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Polarity, questions, and the scalar properties of *even*

Abstract

This paper discusses the behavior of three lexically distinct Greek expressions which appear to be the counterparts of English *even*: *akomi ke*, *oute*, and *esto*. The behavior of these three expressions is examined in positive and negative sentences, and it is demonstrated that they all are polarity sensitive. The distributional constraints of the three *even*-items, crucially, are shown to follow from their distinct scalar associations. In particular, the low-scalar likelihood of positive *even* (*akomi ke*) remains problematic with negation as well as affirmation, a fact supporting the polarity approach to *even* and the lexical ambiguity that is associated with it. In further support of this conclusion, negative bias in questions is shown to arise not with negative polarity *oute* (which is ungrammatical in questions) or positive *akomi ke* (which is fine but creates no bias), but with *esto*— a low scalar item defined on a context-dependent scale. This finding strengthens Kay's 1990 and Horn's 1989 observation that likelihood alone is not sufficient for capturing the scalar properties of *even*.

1. Background: English *even* and its Greek counterparts

The status of English *even* has been under debate since Karttunen and Peters 1979 (henceforth K&P). The problem is that *even* has distinct presuppositions in positive and negative sentences (K&P 1979, Rooth 1985, Horn 1989, Kay 1990). To solve this problem, K&P posit scope ambiguity with respect to negation; Rooth 1985, however, argues that the ambiguity is lexical: *even* has a negative polarity (NPI) incarnation which is licensed in the scope of negation (see also Horn 1989: 148-150 for further criticism of K&P).

To illustrate, in a positive sentence, *even* makes the following contribution:

(1) The Dean invited **even** Bill.

(2) i. $x\,[x \neq \text{Bill} \quad C(x) \quad \text{invited (Dean, x)}]$, and

ii. $x[x \neq \text{Bill} \rightarrow \text{likelihood (Dean inviting x)} > \text{likelihood (Dean inviting B.)}]$

The sentence asserts that the Dean invited Bill. As a focus particle, *even* introduces a set of alternatives that the context makes salient (C(x); a condition that I will henceforth drop in the notation but obviously continue assuming), and a scalar presupposition: that the value of *even*, i.e. the value indicated by the *even* phrase, is the least likely alternative, i.e., it is the lowest, or

near-lowest ranked element of a scale (Horn 1989, Kay 1990), which, according to K&P, is one of likelihood. Likelihood should be understood as a Horn possibility scale.

With negation the presupposition changes. Instead of invited individuals, a negative sentence with *even* makes us think of individuals that the Dean did *not* invite; and Bill appears to no longer be the (near-)least likely person, but the (near-)most likely one:

(3) The Dean didn't invite even Bill.

(4) i. $x\ [x \neq \text{Bill} \quad \neg\ (\text{Dean invited } x)]$

ii. $x\ [x \neq \text{Bill}$ likelihood (Dean inviting Bill) > likelihood (Dean inviting x)]

Rooth (1985) proposed precisely this presupposition with negation; as a consequence, *even* is lexically ambiguous between a meaning with the presupposition in (2), and a negative polarity (NPI) incarnation with the presupposition in (4). Rooth's lexical meaning for NPI-*even* as a propositional operator with the presupposition just described is given below:

(5) Presupposition of NPI even (Rooth 1985)

a $p\ [C(p) \quad \text{not}\ (\ p) \quad p \neq \mathbf{a}]$, where **a** = assertion

b $p\ [[\ C\ (p) \quad p \neq \mathbf{a}] \rightarrow$ likelihood (**a**) > likelihood (p)]

= the proposition created by the **even**-phrase is **the most likely** alternative

To avoid positing a lexical ambiguity, K&P and Wilkinson 1996 proposed instead that the ambiguity is scopal: *even* cannot be in the scope of negation, but must raise above it. In this analysis, the presupposition of non-NPI *even* looks identical to that of NPI-*even*:

(6) i. $x\ [x \neq \text{Bill} \quad \neg$ invited (Dean, x)]

ii. $x[x \neq \text{Bill} \rightarrow$ likelihood (D. not inviting x)> likelihood (D. not inviting B.)]

But there is a cost here too: We stipulate covert movement of *even* above negation which can be shown to be problematic in many ways, and for which there is no actual empirical evidence (for extended discussion see Rullmann 1997, Heim and Lahiri 2002, and Giannakidou 2004). For one thing, the movement rule is posited specifically for *even* (as opposed to other focus particles that are not subject to it); and it must be covert as well as obligatory. In essence, the stipulation that *even* must move above negation renders it a positive polarity item (PPI), an obvious retreat from the unitary analysis of *even*.

Greek provides empirical support for the polarity hypothesis. As we see below, there are three items that may be translated into English as *even*, only one of which can occur unproblematically in positive sentences:

(7)	a	I Maria efaje	**akomi ke**	to pagoto.	(positive EVEN)
		the Maria ate	even	the ice cream.	
	b	*I Maria efaje	**oute**	to pagoto.	(NPI-EVEN)
		the Maria ate	even	the ice cream	
	c	?#I Maria efaje	**esto**	to pagoto.	(flexible scale EVEN)
		the Maria ate	even	the ice cream	

(I use EVEN to refer to the item crosslinguistically). The expressions *oute* and *esto* resist positive sentences; they are both PIs in this sense (though there is a clear difference in status between the two, as we see, discussed in detail in Giannakidou 2004; I use '?#' to indicate systematic deviance which is stronger that mere oddity, but still weaker than ungrammaticality). With negation, *oute* becomes good while *esto* remains bad; *akomi ke*, the positive EVEN, becomes unacceptable[1]:

(8)	a	?#I Maria dhen efaje	**akomi ke**	to pagoto.	(positive EVEN)
		the Maria didn't eat	even	the ice cream.	
	b	I Maria dhen efaje	**oute (kan)**	to pagoto.	(NPI-EVEN)
		the Maria didn't eat	even	the ice cream	
	c	?#I Maria dhen efaje	**esto**	to pagoto.	(flexible scale EVEN)
		the Maria didn't eat	even	the ice cream	

Oute, as we see, can optionally occur with the particle *kan*. Comparing *oute (kan)* and *esto, oute (kan)* is an NPI proper because it improves with negation. Comparable items are Dutch *eens*, German *mal* (Kurschner 1983: 121), and Spanish *ni*. *Akomi ke*, on the other hand, behaves like a PPI.

