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Antonymy and negation—The boundedness hypothesis

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Abstract

This paper investigates the interpretation of unbounded (scalar) adjective antonyms with and without negation such as (*not*) *narrow* – (*not*) *wide* and bounded adjective antonyms with and without negation such as (*not*) *dead* – (*not*) *alive* as well as their interpretations with approximating degree modifiers, *fairly* and *almost*, respectively. The investigation was designed to test the boundedness hypothesis, namely that the negator is sensitive to the configuration of the adjective in terms of BOUNDEDNESS. The data are Swedish and the results of the experiments show that negated unbounded adjectives do not evoke the interpretation of their antonyms, i.e. *not wide* does not equal ‘narrow’. The results of the experiments with bounded adjectives with and without negation showed that some of the negated adjectives were interpreted as synonyms of their antonyms, i.e. *not alive* equals ‘dead’. However, this pattern was not consistent across the bounded adjectives, since a number of them readily lent themselves to partial readings. Four types of bounded antonyms emerged from the participants’ judgements. For both unbounded and bounded adjectives, the interpretations of the approximating degree modifiers and the adjectives were not significantly different from the negated adjectives.

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Keywords: Antonymy; Adjectives; Negation; Degree; Scale; Boundedness

Antonymy and negation are phenomena that have been studied from many angles. In the literature, antonymy is recognized as the most robust of the lexico-semantic relations, important to both the mental organization of the vocabulary and the organization of coherent discourse (Cruse, 1986; Muehleisen, 1997; Fellbaum, 1998; Willners, 2001; Jones, 2002; Murphy, 2003; Croft and Cruse, 2004). Negation has been studied by philosophers, logicians, psychologists and linguists for a long time (for an overview, see Horn and Kato, 2000). “Depending on whom you ask, negation may be a logical operator or a type of speech act, a basic element of semantic

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representations or a pragmatically loaded form of communicative interaction” (Israel, 2004:701). If we disregard the complexity of scopal properties, negation has a relatively straightforward role as a polarity item in the language of logic, in formal linguistic systems and literalist approaches to meaning. In natural language usage, however, the role of negation is anything but straightforward (Giora, *this issue*). Not only is *not* used as an expression of polarity and denial in *common parlance* as in ‘I *don’t* want to go to the cinema tonight’ or ‘Sarah is *not* a music lover’, but it is also frequently used as a hedging device in discourse as in ‘I *don’t* know, but I think it’s a good idea to go swimming’, where no real sense of polarity and denial is conveyed (Tottie and Paradis, 1982; Tottie, 1991) or a modifier of degree as in ‘the water is *not hot*’ said about water that may be warm, lukewarm or cool (Bolinger, 1972; Horn, 1989; Israel, 2001; Giora et al., 2005a).

This paper presents the results of a set of psycholinguistic experiments investigating the interpretation of antonymic adjectives in Swedish and the role of negation with these adjectives. Before we go into details about research questions and hypotheses of these experiments, we describe the theoretical background of antonymy and negation from the point of view of mental representations, language processing and speaker interpretations.

1. Theoretical background

1.1. Antonymy and gradability

Antonyms are at the same time minimally and maximally different from one another. They map on to the same conceptual domain, but they occupy opposite poles/parts of that domain. Due to the fact that they are conceptually identical in all respects but one, we perceive them as maximally similar, and, at the same time, due to the fact that they occupy radically different poles/parts, we perceive them as maximally different (Willners, 2001:17; Murphy, 2003:43–45). The configuration of adjectives that have antonyms is either unbounded, expressing a range on a scale, or bounded, expressing a definite ‘either-or’ mode (Paradis, 2001; Croft and Cruse, 2004:164–192).¹ Adjectival antonyms are thus basically of two kinds: unbounded (scalar) or bounded antonyms. Unbounded antonyms such as *wide* and *narrow* occupy opposite poles of a scale, and hence they are in the possession of more or less of the conceptual content of the given domain. They are counter-directional which means that when intensified they move away from one another in opposite directions of the scale. Extreme values of *wide* and *narrow* only tend towards the extreme but actually never reach an end-point. This characteristic of being construed according to an unbounded scale is highlighted by the fact that *completely narrow* and *completely wide* are infelicitous.²

Bounded antonyms such as *dead* and *alive*, on the other hand, represent another type of antonyms. They are complementaries in the sense that they are absolute and divide some conceptual domain into two distinct parts. ‘She is *dead*’, entails that ‘she is *not alive*’ and ‘she is *alive*’ entails that ‘she is *not dead*’. Because of this absolute divide, the expression ‘she is neither dead nor alive’ comes across as paradoxical. It should be noted, however, that it is a general feature of most bounded adjectives that they for more or less ad hoc purposes can be played

¹ We are using ‘antonymy’ as a cover term for all different kinds of oppositeness in this paper. This is different from how the term is used in Paradis (1997, 2000a, 2000b, 2001) and in Croft and Cruse (2004).

