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Degree modifiers and common ground operators: The case of *at all*[*]

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Abstract *At all* is among the most common negative polarity items in English. In this paper, I argue that *at all* has a dual use as a degree modifier and operator on the common ground. I first present an account of degree modifier *at all* based on Chierchia 2013 that captures its status as a minimizer as well as an NPI. I then show that a very similar account can be used for *at all*'s common ground usage, departing from the usual quantification over worlds approach for common ground management. This degree-based account of common ground *at all* captures its status as an NPI and provides a possible shared semantic core between degree modifiers and common ground operators.

Keywords: *at all*, common ground operators, common ground management, discourse, degree modification, polarity phenomena, negative polarity items

1 The NPI *at all* and a distributional puzzle

At all is an English negative polarity item (NPI) with a puzzling distribution. While at first glance *at all* patterns quite like both weak NPIs and minimizers, this paper presents the hypothesis that it in fact has two distinct uses: one as a degree modifier, and the other as a common ground operator.

I argue that, when *at all* modifies gradable predicates and verbs, it is a minimizer degree modifier of gradable predicates like *determined* and *competent*.

(1) I doubt that Emily is *at all* determined.

(2) It's unlikely that the math tutor is *at all* competent.

Intuitively, (1) above means something like: *I doubt that Emily has even a very small amount of determination*. *At all*'s contribution seems to lower the threshold of determination that Emily possesses, which in turn generates a sentence that is particularly emphatic. Here, *at all* acts as a minimizer NPI. Minimizers are NPIs

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that refer to a vary small degree on a scale, but their use in negative or downward entailing (DE) environments leads to an expression that is particularly emphatic (Israel 2001). They include expressions like *remotely*, *give a damn*, and *the least bit*. While *at all* is attested in a wide range of DE environments, like the weak NPIs *any* and *ever*, its distribution also has substantial overlap with that of the minimizer *remotely* (Hoeksema 2012).

If *at all* is indeed acting as a degree modifier of gradable predicates, it should be degraded with non-gradable predicates unless they are coerced into a gradable meaning. Indeed, this seems to be the case. The following examples show that *at all* is odd with the non-gradable adjectives *boiling* and *dead*.

(3) ?I doubt that the water is *at all* boiling.

(4) ?I don't think Emily is *at all* dead.

So far, *at all* looks like a run-of-the-mill degree modifier: acceptable when it modifies gradable predicates and unacceptable when it modifies non-gradable predicates. However, there is a puzzle. While *at all* is odd when it *precedes* a non-gradable predicate, it is perfectly acceptable when it *follows* a non-gradable predicate:

(5) I doubt that the water is boiling *at all*.

(6) I don't think Emily is dead *at all*.

The generalization, then, is that *at all* can either precede or follow gradable predicates, but it can only follow non-gradable predicates. To confirm this distribution, I conducted a corpus study with COCA (Davies 2008). I first generated a list of non-gradable adjectives: *wooden*, *locked*, *hand-made*, *married*, *single*, *dead*, *alive*, *living*, and *vegetarian*. These nine non-gradable adjectives were roughly matched for ngram frequency with a set of nine gradable adjectives: *competent*, *determined*, *hesitant*, *consistent*, *frightened*, *tired*, *happy*, *concerned*, and *ambitious*. For each adjective, I searched COCA for two search strings: one with *at all* preceding the adjective, and the other with *at all* following the adjective. For example, for the adjective *married*, I searched for the strings *at all married* and *married at all*. I then recorded the number of uses of each string. Sentences were included only if the gradable adjective was paired with the verb *to be* (*is*, *was*, *isn't*, *wasn't*, etc.) rather than another verb to control for possible interactions between *at all* and verbs, some of which might be gradable.

For the non-gradable adjectives *wooden*, *locked*, *hand-made*, *single*, and *vegetarian*, there were no results for either search string (with *at all* preceding or following the adjective). Therefore, only the adjectives *married*, *dead*, *alive*, *living*, and *pregnant* were included in the final totals. There were also zero results for the gradable

Non-gradable adjectives		
Adjective	Preceding adjective (*at all dead*)	Following adjective (*dead at all*)
married	0	8
dead	0	21
alive	0	17
living	0	3
pregnant	0	3
Total	0	52
Gradable adjectives		
Adjective	Preceding adjective (*at all tired*)	Following adjective (*tired at all*)
competent	1	0
hesitant	1	2
consistent	4	2
frightened	3	6
tired	3	10
happy	28	33
concerned	71	86
ambitious	0	1
Total	111	140

Table 1 Results of corpus study

adjective *determined*, so this was excluded as well. Table 1 summarizes the corpus study's results.

The results show that while *at all* is quite acceptable either following or preceding gradable predicates, it is only acceptable when it follows non-gradable predicates. Not only were these results significant ($p < 0.00001$ in a Fisher's Exact Test), but they were also quite categorical, with not a single instance of *at all* preceding a non-gradable adjectives for the adjectives in the study.

In this paper, I argue that this distributional puzzle is due to the fact that *at all* has two distinct uses: one as a degree modifier, and the other as a common ground (CG) operator. Degree modifier *at all* modifies gradable predicates and means something like *the least bit*: it suggests that the gradable predicate's property is expressed to an extremely low degree. *At all*'s other use, which I call common ground *at all* or CG *at all*, modifies propositions rather than predicates. Informally, the addition of CG *at all* signals that a proposition that is already in the CG should be removed according to a perspective holder.

