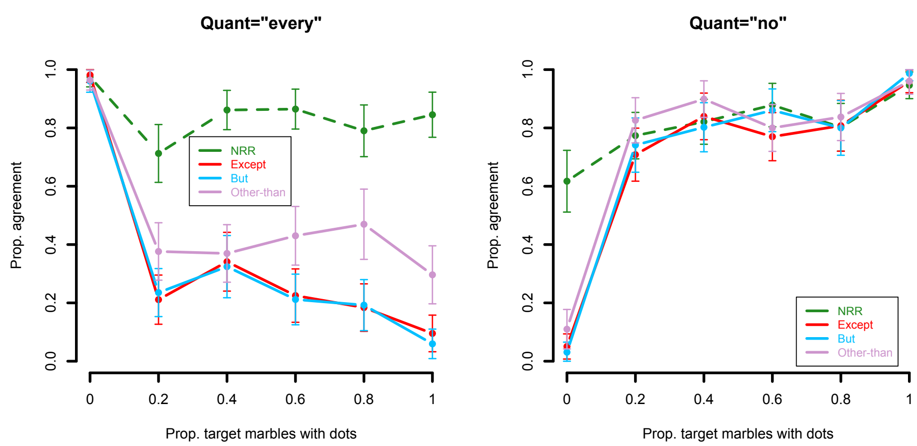
We recruited 180 participants using Amazon's Mechanical Turk platform. All participants were financially compensated. The experiment was viewed in a frame through the MTurk website. Participants were given detailed instructions about the judgement task, accompanied by a sample display with a non-test stimulus. Within the experiment, participants were not able to move from one trial to the next without selecting a response (forced-choice, *true* or *false*). At the end of the experiment, participants were asked to report their native language; they were clearly informed that this would not affect payment.

Each participant saw 48 randomly ordered trials. 24 were test trials; 12 of these were randomly selected from the NRR and *other than* conditions, and the other 12 were randomly selected from the *except* and *but* conditions. The remaining 24 trials were randomly selected from the list of fillers, accompanied by a random display. On average, each of our test items was seen by 88 participants (min: 66, max:112).

4.2 Results

We discarded data from 4 participants who reported a native language other than English. The analysis below includes data from the remaining 176 participants. Our results from both quantifier conditions are shown in (19). Results from NRRs are in green with a dashed line interpolated between points. Results from *other than* are in lavender; *except* is in red, and *but* is in blue, all with solid lines. Error bars are 95% binomial confidence intervals.

(19) *Experimental results, with 95% binomial confidence intervals*



We analyzed each quantifier's data using a linear mixed-effects models with the lme4 package (Bates et al. 2014) in R (R Core Team 2014). For each quantifier, we tested for a main effect of modifier type (NRR, *except*, *but*, *other than*) following the procedure outlined by

Levy (2014).[4] These tests revealed a highly significant main effect of exceptive type for both quantifiers (*every*: $\chi^2 = 250.69$, df=3, $p < 10^{-15}$; *no*: $\chi^2 = 17.431$, df = 3, $p < .001$).

Other than, *except*, and *but* all appear to show a strong Across-the-Board (AtB) effect paralleling our previous findings with *unless*. The AtB effect involves severely degraded acceptability when the sentence would have been true with the exceptive omitted; this occurs at proportion 0 for *no* (no marbles have dots) and at proportion 1 for *every* (every marble has a dot). Also in parallel with our *unless* results, the quantifiers appear to differ in an important way: in the case of *no*, the effect of modifier type seems to be driven entirely by the AtB effect, with no differences at other proportions. To test this hypothesis we re-ran the analyses, removing the AtB proportions for each quantifier to test for a main effect of modifier type without the AtB condition. The results confirmed the hypothesis: without the AtB condition there was no significant main effect of modifier type under *no* ($\chi^2 = 3.2$, df=3, $p = .36$) but a highly significant main effect remained under *every* ($\chi^2 = 178.93$, df=3, $p < 10^{-15}$). This pattern mirrors precisely the effect that we found with *unless* vs. *if not* in Nadathur & Lassiter 2014, with a graded pattern of difference in mixed contexts under *every*, but no difference under *no*.

The results also suggest that *other than* differs from NRRs as well as *except* and *but*—though only under *every*. With AtB conditions excluded, we found a highly significant difference between NRRs and *other than* under *every* ($\chi^2 = 64.318$, df=1, $p = 10^{-15}$), but no significant difference under *no* ($\chi^2 = 2.33$, df=1, $p = .12$). Comparison among *other than* vs. *except* and *but* also showed a main effect of exceptive choice under *every* ($\chi^2 = 36.958$, df=3, $p < 10^{-8}$) and also under *no* ($\chi^2 = 32.81$, df=3, $p < 10^{-7}$).

5. Implications for the Negative Condition

Table (20) shows the predictions of strong vs. weak NCs for $Q[A]$ EXCEPTIVE C P.