Esto looks like a curious PI—bad in both positive and negative sentences, while improving in polarity environments that are not negative, but nonveridical (Giannakidou 1998, 1999): e.g. questions, imperatives, protasis of conditionals, and with modal verbs. NPI *oute (kan)* is ungrammatical, as expected, without a negative licenser:

[1] The Greek data discussed in this paper were checked with a total of 14 native speakers of Greek, including myself, using an extensive questionnaire. I wish to thank my informants for their relatively uniform judgments. Most interestingly, some speakers actually starred instances of negation and *esto* like the ones I discuss here; however, all of the informants found them generally unacceptable.

(9) a Efajes **esto** to pagoto?
Did you eat even (=at least) the ice-cream?
b *Efajes **oute (kan)** to pagoto?
Did you eat even the ice-cream?

(10) a Fae **esto** to pagoto.
Eat even (=at least) the ice-cream.
b *Fae **oute (kan)** to pagoto.
Eat even the ice-cream.

Notice that *esto* receives a reading paraphrasable by *at least* that we revisit later, unlike *even* which always retains an additive meaning. Finally, mere downward entailment is not sufficient for licensing:

(11) ***To poli pende** pedhia efagan {**oute (kan)/esto**} to pagoto.
(?)?At most five children ate even the ice-cream

The above data give crosslinguistic support for an extension of the polarity hypothesis, in line with related observations in the literature for Dutch (Rullmann 1997, Hoeksema and Rullmann 2001) and German (von Stechow 1991; Kurschner 1983; Heim and Lahiri 2002); I will not compare the data here; but see the references above for details. The relevant notion for the description of polarity environments including negation seems to be nonveridicality (Giannakidou 1998, 1999, 2001), and not DE since DE cannot license NPI or flexible EVEN.

The fact that we find EVEN items (*akomi ke* and *esto*) that remain bad with negation is hard to reconcile with the scope theory. The observed variation seems particularly problematic for proposals like Lahiri's (1998), which employs an account of Hindi EVEN-containing PIs by using a single low likelihood EVEN. The evidence for NPI-EVEN removes much of the strength of the enterprise, as Lahiri himself acknowledges (Lahiri 1998: 85); and the fact that unambiguously low scalar EVENs are bad with negation *and* affirmation, as well as with the caradinality predicate *one* as we shall see later, adds considerably to the problem.

In the rest of the paper, I will try to explain why bottom-of-scale EVENs are incompatible with negation. We will see that the explanation follows easily from the lexical approach I am pursuing. First, we take a look at the distinction between PPI and NPI- EVEN in sections 2 and 3. Greek *akomi ke* is shown to be an unambiguous PPI-EVEN which indeed raises above negation. *Oute,* on the other hand, exhibits the typical behavior of an NPI. In section 4 we discuss the item identified here as flexible scale *even*— *esto.* This item is incompatible with both negation and affirmation because of a clash between an expectation of a stronger statement that is created by its use, and the weak assertion that results from using a low

value. Finally, in section 5 the difference is discussed between *esto* and *akomi ke* in questions. We see that our analysis correctly predicts negative bias with low value on a variable scale only, thus undermining approaches that seek to explain negative bias by appealing to a low-likelihood *even.*

2. Evidence for a wide scope EVEN: *akomi ke*

In a positive sentence, Greek uses *akomi* (or *akoma*) *ke* lit. 'still/yet and', for *even*:

(12) O Janis dhiavase **akomi ke** tis iposimiosis.
John read even the endnotes.

(*Akomi ke* attaches to various constituents, e.g. NPs, DPs, PPs, and others, but I will ignore this here; also note that *ke*, lit. the conjunction 'and', is obligatory, in accordance with crosslinguistic observations; cf. the use of German *auch*, Dutch *ook*, etc. in the formation of the respective EVEN items). The sentences above have presuppositions that are in all respects equivalent to those of the English sentence (1):

(13) x [x ≠ **endnotes** read (John, x)], and
x [x ≠ **endnotes** → likelihood (J. reading x) > likelihood (J. reading the endnotes)]

We can then adopt K&P's analysis of *even* for *akomi ke*:

(14) [[**akomi ke** (x) (P)]] = 1 iff P(x)= 1; (assertion)
y [y ≠ x P(y)]
y[y ≠ x → likelihood (P(y)) > likelihood (P (x))] (presupposition)

With negation, *akomi ke* appears odd; and fronting doesn't seem to give a better result:

(15) a ?# O Janis **dhen** dhiavase **akomi ke** tis iposimiosis.
John not read.3sg even the endnotes
?#John didn't even read the endnotes.
b # **Akomi ke** tis iposimiosis **dhen** dhiavase o Janis.
#Not even the endnotes did John read.

Notice also the oddity of the English examples. Why should this be so? The endnotes are, after all, the least likely thing to read, hence the low scalar presupposition should be OK in the scope of negation: the sentence should simply say that John did not read the least likely item. It must

be, then, that this bottom of the scale conjunct, namely that the footnotes are the least likely things to read, is problematic with negation. This will turn out to be a manifestation of a more generalized conflict that reappears later with *esto*.

If, on the other hand, we move *akomi ke* above negation, the endnotes would be made the least likely thing *not* to read (thus the most likely things to read). This, of course, is not true in a normal context, hence the oddity of the overt scoping above negation in (15b). Notice that this oddity can indeed be fixed in examples like the following:

(16) **Akoma ke ti valitsa mou** dhen prolava na ftiakso.
even the suticase my not had-time.1sg to make
Not even my suitcase did I have time to pack.