Like many accounts of discourse structure, my account is built on assumptions about the common ground outlined in Stalnaker 1978. According to Stalnaker,

the common ground of participants in a conversation involves the common, shared knowledge that the discourse participants assume for the purposes of a conversation. The common ground involves a set of propositions that are, in some sense, taken for granted by the participants in a discourse.

(7) and (8) illustrate *at all*'s common ground usage. In each target sentence, *at all* follows the non-gradable predicate *married*.

(7) Jessica: I wonder when Paul and Sophie got married.
Emily: Actually, Paul and Sophie aren't married *at all*.

(8) Jessica: Emily, are any of our friends married? I know that George and Elise are a couple, and I think Paul and Sophie are a couple too.
Emily: Well, Paul and Sophie aren't married (#*at all*).

In (7), Jessica assumes that the proposition *Paul and Sophie are married* is true and that it is in the common ground. Emily then corrects her assumption. Here, *at all* is perfectly acceptable with the non-gradable predicate *married*. In (8), on the other hand, Jessica has no assumption that Paul and Sophie are married. Instead, she asks Emily a neutral, information-seeking question about which students are married. Here, it is unacceptable for Emily to respond with *at all*.

I argue that *at all* appears to be acceptable with non-gradable predicates in sentences like those above because it does not directly modify these predicates at all. Instead, it modifies entire propositions that may or may not contain non-gradable predicates. Very informally, *at all*'s contribution suggests that these propositions were incorrectly taken for granted in the common ground.

Although CG *at all* modifies propositions, it remains an NPI that must be embedded in a DE environment. It must, therefore, attach below negation or another DE operator. The proposition it picks out is the core affirmative proposition, which must scope under sentential negation, a question, a conditional, or another DE operator. The following example shows where *at all* attaches for sentential negation, as well as its very informal, preliminary semantic contribution.

(9) Paul and Sophie aren't married *at all*.
LF: NEG [[Paul and Sophie are married] *at all*]
Informal contribution of *at all*: *Paul and Sophie are married* was incorrectly taken for granted in the discourse (according to the speaker).

In fact, *at all* is far from the only expression that serves this dual purpose. In English, for example, the expressions *really* and *totally* can both act as modifiers of scalar predicates and as operators on the common ground (Romero & Han 2004; Beltrama 2018). In this paper, I first provide an account of *at all* as a degree modifier, followed by an account of *at all* as a CG operator. In doing so, I explore and incorporate a shared semantic core between degree modifiers and CG operators.

2 *At all* as a degree modifier

If *at all* were not a negative polarity item, its use as a degree modifier could be captured straightforwardly using the Kennedy & McNally 2005 framework for degree modifiers and gradable adjectives. In this section, I provide an account of *at all*'s semantics while temporarily putting aside its status as an NPI, treating it as a polarity-insensitive minimizer and degree modifier. I then build on this polarity-insensitive *at all* to account for its polarity sensitivity.

The following is a (somewhat simplified) denotation for the degree modifier *very* from Kennedy & McNally 2002:

(10) $[[\text{very}]] = \lambda G_{<d,<e,t>>}.\ \lambda x\ .\ \exists d.\ [\text{high}(d) \wedge G(d)(x)]$

In this denotation, *very* first takes a gradable predicate, *G*, of type <d, <e,t>>. It then takes an entity *x*. Kennedy & McNally's lexical entry states that there exists some degree *d* that is high on the scale of degrees. Here, *high* means that, in the current context, the degree is greater than the standard by a large degree. The function then feeds this very high degree *d* to the gradable adjective *G*, allowing *G*'s degree argument to be "set" to a very high value.

A "first-draft" lexical entry for *at all* might be very similar to the lexical entry of *very*, but with a degree that is very low on the scale instead of very high.

(11) $[[\text{(polarity-insensitive) } \textit{at all}]] = \lambda G_{<d,<e,t>>}.\ \lambda x.\ \exists d\ [\text{verylow}(d) \wedge G(d)(x)]$

Defining *at all* as a degree modifier that takes a gradable predicate and sets its degree argument to a very low degree captures *at all*'s status as a minimizer and correctly predicts its meaning in DE environments. To illustrate this, consider the following sentence:

(12) Emily isn't *at all* competent.

I assume that *competent* is a gradable adjective with the following denotation:

(13) $[[\text{competent}]] = \lambda d.\ \lambda x.\ \text{competence}(x) \geq d$

With these pieces in place, the truth conditions for (12) are the following:

(14) $\neg\ \exists d\ [\text{verylow}(d) \wedge \text{competence}(\text{Emily}) \geq d]$

This denotation states that there does not exist a degree *d* such that *d* is very low and Emily's competence is greater than or equal to *d*. In other words, Emily's competence must be lower than even a very low degree on the scale of competence.

However, with this polarity-insensitive denotation for *at all*, nothing prevents *at all* from occurring in upward entailing (UE) environments. We predict, then, that a sentence like the following should be acceptable, when it is in fact quite ungrammatical:

(15) #Emily is *at all* competent.

Under this denotation of *at all*, the truth conditions of a sentence like (15) are quite weak, sating that Emily has at least a very small degree of competence. Still, this meaning is coherent, and the fact that this denotation does not exclude *at all* from UE environments demonstrates that it should be modified.