² See Sapir (1949), Bierwisch (1989), Cruse and Togia (1997), Paradis (1997:23–24) and Kennedy and McNally (2005) for discussions of scale models.

around with and laid out on a scale (Paradis, 1997:48–66). For instance, *very dead* comes across as less conventional than *wide open*. Because of this flexibility that language offers, an alternative interpretation of ‘she is neither dead nor alive’ could be ‘almost dead’ or ‘half alive’. These interpretations presuppose both a scale and a boundary (Paradis, 1997:65). Scalar adjectives, however, are normally not associated with a boundary and do not bisect a domain in an ‘either-or’ fashion. They are laid out on a scale, and there is a pivotal area between the two sides which makes the expression ‘this road is neither wide nor narrow’ perfectly acceptable and natural.

Scalar readings of adjectives combine with unbounded, scaling degree modifiers such as ‘very wide’ or ‘fairly wide’, while bounded readings expressing a notion of ‘either-or’ go with bounded and absolute modifiers such as ‘totally dead’ or ‘almost dead’. There is ample evidence in support of this claim based on introspective and experimental data concerning the general combinatorial constraints and collocational possibilities between totality modifiers and the lexical elements they modify on the one hand and scalar modifiers and the elements they modify on the other in terms of boundedness (Paradis, 1997, 2001, 2003b). There is also ample evidence concerning actual combinatorial and collocational possibilities based on corpus investigations (Paradis, 1997, 2000a, 2000b, 2003b), both written data (from the BNC – the British National Corpus) and spoken data (from the LLC – the London-Lund Corpus – as well as the spoken part of the BNC).³

To avoid confusion it is important to point out that when the antonymic relation between two adjectives is made salient some pairs appear to map on to both a bounded and a scale structure. Such double configurations may be basically bounded but with a scale attached to the boundary, e.g. (*totally/almost*) *empty* and (*completely/almost*) *full*. These meanings are objective in the sense that they can be calibrated and language users would agree on their application, i.e. ‘an empty glass’ would be empty for everyone (Warren, 1992:19). When the focus is on one at a time, i.e. either ‘empty’ or ‘full’, they are both bounded in the sense that they are associated with a definite limit, but when they are combined, a scale is construed between the two boundaries. Furthermore, there are also items that are basically scalar but located at the very end of the extreme of the scale, e.g. (*absolutely*) *terrific*, (*totally*) *disgusting*. They are primarily scalar and evaluative-subjective meanings in that language users may disagree on their application. A terrific meal for one speaker might very well be a disgusting experience for somebody else. The term that has been used for these adjectives is ‘extreme adjectives’. Unlike primarily bounded meanings such as ‘empty’, these basically scalar meanings are infelicitous with *almost* (Paradis, 1997:56). As a point of departure for our initial categorization of adjectives into bounded and unbounded meanings we disregard the antonymic or graded construal and take the individual adjective as the point of departure.

The cognitive approach to meaning advanced in this paper takes concepts to form the ontological basis of lexical knowledge, which involves both encyclopaedic and linguistic knowledge. The meaning of a lexical item is its use potential in conceptual space (for the notion of use potential in this model of meaning see (Paradis, 2005a), see also (Allwood, 2003; Zlatev, 2003)). Actual contextual readings of lexical expressions in language use are relevant portions of the meaning potential construed on the occasion of use. Conceptual space is structured relative to two types of ontological domains: the *content domain* and the *schematic domain* (Cruse and Togia, 1996; Paradis, 1997, 2001). Content domains involve meaning proper and schematic domains provide various configurational templates on which meanings are construed, e.g.

³ Information about the BNC can be obtained from <http://www.natcorp.ox.ac.uk/what/index.html>, and the LLC in Greenbaum and Svartvik (1990).

