On additives' interaction with exhaustivity: the view from negative continuations*

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1. Introduction

One of the main concerns in the literature on additive particles (*too, also*) is why additives are sometimes obligatory, as in discourses like (1).

(1) Q: Who sang?
A: Aisha sang. Ben #(also) sang.

It has been argued that additives are obligatory when they serve to avoid unwanted strengthening (Krifka 1998, Sæbø 2004, Bade 2016, Aravind and Hackl 2017). For Bade (2016), the problematic meaning that would arise without *also* comes from the structure in (2), where both sentences are strengthened through the Exh operator of Chierchia et al. (2012) to contradict the other.

(2) Exh_{ALT} [Aisha$_F$ sang]. Exh_{ALT} [Ben$_F$ sang].

How does *also* interact with each sentence in (2) to make them consistent? Call the sentences S1 and S2, and their Exh operators Exh-S1 and Exh-S2. For S2, I will follow Aravind and Hackl's (2017) idea that S2 does not contradict S1 because *also* scopes below Exh-S2. As such, the focus of this paper will be S1, and how *also* makes it consistent with S2.

For Bade (2016), S1's compatibility with S2 arises from Exh-S1 being removed following the utterance of S2 (3a); for Aravind and Hackl (2017), it comes from the domain of Exh-S1 being restricted (3b).

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(3) a. ~~Exh_{ALT}~~ [Aisha sang]$_1$. Exh_{ALT} [also$_1$ [Ben sang]].
b. $\text{Exh}_{\{\mathsf{sang}(a),\mathsf{sang}(c)\}}$ [Aisha sang]$_1$. $\text{Exh}_{\{\mathsf{sang}(a),\mathsf{sang}(b),\mathsf{sang}(c)\}}$ [also$_1$ [Ben sang]].

On either approach, (3) as a whole means that only Aisha and Ben sang. To evaluate the theories, I therefore turn to *negative* S2s like in (4), where additives are optional.

(4) I drew squares. I did not (also) draw triangles.

There is in fact a subtle difference in meaning depending on the presence of the additive: with *also*, S2 is intuited as informative, while without it, it is intuited as redundant. I will show that this is easily understood if *also* results in the domain of Exh-S1 being restricted, but that problems would arise if we took *also* to result in Exh-S1 being entirely removed.

This paper is organized as follows. In section 2, I provide background on the interaction between additives and Exh, and suggest that S2 does not contradict the plain meaning of S1 due to the relative scope of Exh-S2 and *also*. I also lay out the two competing theories for how the presence of *also* in S2 correlates with S1 not contradicting S2. Then, in section 3, I turn to negative S2s, arguing that they favour the theory that *also* in S2 correlates with domain-restriction of Exh-S1. Finally, section 4 strengthens the argumentation empirically by turning to the domain of colour adjectives. I will also show that monosentential additivity motivates a change to Aravind and Hackl's (2017) approach: domain-restriction does not necessarily arise as a result of the QUD. Section 5 concludes.

2. Using *also* to make S1 and S2 consistent

Bade (2016) argues that additives (*also, too*) are obligatory in discourses like (5a) because unwanted exhaustification (Chierchia et al. 2012) would otherwise arise. Without *also*, each sentence is exhaustified in a way that leads to a contradiction (5b) (where the domain is {Aisha, Ben, Carl}). In (5), Aisha and Ben are focused due to being new material (if the QUD is *Who sang?*) or contrastive topics (if the QUD is *What did Aisha and Ben do?*).

(5) a. Aisha sang. Ben #(also) sang.
b. (i) $[\![\text{Exh}_{\text{ALT}}\ [\text{Aisha}_F\ \text{sang}]]\!] = 1$ iff $\mathsf{sing}(a) \wedge \neg\mathsf{sing}(b) \wedge \neg\mathsf{sing}(c)$.
(ii) $[\![\text{Exh}_{\text{ALT}}\ [\text{Ben}_F\ \text{sang}]]\!] = 1$ iff $\mathsf{sing}(b) \wedge \neg\mathsf{sing}(a) \wedge \neg\mathsf{sing}(c)$.