Here *akomi ke* appears overtly above negation, following the pattern of other PPIs which typically have this property, e.g. *some* as in *Some students, I don't like (them) at all.* The presupposition is that, in preparation for a trip, my suitcase is the least likely thing not to have time to prepare, consistent with world facts. The Greek item, then, appears to be a positive EVEN with a low-likelihood presupposition that can indeed scope above negation, at least locally. But there is a strong tendency for this scoping to be overt; notice that the good sentence above becomes worse if we leave *akomi ke* in situ:

(17) ?#Dhen prolava na ftiakso **akoma ke ti valitsa mou**.
not had-time.1sg to make even the suticase
I didn't even have time to pack my suitcase.

This sentence has been systematically judged as deviant by my informants. The pattern seems to be that an item which *must* scope above negation, must do so overtly. This, obviously, contrasts with *even*, as we see.

Before moving on, it is important to note the following. First, it is not the case that *akomi ke* is always problematic in the scope of negation, as the following example shows:

(18) Den tou anagnorisan **akoma ke ta pio stihiodhi dhikeomata**.
not him recognized even the most basic rights
They didn't grant him even the most basic rights.

In this sentence, the most basic rights are the least likely things not to grant to an individual, in accordance with the wide scope *even* analysis. Again, this fact further supports the PPI analysis of *akomi ke*—notice the parallel with *some*: *John didn't talk to some students*, where *some students* appears in the surface scope of negation but scopes above it at LF. And the fact that the

sentence lacks the narrow scope reading supports our earlier observation that the narrow scope reading is somehow problematic with negation.

Second, *akomi ke* is really worse with non-local negation through an indicative tensed complement; overt fronting of *akomi ke* is also impossible.

(19) a ??/* O Janis dhen ipe oti o pritanis kalese akomi ke tin katharistria.
?John didn't say that the Dean invited even the cleaning lady.
b * [Akomi ke tin katharistria]$_i$ o Janis dhen ipe oti o pritanis kalese t_i.
?? [Even the cleaning lady]$_i$ John didn't say that the Dean invited t_i.

In (19a) *akomi ke* is found in an indicative complement and is judged as pretty bad[2]; the corresponding English sentence, however, is judged better by native English speakers. This fact suggests that covert movement of PPI EVEN above negation respects the tense boundary and is not unconstrained, as the scope theory would allow. *Even* does seem to be different in this respect, though its overt movement is still prohibited, as we see in (19b). The impossibility of overt preposing in (19b) thus suggests that both *akomi ke* and *even* cannot raise overtly long distance above negation.

Finally, there are instances of *akomi ke* which are unacceptable even in positive sentences. These are cases where *akomi* focuses on the cardinality predicate *one*:

(20) ?#Akomi ke ENAS fititis irthe.
??Even ONE student arrived.

The unacceptability extends to English, as we see, and must be due to the fact that *one* is the most likely and not the least likely cardinality. Note crucially that the incompatibility of positive EVEN with *one* persists with negation:

(21) a ?#Akomi ke ENAS fititis dhen irthe.
?Even ONE student didn't arrive.
b Oute ENAS fititis dhen irthe.
Not even one student arrived.

(22) a # n [n ≠ **one** n students arrived] n [n ≠ **one** →
likelihood (n students arriving) > likelihood (one student arriving)]

[2] *Akomi ke* is fine, however, in subjunctive *na* complements which lack tense and are the Greek equivalents to restructuring and infinitival domains (because Greek lacks infinitives); see Giannakidou 2004 for more details.

b # n [n ≠ **one** it is not the case that n students arrived] n [n ≠ **one** →
likelihood (n students not arriving) > likelihood (one student not arriving)]

The low scalar presupposition remains problematic with negation as well as affirmation, as we see. It is in fact more likely to see, or not to see, one student than to see (or not to see) more than one, because *one* is the weakest cardinality, i.e. entailed by every other numeral. Hence it makes no difference whether we have negation of affirmation: *akomi ke ena* will be odd in either case. Instead, we see that the NPI *oute* must be used. This suggests that we still need NPI-EVEN to explain these cases, and questions the viability of Lahiri's (1998) enterprise by appealing to a single low likelihood EVEN.

To sum up, we saw in this section that Greek provides evidence for a PPI EVEN, *akomi ke.* This item must indeed scope above negation locally, which explains its PPI-status; and it prefers to do so overtly. If *akomi ke* cannot move above negation, the sentence becomes problematic (either deviant, with local negation, or straightforwardly ungrammatical with long-distance movement). Crucially, the movement of PPI-EVEN above negation is not unconstrained, as expected by the original movement analysis; rather, it was shown to be prohibited across the tensed clause boundary, suggesting that it is a movement of the familiar kind. Given the fact that, unlike *akomi ke, even* is fine with local negation and indeed compatible with *one* under negation, we are forced to conclude that *even* cannot be a PPI, and need not raise above negation. Indeed, when it does so overtly, the result is ungrammatical, as suggested by (19b).

3. NPI even: *oute kan*

For EVEN with negation, Greek employs the expression *oute (kan),* literally *not-and,* plus optionally *and-if* (*ke-an*) itself a PI (Giannakidou 2004). Giannakidou 1998 notes the negative polarity status of *oute kan*:

(23) O pritanis dhen proskalese **oute (kan)** ti Maria.
The Dean did not invite even Mary.

It has also been observed that *oute* is licensed only with negation and antiveridical operators, hence it is a proper NPI. *Oute* itself contains a negative element—*oute, ou* being sentential negation in Ancient Greek. *Oute* is obligatory when an NP or a PP is modified, but it can be omitted in the case of V modification, yielding additional syntactic and pragmatic differences that we will ignore here (but see Giannakidou 2004 for details on bare *kan*).

Apart from the lexical distinction, there is evidence that we are dealing with an item that contributes the top-of-the scale presupposition of NPI-even and not the bottom-of-the-scale one of positive *even*, illustrated in (24):

(24) # O pritanis dhen proskalese **oute kan** tin katharistria.
The Dean did not invite even the cleaning lady.

The cleaning lady is not the most likely person for a Dean to invite, so (24) is odd, hence we can conclude that *oute (kan)* associates only with the most likely alternative. In further support of this, notice the contrast below:

(25) a # I Maria dhen akouse **oute kan** ton paramikro thorivo.
Maria didn't hear even the faintest sound.[3]
b I Maria dhen akouse **oute kan** ton dinatotero thorivo.
Maria didn't hear even the loudest sound.