2.1 Adapting Chierchia's (2013) approach to *at all*

In this section, I use Chierchia (2013)'s framework to account for *at all*'s status as an NPI. With Chierchia's machinery, *at all* will generate a contradiction when it occurs in UE, but not DE, environments. To do this, we need three steps: 1) allow *at all* to set its gradable predicate's degree to one that is extremely low; 2) add an obligatory covert *even* operator that exhaustifies over any alternatives; and 3) add an obligatory set of alternatives that set *at all*'s gradable predicate to higher degrees.

The first step to adapt Chierchia's approach to NPIs to *at all* is to set *at all*'s gradable predicate to an extremely low degree. In the polarity-insensitive version of *at all* given above, this is done arbitrarily. However, Chierchia (2013) offers a much more formal approach to defining this very low degree, and this approach can be adapted to degree modifier *at all*.

Chierchia's account involves the NPI *give a damn*, which sets an individual's degree of caring to d_{min}. D_{min} provides a way to formalize an extremely low degree on the scale of caring. The challenge that *at all* presents is that it can modify any gradable predicate that refers to any scale, not simply caring, so d_{min} must be defined in relation to *at all*'s gradable predicate argument. For *at all*, d_{min} must be parameterized to whatever gradable adjective or verb *at all* modifies.

To account for this, I define a function called MinDegree that takes as its argument any gradable predicate G of type <d, <e,t>> and returns a very small degree:

(16) $\text{MinDegree}_{<<d,<e,t>>,d>} = \lambda G.\ \text{MAX}\ \{d_{minset}\text{: } d_{minset} < \text{MIN}\ (\{d\text{: } \exists w' \in \text{ACC}_w.\ \exists x.\ G(d)(x) \text{ in } w' \wedge \forall d'\ [G(d')(x) \rightarrow d' \leq d]\})\}$

We can show how MinDegree works when it takes a gradable predicate like *competent* as its argument.

(17) $\text{MinDegree}_{<<d,<e,t>>,d>} = \text{MAX}\ \{d_{minset}\text{: } d_{minset} < \text{MIN}\ \mathbf{(\{d:\ \exists w' \in ACC_w.\ \exists x.\ competence(x) \geq d \text{ in } w' \wedge \forall d'\ [competence(x) \geq d' \rightarrow d' \leq d]\})}\}$

In the bolded portion in (17) above, MinDegree generates a set of degrees. This set is composed of degrees *d* that meet two criteria. The first criteria is that for some world *w'* in the set of accessible worlds, for some individual *x*, *x*'s degree of competence in *w'* is greater than or equal to *d*. In other words, there must be some

individual (in any world) who actually expresses a degree of competence *d*. The second criteria is that for all degrees *d'*, if the individual *x*'s competence is *d'*, then *d'* must be less than or equal to *d*. This particular criteria is necessary because, in this system, expressing a predicate to a particular degree *d* entails also expressing it to all lower degrees as well. Without this second criteria, the set of degrees would include not only maximal degrees of competence, but also all other non-maximal degrees of competence that an individual expresses, including extremely small degrees. This criteria means that *d* is the highest degree to which *x*'s competence is expressed, and no smaller degrees are included.

Next, the MinDegree function takes the minimum degree from this set. Informally, this minimum degree is the lowest degree of competence that any individual in any possible world expresses without also expressing higher degrees of competence.

In order to generate an impossibly small degree of competence d_{min}, such that no individual can be competent only to degree d_{min}, we need to pick out a degree that is even smaller than this minimum possible degree. To do this, the function MinDegree then defines a set of degrees d_{minset} such that d_{minset} is lower than the minimum possible degree, underlined in (17) above.

We are now left with a set of degrees that are "impossibly small" degrees of competence: no individual in any world expresses competence to such a low degree without also expressing it to higher degrees. In order for *at all* to set its gradable predicate's degree modifier to one specific degree, however, we need to pick out one unique degree from this set. Any of the degrees in the set would work for this purpose, since all of them are impossibly small. For simplicity, MinDegree selects the maximum degree among the set. This maximum degree returned by MinDegree is d_{min}.

With these pieces in place, the denotation for *at all* can be refined.

(18) [[degree modifier *at all*]] = $\lambda G_{<d,<e,t>>}.\ \lambda x.\ G(d_{min})(x)$
Where d_{min} = MinDegree(G)

With *at all*'s denotation refined to include d_{min}, the second step is to add an obligatory covert *even* operator that must accompany degree modifier *at all*. I assume that this *even* operator attaches high in the structure, scoping above the other material in the sentence. The *even* operator is defined as follows (from Chierchia 2013):

(19) E_{ALT} (p) = $p \wedge \forall q \in ALT\ [p <_{\mu} q]$
where '$p <_{\mu} q$' says that *p* is less likely than *q* with respect to some contextually relevant probability measure μ.

This covert *even* operator states that the original proposition *p* must be true in the first conjunct. The second conjunct states that for all propositions *q* in the set

of alternatives, the original proposition *p* is less likely than *q* with respect to some contextually relevant probability measure.

The *even* operator derives *at all*'s distribution as an NPI in concert with a set of obligatory alternatives. The third step is to define these alternatives so that they generate the correct pattern in UE and DE environments. To do this, *at all*'s alternatives set the degree to which the gradable predicate is expressed to greater than or equal to d_{min}:

(20) [[ALT *at all* G]] = $\{\lambda G_{<d,<e,t>>}.\ \lambda x.\ G(d')(x)\text{: } d' \geq d_{min}\}$

This derives a contradiction in UE environments. In UE environments, all of *at all*'s alternatives will be stronger and less likely than the original proposition. This is because in each alternative, the gradable predicate degree argument is set as greater than or equal to a higher degree than in the original proposition. If a gradable predicate is expressed to a high degree, this entails that it is also expressed to a medium degree, a low degree, an extremely low degree, and so on. Because all of *at all*'s alternatives are less likely than its original proposition in UE environments, the covert *even* operator's requirement is false.