There are two sides to explaining how *also* avoids the unwanted outcome in (5b). First, we must explain how *also* makes S2 non-contradictory with the plain (non-exhaustified) meaning of S1; S2 does not mean 'only Ben sang.' Second, we must explain why S1 does not contradict the plain meaning of S2; S1 does not mean 'only Aisha sang.' Moreover, we must capture that the discourse (5a) as a whole means that *only* Aisha and Ben sang.

2.1 Why S2 is consistent with the plain meaning of S1: *also* scopes below Exh-S2

We start with the first question: what is *also*'s role in making S2 consistent with the plain meaning of S1? I follow Aravind and Hackl (2017) in assuming that *also* scopes below

Exh, strengthening Exh's prejacent.[1] Additives are anaphoric to previous discourse (Kripke 2009[1990]); Heim (1992) captures this via indexation with the presupposed proposition:

(6) $[\![\text{also}_i]\!]^g = \lambda\,\text{ALT}_{\langle st,t\rangle}.\lambda p.\lambda w : g(i) \in \text{ALT} \wedge g(i)(w) \wedge g(i) \neq p.\ p(w).$

Thus, assuming an assignment function g where $[1 \rightarrow \lambda w.\ \mathsf{sing}(a)(w)]$ (7a), the truth conditions in (7b) hold for S2.

(7) a. [Aisha sang]$_1$. Ben also$_1$ sang.
b. $[\![\text{also}_1\ [\text{Ben}_F\ \text{sang}]]\!]^g$
$= 1$ if $\mathsf{sing}(a) \wedge \mathsf{sing}(b)$, 0 if $\mathsf{sing}(a) \wedge \neg\mathsf{sing}(b)$, # otherwise.

In discourses like (5a), all of (7b), which entails the plain meaning of S1, is exhaustified:[2]

(8) Exh_{ALT} [also$_1$ [Ben$_F$ sang]]

Since Exh's prejacent in (8) entails that both Ben and Aisha sang, Exh does not exclude that Aisha sang. It does exclude that other people (i.e., Carl) sang, accounting for the discourse's inference that only Aisha and Ben sang.

Let's see a bit more formally how this works. The alternatives for Exh in (8) are obtained by replacing *Ben* with focus alternatives. Let's consider both what would happen if the alternatives Exh takes in (8) must include *also*$_1$ (9a), and if *also*$_1$ can be pruned (9b). With the alternatives in (9a), (8) does not exclude that Aisha sang because there is no alternative referring to Aisha. On the other hand, with the alternatives in (9b), while we do have the alternative *Aisha sang*, it it is not excluded by virtue of being entailed by Exh's prejacent. Note that in either case, *Aisha also*$_1$ *sang* is not an alternative due to being semantically ill-formed (*also* requires its antecedent and focus associate to be different).

(9) a. ALT $= \{$Ben also$_1$ sang, Carl also$_1$ sang$\}$
b. ALT $= \{$Ben sang, Aisha sang, Carl sang, Ben also$_1$ sang, Carl also$_1$ sang$\}$

Thus, due to both the entailment of Exh's prejacent and the ill-formedness of *Aisha also*$_1$ *sang*, (8) entails that both Ben and Aisha, but no one else, sang. With *also*$_1$, S2 does not contradict the plain meaning of S1.

2.2 Why S1 is consistent with S2: de-exhaustification, or domain restriction?

The scope of *also* vis-à-vis Exh explains why S2 does not contradict the plain meaning of S1 in (5a)/(10). But why is S1's meaning not contradictory of S2 ('only Aisha sang')?

(10) Aisha sang. Ben also sang.

[1] In fact, my discussion differs slightly from Aravind and Hackl's. I use trivalent semantics to explain how *also* strengthens Exh's prejacent, rather than stipulating that *also* both presupposes *and asserts* its antecedent.

[2] See Krifka 1992 for discussion of two focus-sensitive operators co-occurring, much like in (8).

For Bade (2016), Exh is entirely removed from S1, as a post-hoc effect arising upon the utterance of S2. Call this *(post-hoc) de-exhaustification*.