(20)

	Strong NC: $Q[A\&C]\neg P$						**Weak NC** (v.2): $\neg Q[A\&C]P$					
	Target dot proportion						Target dot proportion					
	0	0.2	0.4	0.6	0.8	1	0	0.2	0.4	0.6	0.8	1
EVERY	T	F	F	F	F	F	T	T	T	T	T	F
NO	F	F	F	F	F	T	F	T	T	T	T	T

The strong NC predicts EPs to be acceptable only in the two ‘biconditional’ contexts: at target dot proportion 1 under *no* and 0 under *every*. Our data falsify these predictions in both cases. Under *no*, exceptives were accepted as often as NRRs and *other than* phrases in ‘mixed’ contexts (0.2-0.8, where some but not all of the target marbles have dots). Under

[4] Specifically, we coded the proportion of target marbles with dots as a categorical variable, and included random effects of participant, target colour, and red/blue distribution. We included random intercepts only because the maximal models with random slopes did not converge. We then converted the categorical proportion variable to a sum-coded numeric variable, and calculated the likelihood ratio of two models differing only in the inclusion of a fixed main effect of modifier type. Both models included a fixed main effect of proportion and an interaction between proportion and context, as well as random intercepts as noted above.

every, EPs are indeed markedly worse than NRRs in mixed contexts. However, these results do not support a strong NC entailment: acceptance rates in mixed contexts are higher than the categorical rejection observed in AtB contexts and the low acceptance of false fillers.

Both quantifier conditions are compatible with the predictions of a weak NC (v.1 or v.2, which are indistinguishable with *every* and *no*). As the weak NC predicts, acceptance rates for EPs are at floor in AtB contexts. We propose that EPs are semantically true in mixed contexts—thus explaining their greater-than-zero acceptability—but are somewhat pragmatically degraded, leading participants sometimes to reject them. We speculate further about the nature of the pragmatic mechanism below. In any case, our results and analysis are incompatible with a strong NC, and are at least consistent with a weak NC.

6. Further theoretical consequences

We identify five main patterns in our results:

(I) EPs, but not NRRs, are categorically rejected *only* in 'across-the-board' contexts.

(II) Acceptance for both EPs and NRRs is reduced in 'mixed' contexts.

(III) Quantifier choice affects mixed-context acceptance for EPs. *Every*-EPs are not categorically out, but they are worse than *every*-NRRs, as well as mixed-context *no*-EPs.

(IV) *Other than* largely patterns with the exceptives *but* and *except* rather than NRRs, including both the AtB condition and the mixed-context quantifier asymmetry.

(V) *Other than* clauses are sometimes more acceptable in non-ATB contexts than exceptives with *but* and *except*, though only under *every*.

Patterns (I)-(III) replicate earlier findings in comparing *unless* to *if not*. Consequently, we suggest similar conclusions here. (I) indicates that EPs carry an AtB prohibition, such as a weak NC. The experimental data does not allow us to decide whether this prohibition is an entailment or a presupposition. Considering a wider range of data, and in line with our account of *unless*, we suspect that the weak NC arises as a specific reflex of a more general precondition on the use of EPs: an exception set must be saliently 'marked' with respect to the host's predicate. This line of analysis may help to explain the acceptability of examples like (9), where the (strong) exceptionality of the EP-complement is questioned: in such cases, the exceptions would be marked with respect to the speaker's epistemic state.

We hypothesize that pattern (II) has a pragmatic source, related to the tendency for conditionals to be 'perfected' to biconditionals (Geis & Zwicky, von Fintel 2001, Franke 2009). More work would of course be needed to spell out this connection in sufficient detail. However, if this or a similar explanation is viable then the intermediate status in mixed contexts may be explained by an implicature from the choice of an EP or NRR to the falsity of a simpler alternative. Such an implicature can lead to reduced but non-zero acceptability (e.g., Doran et al. 2012).

However, pattern (III) remains unexplained. Recalling that our stimulus EPs had definite plural complements, one explanation suggests itself. There is independent reason to believe that definite plurals can have both universal and existential readings (e.g. Brisson

2003, Malamud 2012). If the definite plurals *the red/blue ones* were interpreted universally under *every* but existentially under *no*, this might help to explain the results. However, this cannot be the full story, since our experiments with *unless* had no definite plurals but uncovered a virtually identical pattern. We suspect that the interaction between quantifier polarity and exceptionality may be better explained in terms of the role of quantified statements as *generalizations* (Garcia-Alvarez 2008). Roughly, the idea is that generalizations with *every* and *no* create different expectations with respect to the scope of the quantifier, causing pragmatic inferences about the exceptions to arise with different frequencies. We must leave the details of this hypothesis for future work.

Patterns (IV) and (V) argue against the received analysis of *other than* phrases as domain subtractors (von Fintel 1993, Moltmann 1995). Hirsch (2016) proposes that *other than* can optionally be interpreted as a (strong) exceptive, licensing a uniqueness inference via grammatical exhaustification mechanisms. This is at least consistent with pattern (IV), but would need to be supplemented with an explanation of the interaction with quantifier polarity and with details of how optionality is converted into actual decisions in language production and comprehension. More broadly, our results show that semantic theories of EPs must account for the intermediate acceptability of some kinds of exceptionality.

7. Conclusions and future directions

Exceptive phrases with definite plural complements give rise to a striking pattern of results that suggests a relatively weak semantics combined with a fairly complex pragmatics. We argued that EPs and NRRs differ in that EPs conventionally encode a ban on use in 'across-the-board' contexts, where the exception set and its complement are indistinguishable with respect to the predicate. We have also suggested that domain subtractors – NRRs and EPs alike – invite pragmatic reasoning about alternatives, which can drive an implicature towards a biconditional (strong exceptional) reading under certain circumstances. This tendency is markedly stronger with positively-quantified EPs. This interaction between quantifiers and the pragmatics of exceptionality is still in need of explanation.

Our study has uncovered some intriguing patterns, but much remains to be done. Several of the patterns that we noted remain are in need of theoretical explanation. Empirically, controlled study of EPs with non-universal quantifiers will be revealing, as will studies that examine ways of extending the negative condition beyond definite plurals in the EP to quantifier phrases (Moltmann 1995, Peters & Westerståhl 2018). A detailed comparison with the interpretation of generics in matched contexts would also be illuminating.

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