There is, however, a problem here, one that is unique to *at all* as a degree modifier. The problem lies in defining d_{min}, and more specifically, in the fact that d_{min} is parameterized to be the minimum degree for a particular gradable predicate. In order for the alternatives to set a gradable predicate's degree argument to greater than d_{min}, we need to define d_{min}. In order to define d_{min}, we need to know the gradable predicate in question, since the function that derives d_{min} takes this gradable predicate as its argument. The rule that defines the set—$d' \geq d_{min}$—is outside the scope of the gradable predicate argument. Therefore, with this definition, there is no way to use the specific gradable predicate as an argument for d_{min}, and therefore no way to define d_{min} with respect to a particular gradable predicate.

There are two ways to deal with this problem. One is to use something more generic than d_{min}. Instead of d_{min}, *at all*'s alternatives might refer to a more generic degree that is simply characterized as "very low." All of *at all*'s alternatives will set their gradable predicate to degrees that are higher than "very low":

(21) [[ALT *at all*]] = $\{\lambda G_{<d,<e,t>>}.\ \lambda x.\ G(d)(x) : \exists d'\ [\text{very-low}(d') \wedge d \geq d']\}$

In affirmative or UE environments, alternatives in which the gradable predicate's degree is set to higher than *very-low* will all lead to semantically stronger propositions that entail the original. This makes the *even* operator's second conjunct false in all UE environments, generating a contradiction. In DE environments, alternatives in which the gradable predicate's degree is set to higher than d_{min} will all lead to more likely and semantically weaker propositions that are entailed by the original. All of

these alternatives are compatible with the covert *even* operator's requirements, and there is no contradiction.

For the sake of consistency across the original denotation and the alternatives, however, it might be preferable to refer to d_{min} in both. Below, I provide an alternative denotation that achieves this using a syncategorematic rule. This rule defines *at all*'s alternatives for both *at all* and its specific gradable predicate argument. Without the gradable predicate argument, d_{min} cannot be parameterized to that particular gradable predicate's scale.

(22) [[ALT *at all* G]] = {[$\lambda G_{<d,<e,t>>}$. λx. G(d')(x)] : d' $\geq$ d_{min}}(G)
Where d_{min} = MinDegree(G)

In this denotation, d_{min} is defined in the exact same way as described above for *at all*'s original proposition. The only difference is that the alternatives are now defined for *at all* with its gradable predicate, so that the gradable predicate can in turn be an argument in d_{min}.

To put these pieces together, I will show how this account of degree modifier *at all* works with the following sentence:

(23) Emily isn't *at all* competent.
LF: [*(covert) even* [¬ [Emily is [*at all* [competent]]]]]

Assuming the denotation for *competent* in (13), the truth conditions of (23) are the following (excluding the contribution of the covert *even* operator):

(24) ¬ [competence(Emily) $\geq$ d_{min}]
Where d_{min} = MinDegree(G)
Paraphrase: It's not the case that Emily's degree of competence is greater than or equal to d_{min}.

Next, *at all* introduces a set of alternatives. Below, I show what these alternatives look like for the syncategorematic approach; the *very low* version is exactly the same, but with a very low degree instead of d_{min}.

(25) {¬ [competence(Emily) $\geq$ d'] : d' $\geq$ d_{min}}
Where d_{min} = MinDegree(G)

Finally, the covert *even* operator, which sits at the top of the structure, applies to the alternatives. As described earlier, these alternatives will all be semantically weaker than the original proposition, because *at all* occurs in a DE environment. This satisfies *even*'s requirement. However, in affirmative sentences, all of the alternatives are semantically stronger than the original proposition, so the covert *even* operator will always output false—leading to a contradiction.

3 Common ground *at all*

The denotation sketched above for *at all* works only when *at all* is used as a degree modifier of gradable predicates. However, as discussed above, *at all* can also modify entire propositions, and it has a more restricted set of licit syntactic positions when it does so. This version of *at all*, which I'll call CG *at all*, suggests that the proposition it modifies is already in the common ground. The following examples illustrate this version of *at all* with the non-gradable predicate *handmade*.

(26) Emily: Hey, can you tell us about these garden gnomes? Are they handmade?
Shopkeeper: Sure! They're not handmade (#*at all*), but they're still cute.

(27) Emily: I love these garden gnomes. Whoever made them must be talented.
Shopkeeper: Actually, the garden gnomes aren't handmade *at all*. But they're still cute.

In (26), the proposition *They are handmade* is not assumed by Emily, and is not taken for granted in the CG, so *at all* is not acceptable. In (27), on the other hand, Emily does assume that the gnomes are handmade, and so *at all* is now acceptable.

Because this version of *at all* is an NPI and must be embedded under a DE operator, the proposition in question is usually being negated, questioned, or challenged in the sentence overall. The resulting meaning, then, of CG *at all* is that a proposition was incorrectly taken for granted in the conversation's common ground.