(11) Exh_{ALT} [Aisha sang]. $\xrightarrow[\textit{post-hoc de-exhaustification}]{}$ Aisha sang.

For Aravind and Hackl (2017), S1 is always exhaustified; all sentences answer some QUD and all answers are exhaustified. Rather, S1 does not contradict S2 because Ben is not included in the alternatives for S1; the domain of Exh-S1 is restricted.

(12) a. $\text{Exh}_{\text{ALT-S1}}$ [Aisha_F sang]$_1$. $\text{Exh}_{\text{ALT-S2}}$ [also_1 [Ben_F sang]].
b. (i) ALT-S1 = {Aisha sang, Carl sang}
(ii) ALT-S2 = {Aisha sang, Carl sang, Ben sang}

Aravind and Hackl's (2017) theory raises the question of why *also* is necessary in S2; couldn't the domain of Exh-S2 be pruned to just {Ben sang, Carl sang}, in which case *also* would not be necessary to avoid excluding the alternative *Aisha sang*? Perhaps this is impossible simply because the speaker has already mentioned Aisha at this point. While Ben can be pruned from S1 (the speaker is putting Ben aside at that point in the discourse), by S2, Aisha has just been discussed and cannot immediately be pruned without some overt restriction like in (13).

(13) Aisha sang. Other than Aisha, Ben sang.

With the data at hand, it is not clear how to evaluate these proposals; they both capture that the discourse as a whole entails that only Aisha and Ben sang. The fact that Carl did not sing comes only from S2 for Bade (2016), but from both S1 and S2 for Aravind and Hackl (2017). I now turn to new data favouring the the domain-restriction approach.

3. Negated S2s as evidence for domain restriction in S1

In this section, I show that the meaning of negated S2s constitutes evidence for the domain-restriction account of S1's compatibility with S2. The argumentation has two steps. The first is to find an independent way to remove Exh-S2, in order to study Exh-S1 without the complicating factor of inferences that come from Exh-S2; sentential negation does exactly this. The second step is to observe that negated S2s can take *also* in addition to their negation. As it turns out, the presence of *also* in the non-exhaustified S2 affects whether S2 is intuited as redundant or informative in the discourse. On the surface, this can be captured as long as the addition of *also* in a negated S2 ensures that the positive S1 does not entail the negative S2, which the de-exhaustification and domain-restriction theories can both accomplish. But on the de-exhaustification account, there would be no Exh at all in the discourse: none in S1 due to post-hoc de-exhaustification by *also*, and none in S2 due to it being negative. This would fail to capture that the discourse as a whole is still intuited as exhaustive. The domain-restriction account is therefore preferable.

3.1 Our starting point: negation removes Exh

For data like (10), both theories under investigation predict that the discourse means that only Aisha and Ben sang; but they predict it due to different parts of the discourse. The inference that Carl did not sing only arises in S2 for the de-exhaustification account, while it arises in both S1 and S2 on the domain-restriction account. In this section, we begin teasing apart these theories by pointing out that there is an independent way to remove Exh-S2, ensuring that any exhaustive inference must come from Exh-S1.

This mechanism is sentential negation, which results in there being no Exh at all on S2:

(14) Aisha sang. Ben didn't sing.

S2 in (14) has neither an Exh above negation (15) nor below (16), both of which would yield unattested meanings. Both meanings are consistent with S1, but (15) is too strong, and (16) is too weak (it does not entail that Ben didn't sing).

(15) $[\![\text{Exh}_{\text{ALT}}\ [\text{not}\ [\text{Ben}_F\ \text{sang}]]]\!] = 1$ iff $\neg\mathsf{sing}(b) \wedge \neg\neg\mathsf{sing}(a) \wedge \neg\neg\mathsf{sing}(c)$.
$\equiv \neg\mathsf{sing}(b) \wedge \mathsf{sing}(a) \wedge \mathsf{sing}(c)$.
$\approx$ everyone sang except Ben.

(16) $[\![\text{not}\ [\text{Exh}_{\text{ALT}}\ [\text{Ben}_F\ \text{sang}]]]\!] = 1$ iff $\neg[\mathsf{sing}(b) \wedge \neg\mathsf{sing}(a) \wedge \neg\mathsf{sing}(c)]$.
$\approx$ it is not the case that only Ben sang.