The superlative designates either the lowest or the highest element in the loudness scale. We see that *oute (kan)* is odd with the superlative of the lowest end, suggesting that it is a lexical

[3] Notice that sentences like (25a), where *even* associates with *the faintest sound*, are not totally unproblematic for some speakers of English. Gregory Ward actually suggests that they may be odd:

(i) #Maria didn't hear even the faintest sound.

This may be taken to suggest that that *even* indeed prefers low likelihood values rather than high likelihood ones. However, many English spakers still accept (24b), and examples of *even the faintest sound* can easily be constructed with *without, if-* clauses, and modal verbs wit negation. I give below a few examples that resulted from Google search (thanks to Jason Merchant):

… anything or even sensing him, Willow lay broken and crippled against her side and was unable to scream or cry out or make ***even the faintest sound.*** *…*
www.stormsdream.com/pages/fictionFireDawnNight.html

… For something like an hour I do not think there was ***even the faintest sound*** *within those four walls and under the canopy of that vaulted roof. …*
www.gordon-fernandes.com/hp-lovecraft/ other_authors/nemesis_fire.htm -

... The idols cannot utter ***even the faintest sound****, they cannot communicate with their worshippers, they can neither promise nor threaten, …*
www.spurgeon.org/treasury/ps115.htm -

... That might have been happening on a different planet form this one where there wasn't ***even the faintest sound*** *or glimmer of light. ...*
www.sheilaomalley.com/archives/002018.html -

... our good fortune desert us, for we passed the outer purlieus of the dead city and came to our camp without hearing ***even the faintest sound*** *of pursuit. …*
www.fantasticfiction.co.uk/etexts/n4281_16.htm

property of *oute* to only associate with high values. I will take it therefore that *oute (kan)* has the content that Rooth proposed for NPI-*even.*

(26) [[**NOT oute (kan)** (x) (P)]] = 1 iff ¬ P (x) = 1; (assertion)
y [y ≠ x ¬ P(y)]
y [y ≠ x → likelihood (P(x)) > likelihood (P(y))] (presupposition)

In Giannakidou 2004 this semantics is coupled with a syntax where *oute* contains an uninterpretable negative feature [uNeg], realized morphologically in *ou.* This feature must agree (in the sense of Chomsky 2000) with a negative head. This condition is responsible for locality effects— *oute* is licensed within a tensed clause boundary only— and explains why failure of licensing with *oute* is a clear case of ungrammaticality and not just deviance (albeit systematic deviance). As the scalar properties of *oute* are fully compatible with negation, they require no further discussion.

Before moving on, let me offer a few comments on the *akomi ke- oute* alternation regarding another plausible description of it. It seems appealing, at first glance, to treat the lexical opposition as a case of allomorphy. For example, one could argue that there is one basic lexical item meaning EVEN with the semantics we have assigned to *akomi ke,* and assume further that this expression can be optionally associated with a negative feature. When this happens, EVEN is pronounced *oute*; if there is no association with a negative feature, the expression is pronounced *akomi ke.* In this analysis it looks like we can handle the facts we explain with the lexical ambiguity line I am pursuing, while at the same time being able to reduce the different instantiations to one common core (Thanks to Chris Kennedy for discussion on this point).

Yet the may be reasons to be cautious about going this route. For one thing, there is a third instantiation of EVEN that we would still need to allow for: *esto.* Second, allomorphy typically comes with strict complementarity, which we do not have in this case; recall the fact that *akomi ke* can be good with negation given certain conditions, and certainly when it appears overtly above it. Given this case, and assuming, as we do (see Giannakidou 2004 for more details), that for *oute* to check its negative feature it must be raised to Spec, NegP, we end up with free optionality after movement: we predict that we can either insert *akomi ke* or *oute* under negation, which doesn't capture the fact that the choice is not really free and that the use of *akomi ke* is marginal. In order to achieve this result we would need to posit an additional blocking mechanism, and I am not sure whether this would produce an account more *explanatory* than the one suggested here.

Indeed, however, one would like to be able to bring about a sense of unitary source of the ambiguity *akomi ke-oute kan*, as well as *esto*, and the driving idea of the account I have in mind offers the following way of doing this (see Giannakidou 2004 for more details). We

envision alternatives and scalarity as predicting a limited set of potential presuppositions for items meaning EVEN crosslinguistically. This set consists of the propositions below, where x is the meaning of the constituent EVEN associates with.

(27) Existential presuppositions

a $\exists y [y \neq x \quad P(y)]$ (positive existential)

b $\exists y [y \neq x \quad \neg P(y)]$ (negative existential)

(28) Scalar presuppositions

a $\exists y [y \neq x \rightarrow \text{likelihood}(P(y)) > \text{likelihood}(P(x))]$ (bottom-of-scale)

b $\exists y [y \neq x \rightarrow \text{likelihood}(P(x)) > \text{likelihood}(P(y))]$ (top-of-scale)

In addition, a variant on context dependent scales will be needed for *esto* as I will suggest next. These propositions can combine in four distinct ways in order to produce presuppositions for EVEN expressions, deriving also possibly distinct lexical items within and across languages, as is suggested in Table 1:

Table 1: Combinatorics of presuppositions as realized in Greek

Scalar \ *Existential*	positive	negative
bottom-of-scale	*akomi ke*	*esto*
top-of-scale	*kan*	*oute (kan)*

In Greek, all four options are lexically distinct, as shown in Giannakidou 2004, where it is also suggested that the English counterpart of the fourth option is *so much as*. I will not offer a more detailed analysis at this point, but I hope that it is clear that the typology of presuppositions briefly scketched here may offer a viable way of talking about a common core in the various lexicalizations of EVEN.

Next, we turn to flexible scale EVEN.

4. Flexible scale EVEN: *esto*

Esto is in many cases paraphrasable by *at least*, but *at least* does not appear to be polarity sensitive:

(29) a ?? O pritanis proskalese **esto (ke)** tous diikitikous ipalilous.

b O pritanis proskalese **tulaxiston** tous diikitikous ipalilous

The dean invited **at least** the administrators.