3.1 The quantification-over-worlds approach

At all is far from the only degree modifier that has a dual function as a CG operator. Other particles that show a similar dual function include the English *really* (Romero & Han 2004); English *totally* (Beltrama 2018); informal uses of *so* and *one hundred percent*; and French *vraiment*. Despite these crosslinguistic patterns, degree modifiers and CG operators are not usually accounted for in the same way or using similar machinery. Degree modifiers modify the degree arguments of gradable predicates that correspond to scales. CG operators, on the other hand, are not generally accounted for with degrees; instead, they are captured using quantification over worlds in which a discourse participant's goals are met.

In fact, this traditional account can be adapted reasonably well to account for *at all*. Here, I adapt Frana & Rawlins's (2019) account of the Italian particle *mica*, a CG management operator, to fit *at all*.[1] Their account builds on previous work

1 One key difference between *mica* and *at all* is that *mica* itself contributes a negative meaning, while *at all* does not. In Frana & Rawlins's account, *mica* is bundled with sentential negation; its truth conditions negate its proposition. In *at all*'s case, the DE operators that license *at all* provide the

on CG management and both VERUM and FALSUM operators, including Romero & Han 2004, Romero (2015), and Repp (2013).

The presupposition *at all* contributes can be captured with the same presupposition that Frana & Rawlins (2019) provide for *mica*:

(28) $[[at\ all]]_{c,w} = \lambda p.\ p$
Defined for p, c,w only if $\forall w' \in Epi_x(w)$: $(\forall w'' \in Conv_x(w') : (p \notin CG_{w''}))$

Here, $Conv_x(w')$ is the set of worlds in which an attitude holder x's conversational goals are met, and $Epi_x(w)$ is the set of worlds that conform to the attitude holder x's knowledge in w. This discourse condition states that for all worlds *w'* in the set of worlds that conform to an attitude holder x's knowledge in w, for all worlds *w"* in which the attitude holder's conversational goals are met, the proposition p is not in the CG in *w"*.

I assume that in declaratives, x is anchored to the speaker or, in embedded contexts, to the attitude holder. So in a sentence like *The chair isn't handmade at all*, x is anchored to the speaker; in a sentence like *Emily doesn't think that the chair is handmade at all*, x is anchored to Emily.

3.2 Meta-conversational implicature

One important feature of this account of *at all* is that it does not overtly require the proposition *at all* modifies to be in the CG already. Instead, it states that a perspective holder believes that a proposition should not be in the CG. Yet, intuitively, this is a core contribution of *at all*, which cannot be uttered unless the proposition it modifies is taken for granted in a discourse.

As discussed in Romero & Han 2004 and Frana & Rawlins 2019, this discourse requirement need not be derived through an independent presupposition. Instead, it can be derived through discourse requirements for the addition of meta-conversational operators. Because *at all*'s presupposition comments on the attitude holder's ideal common ground, it is meta-conversational: it refers to the unfolding conversation itself. Romero & Han (2004) propose an economy constraint that prevents meta-conversational moves unless they are necessary:

(29) Principle of Economy: Do not use a meta-conversational move unless necessary (to resolve epistemic conflict or to ensure Quality).

Here, quality refers to the Maxim of Quality, which states that an interlocuter should assert a proposition only if she has at least indirect evidence that the proposi-

sentence's "negative" meaning; *at all* does not, by itself, contribute additional negation. Under a Frana & Rawlins-style account, then, *at all*'s truth conditions simply assert its proposition argument, rather than negating it.

tion is true. *At all*'s meta-conversational status means that its use must be justified to resolve an epistemic conflict or to ensure quality, which in turns means that there must be a conflict about whether *at all*'s proposition should be in the CG. Since *at all*'s presupposition indicates that the attitude holder believes that the proposition should *not* be in the CG, the conflict must be derived from the fact that other discourse participants believe the opposite: that the proposition should be in the CG. *At all*, therefore, licenses an inference that the proposition was already in the CG.

3.3 Problems with the traditional account

This denotation for CG *at all* also goes a fairly long way to capture *at all*'s distribution as an NPI. *At all*'s conditions for use require that, according to a perspective holder's conversational goals, the proposition should not be in the CG. In a plain affirmative sentence, this generally leads to a contradiction: the speaker asserts a proposition, which suggests that the proposition should, according to the speaker, be added to the CG, contrary to *at all*'s presupposition.

While the addition of CG *at all* to a run-of-the-mill assertion generally results in a very odd and contradictory meaning, this is not necessarily true for all UE environments. In order for a Frana & Rawlins-style approach to CG *at all* to be adequate, it must predict that CG *at all* should be unacceptable in all contexts that do not license NPIs. The question, then, is whether it is possible to generate a UE sentence and a discourse context that allow for both the asserted content of the sentence and CG-*at all*'s presupposition to be satisfied. The example below attempts to provide such a sentence.

(30) Context: Emily and Sarah are discussing a grandfather clock. Sarah takes it for granted that the clock is a handmade antique.
Sarah: It's so cool that this grandfather clock was handmade!
Emily: Well, it's *possible* that the clock was handmade (#at all). I wouldn't take it for granted...

In (30), the addition of CG *at all* renders the sentence unacceptable. However, under the story for CG *at all* presented above, it's not clear why. *At all*'s presupposition requires that the speaker believes that the proposition *the clock was handmade* should not be in the common ground in an ideal conversation. This presupposition is met, since Emily does not take it for granted that the clock was handmade, and doesn't want the other discourse participants to take it for granted either. *At all*'s meta-conversational implicature should also be met, since the discourse participants take the proposition *the clock was handmade* for granted. Despite this, the sentence *it's possible that the clock was handmade at all* is degraded. The fact that monotonicity plays a key role in the licensing of CG *at all* is also supported by the fact

that the sentence in (30) can be saved simply by changing the UE predicate possible to the DE predicate *unlikely*.