Going forward, we will use negated S2s to ensure that there is no Exh on S2, thereby studying S1 and its Exh in a controlled environment. Concretely, if we find a discourse with a negative S2 that has the inference that Carl did not sing, this must come from S1, not S2. For instance, in (14), there such an inference, and it must stem from Exh-S1:

(17) $[\![\text{Exh}_{\text{ALT}}\ [\text{Aisha}_F\ \text{sang}]]\!] = 1$ iff $\mathsf{sing}(a) \wedge \neg\mathsf{sing}(b) \wedge \neg\mathsf{sing}(c)$.

But this does not tell us anything about the two theories under investigation. Indeed, Bade (2016) only postulates post-hoc de-exhaustification in the presence of an additive in S2. As for Aravind and Hackl (2017), they might suggest that (17) would not exclude that Ben sang (contrary to my exposition), but they would still take it to exclude that Carl sang. Both accounts therefore expect an exhaustive inference from S1 in (14). With this in mind, we now turn to what happens when S2 is given an additive in addition to negation.

3.2 Domain restriction in S1

When S2 is negated, the meaning of discourses like (14) changes according to whether there is an additive in addition to the negation:

(18) Q: Among Aisha, Ben, and Carl, who did you talk to today?
A: (i) I talked to Aisha. I didn't talk to Ben. (S2 is *redundant*)

(ii) I talked to Aisha. I didn't also talk to Ben. (S2 is *informative*)

Indeed, *also* affects whether S2 is intuited as redundant (18i) or informative (18ii). The effect is clearer in (19) (inspired by Douglas Lebo, p.c.) or examples involving pragmatic expectations of 'uniqueness' of some sort (20), but I will focus on (18).[3]

(19) Q: Which shapes did you end up deciding to draw?
A: (i) I drew squares. I didn't draw triangles. (S2 is *redundant*)
(ii) I drew squares. I didn't also draw triangles. (S2 is *informative*)

(20) a. Carl married Aisha. He did not marry Ben. (S2 is *redundant*)
b. Carl married Aisha. He did not also marry Ben. (S2 is *informative*)

This contrast is curious: what exactly is *also* contributing to create this difference in meaning? In section 2.1, I analyzed *also*'s contribution as simply being the addition of an entailment below Exh-S2. But the negated S2s in (18) have no Exh for *also* to scope below.

Rather, the presence of *also* must correlate with something happening in S1. Naively, the difference in whether a sentence is intuited as redundant or informative at a point in discourse should arise from whether that sentence is entailed by the prior discourse. For (18), it must be that *also* is affecting whether S2 is entailed by S1.

In which way, then, does *also* affect S1: by removing Exh-S1, or restricting the domain of Exh-S1? Let's first consider the de-exhaustification theory:

(21) Exh_{ALT} [I talked to Aisha$_F$]. $\overrightarrow{\textit{post-hoc de-exhaustification}}$ I talked to Aisha$_F$.

On this view, both S1 and S2 in (18ii) are non-exhaustified, due to *also* and negation, respectively. But this misses something important: the discourse means that the speaker only talked to Aisha. Not only did they not talk to Ben, they also did not talk to Carl. The inference that they did not talk to Carl cannot come from S2, which has no Exh. Hence, S1 must be strengthened to mean that the speaker talked to no one other than Aisha or Ben.

At the same time, S1 in (18ii) cannot entail that the speaker did not talk to Ben. If it did, S2 would be entailed and therefore redundant; there would be no difference in intuition between (18i) and (18ii). Hence, S1 in (18ii) must be strengthened enough to mean that the speaker did not talk to Carl, but not so much as to mean that they did not talk to Ben. This can be achieved by pruning the domain of Exh-S1:

(22) a. Exh_{ALT} [I talked to Aisha$_F$].
b. $\text{ALT} = \{\text{I talked to Aisha, I talked to Carl}\}$

[3]The effect is very weak in (14) itself (i), and not all speakers report a contrast.