The sensitivity of *esto* to polarity has thus far escaped attention in the literature. Addition of conjunction *ke* is possible following the pattern of the other focus particles (see Kalokerinos 1997 for some comments on the use of *ke*). The combination with *ke* seems to be more restricted than bare *esto*, but I will ignore this additional detail here.

As I noted earlier, *esto (ke)* is good in nonveridical contexts (cf. Kalokerinos 1997 for preference to "modal" contexts). Here are some examples:

(30) An diavasis **esto ke mia** selida ap' afto to vivlio, kati tha mathis. (conditional)
If you read even one page from this book, you will learn something.

(31) Na lisis **esto** to provlima 1. (subjunctive)
(Please) solve {even/at least} Problem 1.

(32) **Esto ke ena atomo** bori na sikosi afto to trapezi. (modal verb)
Even one person can lift this table.

(33) Erxete stis sinandisis, **esto ke me kathisterisi**. (habitual)
He comes to the meetings, even though with delay.

(34) **Tha ithela** na mou egrafe **esto ke mia leksi**. (directive intensional verb)
?I would like it if he wrote to me **even one** word.

The crucial contrast in (34) is with epistemic verbs like *believe* or *remember*, which block *esto*, and likewise *even*:

(35) a ??**Thimithika** pu mou egrapse esto ke mia leksi.
??I remember that he wrote to me even one word.

b ??**Pistevo** oti mou egrapse esto ke mia leksi.
??I believe that he wrote to me even one word.

We have, again, confirmation for the general pattern of PI-licensing regulated by nonveridicality described in earlier works (Giannakidou 1998, 1999, 2001). In the above contexts, *esto* shares its distribution with *akomi ke*; we discuss an example illustrating their differences later on. First, we discuss the presupposition of *esto*.

4.1 The presupposition of *esto*

The key idea is that *esto*, unlike the other EVENs which associate with likelihood, is flexible with respect to the scale on which it ranks alternatives. *Esto* relies on the context to make a scale salient (possibly among a number of available scales), and this property makes its distribution more variable than that of likelihood EVEN, with significant consequences in certain cases, e.g. questions, as we shall see later. Apart from this difference in the nature of the scale, the ordering

of *esto* is similar to that of positive *even*: it associates with the lowest element(s), as shown below:

(36) [[**esto (ke)** (x) (P)]] = 1 iff P(x)= 1; (assertion)

y [y ≠ x ¬ P(y)]

$\mathbf{Q}_{\text{scalar}}$ [C(**Q**) y [y ≠ x → **Q**(y) > **Q** (x)]] (presupposition)

The scalar presupposition is reminiscent of *akomi ke*, but *esto* combines it with the negative existential presuppostion of *oute*. The negative presupposition of *esto* and *oute* is very much like the assertion of *only* (Horn 1996), a fact consistent with crosslinguistic practice to employ equivalents of *only* for PI-EVENs (e.g. German *nur* in *auch nur)* . But why is a lexical item with the presupposition of *esto* unacceptable in positive sentences?

To see why, consider first a non-PI with a similar meaning, *at least*, which is acceptable:

(37)	I Maria	dhiavase	**tulaxiston**	to arthro tis Heim.
	the Maria	read. 3past.3sg	at least	Heim's article
	Maria read at least Heim's article.			

As we know from Larry Horn's work, *at least P* does not imply that you read *only P* (or *exactly P*), but it can certainly *implicate* it, as in the sentence above. When this happens, crucially, *at least* associates with a top-of-scale element: Heim's article was among the most expected or desired by the speaker. The sentence asserts that some person read the most expected item, and implicates that nothing else was read.

In the absence of a scalar item altogether, again we have a well-formed sentence, but this time lacking the implicature of universal negation that is licensed with the scalar *at least:*

(38)	I Maria	dhiavase	to arthro tis Heim.
	the Maria	read. 3past.3sg	Heim's article
	Maria read Heim's article.		

Hence the use of a scalar item is decisive in allowing a defeasible inference of universal negation, as well as for ranking the NP along some dimension. Importantly, the stronger statement of universal negation is licensed when the scalar item places the NP on the higher end of the scale. One way of formulating this is to use Krifka's (1995) **Scal.Assert** operator. This operator is lexically iserted whenever we have a focus structure, and its semantic impact is that "all propositions that are semantically stronger than the proposition made are negated " (Krifka 1995: 224):

(39) **Scal.Assert** (<B, F, A>) (c) = (Krifka 1995: 31b)

{i c | i B(F) ¬ F' A [[c∩ B(F')] [c∩ B(F)] i B(F')]}

where <B,F,A> is a focus structure with B as the background, F the foreground (a polarity item, or an item in focus), and A is a set of alternatives to F of type identical to F but excluding F itself.

Scal.Assert triggers a condition on the use of scalar items that says that such items will be felicitous only if their assertion B(F) is at least as strong as any of the alternatives, and strength is defined as entailment based on inclusion: α ("is stronger than") β iff α→β (Krifka 1995: 219). Strength thus allows inference from the more general to the more specific information. It is obvious that **Scal.Assert** is an attempt to "semanticize" the usual quantity implicature we otherwise get purely pragmatically in neo-Gricean (i.e. *Hornian*) terms. I will remain neutral as to whether we want to talk about this inference (i.e. the underlined negative conjunct of (39)) in pragmatic or more representationalist terms like in Krifka.

In a sentence without a PI or a focus item there is no universal negative quantity implicature-- or, in Krifka's terms, **Scal.Assert** is not inserted. This is what we have with sentence (38). In (37), on the other hand, we have a prototypical case illustrating the working of scalarity and the result of getting universal negation.

Consider now what happens with *esto*, which typically associates with a low value:

(40) ?# (Xthes to vradi), i Maria dhiavase **esto (ke)** tin ergasia tou xiroterou fititi tis.
last night the Maria read. past.3sg even the paper of worst student her
(?) Last night, Maria read at least her worst student's paper.