3.4 A scalar approach to common ground management

One way to capture the parallelism between the two *at all*s—and perhaps other dual degree modifiers and CG operators—might be to assume that both derive their NPI distribution in the same way. If modification of the common ground could be described using scales and degrees, like gradable adjectives and degree modifiers, Chierchia's approach to NPIs could then be extended to CG *at all*. Very informally, CG *at all* might mean that the perspective holder has an extremely low degree of commitment that a proposition should be in the common ground. A degree-based approach would require shifting from universal quantification over worlds to degrees on a scale.

There is intuitive support for such an analysis. A number of accounts of CG operators reference degrees, even though their ultimate analysis uses only quantification over worlds. Romero & Han (2004), for example, characterize CG management as a perspective holder's degree of certainty that a proposition should be added to the CG. Beltrama (2018) goes further, discussing the connection between scalar modifiers and CG management (as well as some of the problems with postulating an isomorphism between the two).

The account I sketch out in the following section attempts to formalize what Beltrama (2018) calls a possible shared "semantic kernel" between the lexical and pragmatic uses of items like *at all*. This shared semantic kernel creates a parallelism between degree modifiers and CG operators that might help explain why the two are so often homophonous. However, this account does not suggest that all degree modifiers can or will become CG operators, nor does it prevent CG operators from having restrictions and semantic contributions above and beyond what would be expected from their corresponding degree modifiers. It simply attempts to formalize a shared semantic core between the two.

With this caveat aside, I present an account of common ground *at all* that treats common ground modification as a scalar notion. In this account, a speaker's belief that a proposition should or should not be in the common ground is modeled with degrees on a scale that I call "CG-goodness$_x$."

CG-goodness$_x$ is a scale that corresponds to the extent to which a given proposition being in the common ground is consistent with a perspective holder's conversational goals. It is anchored to x, the perspective holder. If a proposition p has a higher degree of CG-goodness$_x$ than a proposition q, p is more consistent with x's conversational goals than q. If p's degree of CG-goodness$_x$ is higher than q's, the perspective holder x would rather be in a conversation in which everyone

believes *p* but not *q* than in a conversation in which everyone believed *q* but not *p*. A very high degree of CG-goodness$_x$ indicates that a proposition is consistent with *x*'s conversational goals, while a low degree indicates that a proposition is inconsistent.

As in the account for *at all* sketched above, the perspective holder is the speaker in ordinary assertions without attitude predicates. In contexts in which *at all* is embedded under attitude predicates, however, *at all*'s pragmatic contribution is anchored to the attitude holder.

3.5 Polarity-insensitive CG *at all*

Before moving on to the more complex case of NPI *at all*, I'll illustrate how this approach to CG operators could be applied to an imaginary polarity-insensitive *at all*. While the examples I give below all embed this polarity-insensitive *at all* under negation, there is nothing in the semantics so far that prevents it from occurring in UE environments.

Informally, sentences with sentential negation and CG *at all* suggest that the attitude holder does not think that there is the least degree of certainty that a proposition *p* should be in the common ground. To capture this, polarity-insensitive CG-at all's denotation takes a proposition and sets that proposition's degree of CG-goodness to an (arbitrary) very low degree:

(31) [[polarity-insensitive CG *at all*]] = λp. λw. $\exists$d [verylow(d) $\wedge$ CG-goodness$_x$(p) $\geq$ d in w]

This denotation states that there exists some degree *d* such that *d* is very low and the CG-goodness$_x$ of *p* according to *x* is greater than or equal to *d* in *w*. Again, CG-goodness$_x$ is a scale that corresponds to how well x's conversational goals are met given that a particular proposition is in the CG. Like with the traditional account of CG management, this scalar *at all* also generates a meta-conversaional implicature that the proposition in question was taken for granted in the CG: otherwise, a CG management operator would not be licensed due to the Maxim of Quality. The following example shows how this denotation works for a sentence with negation.

(32) Emily: Jane isn't dead *at all*. LF: $\neg$ [[Jane is dead] *at all*]

Truth conditions: $\neg$ [$\exists$d [verylow(d) $\wedge$ CG-goodness$_{Emily}$(Jane is dead) $\geq$ d in w]]

Paraphrase: It is not the case that there exists some degree *d* such that *d* is very low and the degree of CG-goodness of the proposition *Jane is dead* according to Emily is greater than or equal to *d* in w.

Meta-conversational implicature: *Jane is dead* was in the CG.

3.6 Adapting Chierchia's (2013) approach to CG *at all*

This approach to *at all*, however, does not capture *at all*'s status as an NPI. *At all*'s NPI distribution can be captured in the same way as the NPI distribution of degree modifier *at all*: by setting CG-goodness to an impossibly low degree and exhaustifying, in the style of Chierchia 2013.