(i) a. Aisha sang. Ben didn't sing.
b. Aisha sang. Ben didn't also sing.

I do not presently have an explanation for what leads to the relative strength of the reported contrasts.

c. $[\![(22a)]\!] = 1$ iff $\mathsf{talk}(s,a) \wedge \neg\mathsf{talk}(s,c)$.

The truth conditions in (22c) entail that the speaker only talked to Aisha and possibly Ben. With S2 entailing that they did not talk to Ben, the discourse ends up meaning that they only talked to Aisha, as desired; and given that S1 makes no entailment about Ben, S2 in (18ii) is intuited as informative rather than redundant, as desired.

To be clear, the theories under discussion deal with how *also* interacts with S1 from a *positive* S2. Strictly speaking, they do not make predictions for how *also* should interact with S1 from a *negative* S2. Yet, if the long-distance interaction between *also* and S1 is best modelled through domain restriction when S2 is negative, the simplest hypothesis for positive S2s is that the interaction is of the same kind.

4. A stronger contrast: colour terms and tautologous vs. contingent statements

We have just seen evidence that S1s do not contradict S2s in the presence of *also* due to Exh-S1 being domain-restricted. In this last section, I turn to a different way to observe what is underlyingly the same effect as in (18). Indeed, some speakers find the judgment in (18) weak (although I think it is significantly clearer in (19) and (20)). I therefore turn to a different empirical domain, with the intent of solidifying the empirical description given in section 3.2. Specifically, the new data will involve colour terms and additivity effects that occur clause-internally rather than across sentences. I first motivate that the meaning of colour terms involves exhaustivity in section 4.1, then show that Exh interacts with negation and additives in the expected way in section 4.2.

4.1 Colour terms' universality as an exhaustivity effect

In basic sentences (23), colour terms are interpreted as true of all parts of their argument.

(23) The flag is green.
$\approx$ the flag is entirely green

Following Harnish (1976) and Levinson (1983), I have argued (Paillé 2020, 2021) that this is the result of strengthening. On this view, colour terms are lexically weak:

(24) $[\![\text{green}]\!] = \lambda x.\ \exists y[y \sqsubseteq x \wedge \mathsf{green}(y)]$.

Motivation for colour terms' lexical weakness comes from sentences like (25). Predicate conjunctions with an atomic subject are always intersective (Winter 2001, Paillé 2021), so the fact that (25a) is consistent shows that the lexical meaning of the colour terms cannot be universal. Likewise, the universal interpretation of colour terms disappears with *also* (25b); this would be unexpected if colour terms were lexically strong (i.e., mutually exclusive).

(25) a. The flag is green and white.
b. (i) A: The flag is white.

B: Yes, but it's #(also) green.
(ii) The white flag is #(also) green.

To simplify,[4] the idea is that (23) has the structure and meaning in (26):[5]

(26) $[\![\text{Exh}_{\text{ALT}}\ [\text{the flag is green}]]\!] = 1$ iff $\mathsf{green}_{\exists}(f) \wedge \neg\mathsf{white}_{\exists}(f) \wedge \neg\mathsf{red}_{\exists}(f)$.

Given that all parts of the flag must have a colour, if the flag is at least partially green and not partially of any other colour, it must be entirely green. The exhaustivity effect interacts with *also* in the expected way (25b), and disappears entirely with sentential negation, which simply negates the plain existential meaning (27). This patterns just like the exhaustivity effect observed with focused individuals (discussed in section 3.1).

(27) The flag is not green.
$\approx$ the flag is not green at all

4.2 Domain restriction in A1

To see that the exhaustivity effect with colour terms supports the domain-restriction account of how *also* interacts with antecedents, let's zero-in on monoclausal examples like (28). *Also* in these examples is meant to be interpreted as taking its antecedent clause-internally: here, *also* refers back to *white*, not to other prior material. Terminologically, the question is not how *also* interacts with 'S1' and 'S2,' but how it interacts with 'A1' and 'A2.'

(28) The white_{A1} flag is #(also) green_{A2}.