In order to use *esto*, the speaker must be in position to derive the negative conjunct that would yield the expected stronger statement. However, this is not possible with this sentence, which has the following presupposition:

(41) [[I Maria dhiavase **esto (ke)** tin ergasia tou xiroterou fititi tis]] = 1 iff Maria read her worst student's paper

Presuppositions:

i. x [x ≠ the paper of Maria's worst student C(x) ¬ read (Maria, x)]

ii. x [x ≠the paper of Maria's worst student → **pleasant** (x) > **pleasant** (the paper of Maria's worst student)]

The sentence asserts (B(F)) that Maria read the paper of her worst student (F); this paper, under standard assumptions, is at the bottom of a contextually salient scale of, say, pleasure; hence F is the weakest item. This means that there are no alternatives F' that can be entailed or implicated by the asserted B(F), which in turn means that the universal negative conjunct of (39) is *not* satisfied. As a result, **Scal.Assert** is not defined in this sentence, and the sentence is odd. Recall that the weak assertion is fine if no focus particle is used (as in (38)) because the **Scal.Assert** is not inserted; and **Scal.Assert** is defined unproblematically if we have association with a high value (or simply with any higher value such that it would allow inference to a stronger statement) as is the case with *at least.*

In other words, in a positive sentence *esto* creates a problematic assertion because of a tension between the bottom-of-scale ranking, and the expectation of a stronger statement containing the universal negative conjunct. It is the use of a focus item that yields this expectation. Notice that I am talking about unacceptability here and not ungrammaticality, as the effect is weaker. This weaker effect is in fact predicted by the pragmatic explanation that we are offering—and raises questions as to whether such an explanation is appropriate to rule out PIs like *any* where ill-formedness is much more robust, akin to ungrammaticality.

Let us see now how this analysis explains the ill-formedness of *esto* with negation.

4.2 Flexible scale EVEN and negation

Consider an example with negation:

(42) ?#O Janis dhen diavase esto (ke) tis iposimiosis.
#John didn't read even the endnotes.

Notice further that if instead of *the endnotes* we have *the title, even* becomes fine, and *esto* likewise improves (without becoming impeccable, however):

(43) ?O Janis dhen diavase esto (ke) ton titlo.
John didn't read even the title.

Esto carries the following presupposition, for (42):

(44) i. Assertion: John didn't read the endnotes.
ii. Presupposition:

$\exists x [x \neq$ **endnotes** $\neg$ John read x]

$\exists x [x \neq$ **endnotes** $\rightarrow$ expected-to-read (x)> expected-to-read (endnotes)]

The existential as well as the scalar conjunct conditions are met in a negative sentence; but again we have an assertion with ill-defined **Scal.Assert**. The sentence asserts (B(F)) that John did not read the least expected item (F), which would have been fine had no focus particle been used:

(45) John didn't read the endnotes.

This bare assertion does not say anything about having, or not having, read anything else, since in the absence of focus we have no alternatives. However, when *esto* is used, we have the expectation of a stronger statement, namely that John read nothing at all, i.e. a statement that would be consistent with Krifka's **Scal.Assert. Scal.Assert** will be defined in an assertion when we have association with a higher value, which is the case with NPI-EVEN; but the low value makes the sentence with *esto* anomalous. Recall that low-likelihood of *akomi ke* creates a similar problem inside the scope of negation (and drives the PPI-property of this items, as we noted in section 2).

Now consider our sentence (43) with t*he title* instead of *the footnotes*, which improved with *esto*. Here *esto* has shifted to a scale of ignorability:

(46) i. Assertion: John didn't read the title
ii. Presupposition:
$\exists x [x \neq$ **title** $\neg$ John read x]
$\exists x [x \neq$ **title** $\rightarrow$ possible-to-ignore (x)> possible-to-ignore (title)]

This combination produces an assertion very close to the one with NPI-*even*, since the least likely thing to ignore is the most likely thing to read, thus the improvement. We thus make a further prediction: That a low value on a context-provided scale will occasionally be able to rescue low-scale EVEN if it produces, by reversal of entailment, a high value on a likelihood scale, thus rendering the presupposition of *esto* equivalent to that of NPI-EVEN. This explains why in such cases the readings with *esto* and NPI *oute* feel intuitively close.

At any rate, we witnessed that what excludes *esto* in positive and negative sentences alike is the fact that it associates with low scalar values. The ill-formedness is due, as we argued, to a conflict between using a focus item that creates an expectation of a stronger statement (derived by the classical neo-Gricean reasoning (Horn 1989), or where **Scal.Assert** is defined in Krifka's terms) on the on hand, and the low value, on the other, that systematically blocks that stronger statement. In nonveridical contexts no such confilicts arises, and *esto* can therefore be used unproblematically.

4.3 Nonveridical contexts

It is easy to show that nonveridical contexts are consistent with the presupposition and scalar structure of *esto*. Consider a request, where the low-scalar *akomi ke* is also acceptable:

(47) a Na lisis **esto to provlima 1.** (Problem 1 is the easiest)
(Please) solve {even/at least} Problem 1.
b Na lisis **akomi ke to Provlima 1.** (Problem 1 is the hardest)

(48) *Esto*

$\exists x [x \neq \text{Problem 1} \quad \neg (\text{you solve } x)]$

$\exists x [x \neq \text{Problem 1} \rightarrow \textbf{difficult}(x) > \textbf{difficult}(\text{Problem 1})]$

Here *esto* ranks alternatives on a difficulty scale. The sentence presupposes that the speaker considers Problem 1 to be the least difficult to solve, and presumes that the addresee won't be able to solve any problems other than this one; so they'd be happy to see just that one problem solved. We will call this the *at least* reading. Of course, the least difficult problem is in fact the easiest one, hence the flavor of easiness that Problem 1 acquires in this context.

Akomi ke presupposes a different context producing the opposite effects: Problem 1 now seems to be the hardest one, and the request seems to be about solving *also* this problem:

(49) *Akomi ke*

$\exists x [x \neq \text{Problem 1} \quad \text{solve}(\text{you}, x)]$

$\exists x [x \neq \text{Problem 1} \rightarrow \textbf{likelihood}(\text{you solving } x) > \textbf{likelihood}(\text{you solving Problem 1})]$

Here the context imposes an excess of problem solving. The addressee is now taken to be somebody smart, who would be able to solve, *in addition to* the problems they are solving, also the least likely problem to solve, which is, of course, the most difficult one. We will call this the *also* reading. Hence, the contrast with *esto* in terms of the status of Problem 1 as the easiest or the hardest problem is a result of the fact that likelihood and difficulty have reverse entailments. This fact will be significant when we discuss negative bias in questions.