To account for CG *at all* in a manner that is consistent with degree modifier *at all*, we need to set a minimum degree of "CG-goodness$_x$," which I call d_{CG-min}. This is achieved in virtually the exact same way as it was for degree modifier *at all*. The final denotation for d_{CG-min} is the following:

(33) $\mathrm{d}_{CG-min} = \mathrm{MAX}\{\mathrm{d}_{CG-minset}: \mathrm{d}_{CG-minset} < \mathbf{MIN}\ (\{\mathbf{d}: \exists \mathbf{w'} \in \mathbf{ACC}_w. \exists \mathbf{x}. \exists \mathbf{p}. \mathbf{CG\text{-}goodness}_x(\mathbf{p}) \geq \mathbf{d} \wedge \forall \mathbf{d'}\ [\mathbf{CG\text{-}goodness}_x(\mathbf{p}) \geq \mathbf{d'} \rightarrow \mathbf{d'} \leq \mathbf{d}]\})\}$

In this denotation, we first pick out the set of degrees that correspond to the maximal degrees to which CG-goodness is expressed by any proposition, by any individual, in any accessible world. Then, we pick out the minimum of this set of degrees: the absolute minimum amount of CG-goodness that any proposition could have, according to any individual in any accessible world, without also having higher degrees of CG-goodness. This step is shown in bold above. Finally, the function picks out a degree that is *even lower* than this minimum degree. The highest degree among a set of lower degrees is selected, though any of these lower degrees would work just as well.

Like degree modifier *at all*, CG *at all* also comes with a set of alternatives and an obligatory covert *even* operator. I assume that the *even* operator attaches high in the syntax, scoping over the rest of the sentence. The alternatives for CG *at all* are the following:

(34) $[\![\text{ALT CG } \textit{at all}]\!]_x = \{\lambda \mathrm{p}.\ \lambda \mathrm{w}.\ \text{CG-goodness}_x(\mathrm{p}) \geq \mathrm{d'} \text{ in w: } \mathrm{d'} \geq \mathrm{d}_{CG-min}\}$

In these alternatives, the degree argument of CG-goodness is set to degrees higher than d_{CG-min}. Just as in the case of degree modifier *at all*, these alternatives in concert with the covert *even* operator lead to a contradiction in UE environments. The covert *even* operator requires the proposition with *at all* to be less likely than its alternatives. In DE sentences, all of the alternatives are entailed by the original sentence: if it is not the case that a proposition's CG-goodness is set to less than the minimum possible degree, this entails that it's not the case that the proposition's CG-goodness is set to any higher degrees. In affirmative sentences, however, there is a problem. In affirmative environments, the original sentence is in fact entailed by all of the alternatives, which are stronger and less likely. The covert *even* operator's second conjunct is never satisfied, generating a contradiction.

3.7 Embedded environments and attachment ambiguity

In the following section, I will show how this account of CG *at all* can be applied to a sentence in which *at all*'s attachment is ambiguous. CG *at all*, as an NPI, must attach below negation. At the same time, it takes a propositional argument, attaching at the vP level. When a sentence contains multiple vPs, CG *at all* may modify either one, provided that both occur in a DE environment. For example, the following sentence contains two vPs, both of which are in a DE environment:

(35) Jane doesn't think that Emily is dead *at all*.
LF: NEG [Jane thinks that [Emily is dead]]

(35) is ambiguous with respect to *at all*'s attachment. *At all* may attach to the lower, embedded proposition, *Emily is dead*, which occurs entirely within the DE environment created by sentential negation in the matrix clause. However, *at all* may also attach to the matrix clause vP, which includes the proposition *Jane thinks that Emily is dead*. This proposition also falls within the DE environment created by the matrix clause's sentential negation. Depending on where *at all* attaches, different meanings are generated. Importantly, *at all* is anchored to the attitude holder within the scope of an attitude verb, and to the speaker otherwise. (36) shows the LF and truth conditions for *at all*'s lower attachment at the level of the embedded proposition, for which *at all* is anchored to the attitude holder *Jane*.

(36) LF: Covert-*even* [NEG [Jane thinks that [[Emily is dead] *at all*]]]
Truth conditions (excluding *even*'s contribution): ¬ Jane thinks that [CG-goodness$_{Jane}$(Emily is dead) $\geq$ d$_{CG-min}$ in w]
Paraphrase: It's not the case that Jane thinks that the proposition *Emily is dead* being in the CG meets her (Jane's) conversational goals to the least degree.

(37) shows the LF and truth conditions for *at all*'s higher attachment at the matrix proposition. Here, *at all* is anchored to the speaker, since its higher attachment means that it is no longer within the scope of an attitude verb:

(37) LF: [Covert-*even* [NEG [[Jane thinks that that Emily is dead] *at all*]]]
Truth conditions (excluding *even*'s contribution): ¬ [CG-goodness-function$_{the-speaker}$(Jane thinks that Emily is dead) $\geq$ d$_{CG-min}$ in w]
Paraphrase: It's not the case that the proposition *Jane thinks that Emily is dead* being in the CG meets the speaker's conversational goals to the least degree.

In (36) above, with lower attachment, *at all*'s contribution suggests that Jane, the attitude holder, does not believe that *Emily is dead* should be in the CG. In (37),

at all attaches to the proposition in the matrix clause, *I think that Emily is dead*, below sentential negation. Its contribution suggests that the attitude holder—this time the speaker—does not believe that the entire proposition *I think that Emily is dead* should be in the common ground. The disputed addition to the common ground is now about the speaker's beliefs, not about Emily's death. From the English speakers I have consulted, this ambiguity is a correct prediction.

3.8 *At all* in questions

In questions, I assume that *at all*'s perspective holder, *x*, is anchored not to the speaker but rather to the listener or interlocutor. Consider the following example:

(38) Emily, to Jane: Is this fish dead *at all*?
LF: [+Q [this fish is dead] [at all]]

Here, CG-goodness within *at all*'s denotation will be anchored to Jane, not to Emily. Substituting the proposition this *fish is dead* for *p*, and adding Jane as the attitude holder, derives the following:

(39) [[CG-at all]]([[this fish is dead]])(w) = CG-goodness$_{Jane}$(this fish is dead) $\geq$ d$_{CG-min}$ in w

The end result will be a question in which Emily asks Jane whether Jane has even the least degree of comfort with the proposition *this fish is dead* being in the common ground. As always, *at all*'s meta-conversational status generates an inference that the proposition *this fish is dead* was already taken for granted.