In parallel with the discussion in section 3, what concerns us is how *white* becomes non-contradictory of *green* in the presence of *also*.[6]

As mentioned in footnote 4, under the view that additives are obligatory when an unwanted exhaustivity effect would arise without them, examples like (28) require a stipulation that Exh must be local to colour terms (see Paillé 2020, 2021). Without *also*, I assume that (28) has the form and meaning in (29), where Exh is either type-flexible or the colour adjectives come with covert variables turning them into propositions of the form *x is white*.

(29) $[\![\text{The } [\text{Exh}_{\text{ALT}}\ \text{white}]\ \text{flag is } [\text{Exh}_{\text{ALT}}\ \text{green}]]\!]$
$= 1$ iff the (white & not green & not red) flag is (green & not white & not red).
$\Rightarrow$ contradiction

[4](26) is a simplification because in fact, I argue in Paillé 2020 and 2021 that the Exh associated with colour terms must always be syntactically local to them. Among other things, if Exh could scope anywhere syntactically, we would not expect (25bii) to require *also*. Exh could simply scope at the top of the sentence, so that its prejacent would entail both that the flag has a white part and that it has a green part.

[5]For simplicity of presentation, pretend the only colours are green, white, and red.

[6]For the purposes of this paper, I will assume that *green* becomes non-contradictory of *white* due to *also* scoping below the Exh operator associated with *green*, in parallel with the discussion in section 2.1.

Now recall that colour terms in predicative position are not exhaustified under negation (27), much like S2s in the bisentential discourses with focused individuals (section 3.1).

(30) not [the [Exh_{ALT} white] flag is green]

(30) is tautologous due to Exh-A1 excluding *green*. But what happens when *also* is added to this sentence? Since there is no Exh-A2, any exhaustivity inferences must be shouldered by Exh-A1. It turns out the same pattern as in (18) emerges, but sharper. The addition of *also* goes so far as to make a tautologous sentence (31a) contingent (31b).

(31) a. The white flag is not green. (*tautologous*)
b. The white flag is not also green. (*contingent*)

Once again, let's compare how the de-exhaustification hypothesis (32a) and the domain-restriction hypothesis (32b) fare in light of the pattern in (31).

(32) a. The [~~Exh_{ALT}~~ white] flag is not also green. (*de-exhaustification*)
b. The [$\text{Exh}_{\{\text{white, red}\}}$ white] flag is not also green. (*domain restriction*)

The crucial observation is that (31b), just like (31a), is intuited as meaning that the flag is entirely white. This is captured under (32b) but not (32a). (32a) has no Exh at all, and therefore does not strengthen the existential meaning of either colour term.

Beyond empirical clarity, the monoclausal data also suggest a change to Aravind and Hackl's (2017) analysis. These authors argue that the domain of Exh-S1 is a proper subset of the domain of Exh-S2 because S1 answers a QUD with a smaller domain than the QUD of S2. Yet, constituents of single clauses cannot answer different QUDs. Thus, something other than the QUD must restrict the domain of Exh-A1/S1 (e.g., the additive itself).

5. Conclusion

What is the nature of the long-distance effect that *also* has on a preceding sentence? Bade (2016) claims Exh is removed from S1; Aravind and Hackl (2017) claim that the domain of Exh-S1 is restricted. These claims make the same empirical prediction for positive discourses like (33), assuming exhaustification of S2.

(33) Aisha sang. Ben #(also) sang.

While work on the interaction between additive particles and exhaustivity focuses on obligatory additive effects (Krifka 1998, Sæbø 2004, Bade 2016, Aravind and Hackl 2017), I suggested that a case of *optional* additivity can help tease apart these theories. Indeed, discourses with a negative S2 optionally take an additive, but its presence comes with a difference in whether S2 is redundant, or contributes something new to the discourse.

(34) I drew squares. I didn't (also) draw triangles.

The inference in (34) that the speaker drew no shape other than squares can only be captured if S1 is exhaustified, with domain-restriction when *also* is present in S2. This disfavours the hypothesis that *also* fully de-exhaustifies S1, at least if *also* has the same kind of effect on S1 regardless of whether it acts from a positive or negative S2.

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