Note that in case *akomi ke* is forced to associate with a high-likelihood item, it becomes odd. This is what we see in the sentence below:

(50) ?? Na lisis **akomi ke to efkolotero provlima.**

(Please) solve even (= at least/*also) the easiest problem.

The easiest problem ranks HIGH on the likelihood scale, and this rules out low-likelihood EVEN. In English, allhough *even* is admitted, it only receives the *at least* reading; but in Greek, the incompatibility of *akomi ke* with high values produces ill-formedness since this item unambiguously associates with only low likelihood.

To sum up, in polarity contexts, *esto* and PPI *akomi ke* exhibit two distinct readings, what I call here the *at least* reading (*esto*) and the *also* reading (PPI). *Even* seems to be ambiguous in allowing both; with high-likelihood only the PPI *also* reading is licensed. This contrast between the *even-at least* and *even-also* readings is generally visible in the other contexts in which both items are admitted, but I will not illustrate with more examples here (see Giannakidou 2004). Instead, for the sake of completeness, we now turn to questions where we can see that negative bias is licensed only with the *at least/esto* reading.

5 Polar questions: negative bias revisited

The literature offers two observations: first, questions with *even*, and *even*-containing PIs (*strong* NPIs known as *minimizers*, e.g. *lift a finger, sleep a wink*) express negative bias (Ladusaw 1979 among others):

(51) a Did Beatrix lift a finger to help?
Expected answer: No, she didn't.
b Have you talked to him even once?
Expected answer: No, you didn't.

Negative bias surfaces in what counts as an expected answer: negative propositions are expected. But the bias is a conversational implicature: we can still answer the questions positively without contradiction. The second observation is that the bias is due to the fact that strong NPIs contain *even* (Linebarger 1980, Heim 1984), and that this *even* is associated with minimal amount thus making the NPI itself denoting minimal amount. In a different vein, Wilkinson 1996 and Guerzoni 2002 argue that the *even* involved in negative bias is either NPI-*even* or wide scope low likelihod *even*. We see in this section that the Greek facts are a problem for this latter assumption (an earlier version of the argument can be found in Giannakidou 2003). We will confirm indeed that the original intution that negative bias arises with expressions of minimal amount is correct, and extend it to include in general lower ranking elements on a contextually defined scale. The EVEN meaning we will need, then, will be that of *esto*. English *even* will show ambiguity between this reading the true low-likelihood one of *akomi ke*, which, crucially, yields no bias.

First, consider that, crosslinguistically, an overt *even* in a negative sentence may occur with bias inducing minimizers, e.g. in Catalan, Spanish (Vallduvi 1994; Herburger 2003), or Greek; this EVEN is indeed the NPI-one (see Vallduvi 1994 and Herburger 2003 for the NPI status of *ni*):

(52)	a	No va dir	*(**ni**) paraula en tota la tarda.	Catalan
	b	No dijo	(**ni**) palabra en toda la tarde.	Spanish
	c	Dhen ipe	(**oute)** mia leksi oli nixta.	Greek
		He did not say	even a word all evening	

Crucially, these NPI-EVENs are disallowed in questions, suggesting that negative bias cannot be derived from NPI-EVEN:

(53)	a	*Ipe	**oute mia** leksi?	(Greek)
		Did he say	even one word?	
	b	*Va dir	**ni** paraula en tota la tarda?	(Catalan)
	c	*Dijo	**(ni)** palabra en toda la tarde?	(Spanish)

The ungrammaticality follows from the NPI status of *oute* and *ni,* and invalidates the arguments that try to assimilate wide scope and NPI-EVEN in questions (Guerzoni 2002). In questions, *esto* and *akomi ke* can be used; negative bias, crucially, arises only with *esto.*

5.1 EVEN with minimal amount

Consider first the case of EVEN with an expression denoting a minimal amount:

(54)	a	Tu exis milisi	**esto ke mia** fora?
	b	?#Tu exis milisi	**akomi ke mia** fora?
		Have you talked to him even once?	Expected biased answer: No.

Interestingly, *akomi ke* is unacceptable with low-frequency *once,* which we expect given our account. The low likelihood of *akomi ke* conflicts with the high likelihood of ONE, since ONE is the weakest, hence the most likely predicate (it is entailed by any other cardinality):

(55) n [n ≠ **once** you talked to him (n)] n [n ≠ **once** → likelihood (talking to him n times)) > likelihood (talking to him **once**)] (*akomi ke*)

This fact is problematic for Lahiri's (1998) account of the occurence of Hindi *EVEN-one* PIs in questions. According to Lahiri, the Hindi *bhii* that participates in the formation of these PIs is a low-likelihood one, but what the Greek facts show is that a true low likelihood EVEN, *akomi ke*, actually remains unacceptable with a high likelihood predicate like *one*. The explanation for why *bhii*-items are good in questions must therefore look elsewhere for an EVEN meaning that is in fact compatible with *one*-- *esto*.

Generally, the prediction is that the combination of positive EVEN with inherently high likelihood items will be problematic; and we confirm again that this is the case.

(56) ?# Boris na prosthesis **akomi ke 1 + 1**? 'Can you add even 1+1?'
(This addition is the easiest one to do, hence the MOST likely).

But *esto* is fine with high likelihood, as long as it scores low on the context given scale:

(57) Boris na prosthesis **esto 1 + 1**? 'Can you add even 1+1?'
(This addition is the least difficult one to do).