3.9 Presuppositional vs. at-issue content

One key feature of the account sketched above is that *at all* modifies truth conditions rather than introducing a presupposition. The fact that *at all* modifies truth conditions is not simply an ancillary component to the account, but rather a core assumption. This is because the denotation for *at all* is designed to work within sentences that include DE operators like negation. In order for CG *at all* to yield correct truth conditions, it must interact with the sentence's DE operator. If, on the other hand, *at all* contributed a presupposition, as in the Frana & Rawlins style account, we would not expect its contribution to interact with DE operators in the way that it does.

The assumption that *at all* modifies truth conditions, however, is one that has potentially worrisome consequences. Propositions modified by *at all* no longer directly assert truth conditions; rather, they assert that, according to a speaker or perspective holder, there is an extremely low degree of confidence for adding the content of the proposition to the common ground.

One possible way to remedy this problem might be to change the denotation for CG *at all* to add disjunction, asserting the proposition *p* **or** the truth conditions related to *p*'s status in the common ground:

(40) [[Revised CG *at all*]] = λp. λw. $p \vee \text{CG-goodness}_x(\text{p}) \geq \text{d}_{CG-min}$ in w

Under negation, the proposition modified by *at all* must be false (according to the attitude holder) and the attitude holder must believe that the proposition should not be in the CG in order for the sentence as a whole to be true. This revised denotation is also not without problems, though I leave this discussion for future work.

4 Conclusion and open questions

A number of open questions remain that are beyond the scope of this paper. I have not elaborated on how, precisely, CG *at all*'s perspective holder is anchored to the speaker or attitude holder in embedded clauses. There are also a few remaining puzzles related to CG *at all*'s distribution. For example, it is not licensed in the restrictors of universal and negative quantifiers, even though such environments are DE. CG *at all* is also licensed with the negative quantifier *no* (e.g., *no one*), but not with other DE quantifiers like *few*. This suggests that it may require a split scope account of *no one*, attaching between *no* and a proposition. Finally, *at all* can also occur with free choice *any*, as in *I will eat any ice cream at all*, a rather limited usage that is not captured by either degree modifier or common ground *at all*.

All in all, I hope to have shown that a scalar version of common ground management may be a viable way to both account for *at all*'s status as an NPI and to capture a parallelism between common ground management operators and degree modifiers within and across languages. This account can be extended to other common ground management operators, especially ones that have a dual usage as degree modifiers. For example, *really* can be accounted for by setting CG-goodness to a high, rather than low, degree. A degree-based semantics for common ground management may help account for the tendency of degree modifiers to be used as CG operators both diachronically and synchronically.

References

Beltrama, Andrea. 2018. *Totally* between subjectivity and discourse: Exploring the pragmatic side of intensification. *Journal of Semantics* 35(2). 219–261. doi:https://doi.org/10.1093/semant/ffx021.

Chierchia, Gennaro. 2013. *Logic in grammar: Polarity, free choice, and intervention*. Oxford, United Kingdom: Oxford University Press.

Davies, Mark. 2008. The Corpus of Contemporary American English (COCA): One billion words, 1990-2019. Available online at https://www.english-corpora.org/coca/.

Frana, Ilaria & Kyle Rawlins. 2019. Attitudes in discourse: Italian polar questions and the particle *mica*. *Semantics and Pragmatics* 12(16). 1–48. doi:http://dx.doi.org/10.3765/sp.12.16.

Hoeksema, Jack. 2012. On the natural history of negative polarity items. *Linguistic Analysis* 38(1-2). 3–34.

Israel, Michael. 2001. Minimizers, maximizers and the rhetoric of scalar reasoning. *Journal of Semantics* 18(4). 297–331. doi:https://doi.org/10.1093/jos/18.4.297.

Kennedy, Christopher & Louise McNally. 2002. Scale structure and the semantic typology of gradable predicates. Unpublished manuscript.

Kennedy, Christopher & Louise McNally. 2005. Scale structure and the semantic typology of gradable predicates. *Language* 81(2). 345–381. doi:https://doi.org/10.1353/lan.2005.0071.

Repp, Sophie. 2013. Common ground management: modal particles, illocutionary negation and VERUM. In *Beyond expressives – explorations in use-conditional meaning*, vol. 28 Current Research in the Semantics / Pragmatics Interface, 231–275. Leiden: Brill. doi:https://doi.org/10.1163/9789004183988_008.

Romero, Maribel. 2015. High negation in subjunctive conditionals and polar questions. In *Sinn Und Bedeutung*, vol. 19, 499–516. doi:https://doi.org/10.18148/sub/2015.v19i0.247.

Romero, Maribel & Chung-Hye Han. 2004. On negative *yes/no* questions. *Linguistics and Philosophy* 27. 609–658. doi:https://doi.org/10.1023/B:LING.0000033850.15705.94.

Stalnaker, Robert. 1978. Assertion. In Peter Cole (ed.), *Pragmatics*, vol. 9, 315–333. New York: New York Academic Press. doi:http://dx.doi.org/10.1163/9789004368873_013.

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