Likewise for the frequency *once* in the case of (54a):

(58) n [n ≠ **once** ¬ (you talked to him n times)] > **frequent** (once)] n [n ≠ **once** → **frequent** (n-times) (*esto*)

This explains the use of *esto* with the cardinality predicate *one*. Hence, we have to conclude that PPI-EVEN, which is indeed a wide scope low-likelihood *even*, cannot be responsible for negative bias in questions with expressions of minimal amount; flexible scale EVEN is. This conclusion supports the polarity theory of EVEN, and indicates that negative bias with EVEN in questions cannot be due to low-likelihood. This result, as I said, challenges Lahiri's attempt to account for EVEN-ONE PIs in questions by appealing to low likelihood only.

5.2. Variable likelihood

With predicates of variable likelihood, both *esto* and *akomi ke* are fine. But notice the difference in interpretation.

(59) a Elises **esto to Provlima 1**? (Problem 1 is the easiest; negative bias)
Did you solve even (*at least)* Problem 1?
b Elises **akomi ke to Provlima 1**? (Problem 1 is the hardest; no bias)
Did you solve even (*also*) Problem 1?

Akomi ke has only the expected *also* reading:

(60) x [x ≠ **Problem 1** you solved x] x [x ≠ **Problem 1** → **likelihood** (you solve x) > **likelihood** (you solve Problem 1)]
= Problem 1 is the least likely one to solve, hence the most difficult one.

This presupposition does not create negative bias: The speaker assumes that other problems were solved. Additionally, because *akomi ke* must pick out the least likely element, Problem 1 must be the hardest one. This describes correctly the conditions under which a polar question with *akomi ke* can be used. Notice that if we force *akomi ke* to combine with high likelihood, the result will be unacceptable, in accordance with what has been observed so far:

(61) ?#Elises **akomi ke to efkolotero provlima**?
Did you solve even (= also) the easiest problem?

This is odd, because the easiest problem is the most likely one to solve. With *esto,* on the other hand, we have the following presupposition:

(62) x [x ≠ **Problem 1** ¬ (you solved x)]
x [x ≠ **Problem 1** → **difficult** (x) > **difficult** (Problem 1)] (*esto*)

This presupposition creates negative bias: the speaker assumes that there are other problems besides Problem 1 that were not solved; and if Problem 1 is the least difficult one, then the question is about whether *at least* the least difficult problem is solved, hence the bias.

As expected, *esto* will be impossible with *the most difficult problem* exactly because of a conflict with its scalar presupposition:

(63) ?#Elises **esto to diskolotero provlima**?
Did you solve even (in the least) the most difficult problem?

As an overall conclusion, then, we can say that the behavior of EVEN-items in questions supports the polarity hypothesis in its entirety. The scope theory of EVEN actually predicts no bias, and this is in fact what we have with Greek *akomi ke,* and other particles crosslinguistically that can be shown to have a PPI meaning (e.g. Japanese - *sae*; Yoshimura 2004). Recall again that negative bias cannot be due to NPI-EVEN, because NPI-EVEN is ungrammatical in questions.

The behavior of English *even* in questions thus suggests that *even* must be ambiguous between *esto* (the least) and *akomi ke* (also). An unambiguous analogue of the *esto-at least* reading can be identified in the item *in the least*, which is a V modifier in English:

(64) a Did you in the least solve the easiest problem?
b # Did you in the least solve the hardest problem?

Just like *esto*, then, *in the least* cannot be associated with high scalar values.

To sum up, the behavior of EVEN items in questions seems to be entirely predictable by the refined polarity analysis I have been arguing for. Negative bias is derived by the presupposition of minimal amount or low ranking at a scale other than likelihood that comes with *esto*, along with a negative existential presupposition that is also part of the contribution of this item. Crucially, low likelihood yields no bias in questions, but contributes the expected additive meaning that low likelihood items contribute in positive contexts in general.

6. Conclusion

In this paper, we have seen that the scalar properties of EVEN are much more complex than predicted by Karttunen and Peters' original analysis. In a given language, there are (at least) three meanings identifiable as EVEN with distinct scalar properties. Positive EVEN, Greek *akomi ke*, is indeed a low scalar positive polarity item (PPI) that must scope above negation; *oute*, on the other hand, is a well-behaved high-scalar negative polarity item (NPI) licensed in the scope of negation; and flexible scale EVEN, *esto*, is a low-scalar polarity EVEN, defined not on likelihood but on a contextually specified scale.

The scalar presupposition of bottom-of-scale EVENs (positive as well as flexible scale) was shown to remain problematic with respect to negation: the clash between the assertion with a bottom of scale item, and the expectation of a stronger statement that the use of the scalar focus particle creates seems irreparable. In the case of low-likelihood EVEN (*akomi ke*) the problem can be fixed by *overt* raising above negation, an option apparently not available for *esto* which threfore remains ill-formed inside negation. Yet, even after overt raising, low likelihood *akomi ke* is incompatible with the the cardinality predicate one. This result challenges the usefulness of bottom-of-the-scale inferences in explaining the distribution of EVEN-*one* PIs that are impeccable in the scope of negation and in questions(Lahiri 1998).

Rooth's original idea, then, about the role of polarity in EVEN was shown to have far-reaching consequences. At the same time, by deriving the (in)compatiblity with negation from the presuppositional content of the relevant polarity expressions, we made one step forward compared to earlier approaches, which stipulated PI-hood as a mysterious composition-external

property of polarity items. In doing so, we have removed much of the conceptual appeal of the original scope analysis. One final question remains: Do we still need it for English *even?*

The raising analysis of the scope theory renders *even* a PPI; but, crucially, there are important empirical differences between a true PPI-EVEN and *even* that cannot be glossed over. For example, *akomi ke* is odd in the actual scope of negation, remains odd in positive as well negative sentences when combined with the cardinality *one*, is incompatible with expressions of high-likelihood, and retains an additive meaning that does not produce negative bias in questions. These are all properties expected from an unambiguous wide scope low-likelihood EVEN. However, *even* is fine in the cases where *akomi ke* is bad: its unproblematic occurrence with negation, the fact that it remains inside the scope of negation across tensed boundaries, the fact that it combines with expressions of variable likelihood, and the fact that it does produce negative bias in questions, cover the additional space of NPI-EVEN and flexible scale *esto.* I cannot see how we can correctly characterize this variable behavior without resorting to some sort of lexical ambiguity.

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