BOUNDEDNESS and SCALE. Both these domains are conceptual in nature and mirror our perception of the world. In addition to the conceptual realm, there is an operating system consisting of different types of *construals*, which are imposed on the domains by speakers and addressees at the time of use (Paradis, 2004, 2005a). In our model, antonymy is treated as a construal that makes use of boundaries and scales in order to structure various content domains. A great deal of flexibility is built into our modelling of meaning in that configurational concepts such as BOUNDEDNESS and SCALE are considered to be free structures that are mapped on to different content domains. The advantage in the context of antonymic meanings is that we are able to treat both conventionalized couplings between configuration and content, such as *very long* in the same way as we treat ad hoc readings, such as *very Swedish* (for discussions of these matters as well as of meaning change within our model see Paradis, 2000a, 2000b, 2003a, 2003b, 2005b).

Although their assumptions about the nature of meaning are radically different from ours, Kennedy and McNally (2005) propose similar ideas about gradable predicates. Like Paradis (1997), they operate with both bounded and unbounded representations. In addition, they also posit two subtypes of combined structures, lower closed scales and upper closed scales. In contrast to our conceptual model of meaning, Kennedy and McNally assume that meanings are truth-conditional in nature, i.e. the denotations of adjectives equal their truth-conditions which predict the entailment patterns for the different types of scales. In other words, they assume gradable predicates such as *long* and *open* to carry set meaning specifications and set scale structures. In cases when interpretations of lexical items do not conform to the predicted scale type, Kennedy and McNally leave the problem of their ‘misbehaviour’ at that. Our model, on the other hand, has the advantage of being capable of handling meaning flexibility which by us is considered to be one of the hallmarks of natural language. Alternative readings of lexical items are formed in context through construals that operate on their content and configuration structures. More specifically for gradable adjectives, this means that on the occurrence of use, meanings may be construed on the basis of scales and/or boundaries due to the contextual requirements that form the current readings. The suitable reading is construed on the basis of a relevant portion of the meaning potential of the lexical items motivated by context and communicational demands. Multiple meanings in Kennedy’s and McNally’s model is accounted for in terms of an enumeration of structures involving scales and boundaries in set combinations; in other words, one reading one sense/truth-condition. It is not a primary goal for them to provide contextual explanations for how alternative readings arise, nor do they attempt to provide explanations for non-default readings or meaning shifts. Their priority is formalization of truth-conditions. However, in spite of major theoretical differences, the predictions that fall from Kennedy’s and McNally’s truth-conditions for bounded and unbounded structures (totally open and totally closed scales in their terminology) are the same as the predictions we are making, i.e. (i) ‘The door is *not large*’ \neq ‘The door is *small*’, and (ii) ‘The door is *not open*’ = ‘The door is *closed*’. The next section discusses the predictions made about antonymic adjectives in combination with negation.

1.2. Negation and degree

Turning now to the negator, we note that in traditional literalist semantics, negation is an operator expressing the absolute opposite proposition; given the truth of p , $\neg p$ (not p) is false. If we see negation as an absolute operator, we may argue that its role is to apply a definite boundary to the meaning of an adjective. Negated antonymic adjectives differ from antonymic adjectives qualified by degree modifiers in that the oppositeness relation is in focus. Negated

propositions are assumed to evoke two contrasting spaces, a factual space and the counterfactual space, which makes interpretations of negated expressions more complex (Langacker, 1991; Fauconnier and Turner, 2002; Hasson and Glucksberg, this issue). For instance, if we compare *totally dead* and *not dead*, it is obvious that the focus in *totally dead* is on ‘total death’ as opposed to some kind of approximation of death, while *not dead* is ‘life’ as opposed to ‘death’. The prediction will be that if the negated adjective is antonymic, the interpretation of the expression will be synonymous to the lexically coded antonym, i.e. *not alive* equals ‘dead’ and *not dead* equals ‘alive’. In like manner, in the case of negated unbounded antonyms the relation holds, i.e. *not wide* equals ‘narrow’ and *not narrow* equals ‘wide’. It is within this spirit that Horn (2004:10) states that what is said and not implicated in scalar expressions such as ‘it’s warm’ is that something is at least warm, which is a lower bound interpretation. Negating *warm*, as in *not warm* denies the lower bound and the interpretation is ‘cool’ and *not cool* is understood to mean ‘warm’. The prediction is that the ‘warm’/‘cool’-scale is symmetric in the sense that there is no difference between the negated adjective and the coded antonym (*not warm* = *cool*). Upper-bound interpretations of negation, however, are arrived at by implication, i.e. post-semantically. Such interpretations presuppose syntactic, semantic or prosodic cues and the function of the negator is to promote the interpretation ‘Its not warm, it’s hot’ (Horn, 2004:10).

Colston (1999) criticizes the literalist account. He claims that the metalinguistic function of negation is crucial for the understanding of the use of negation in natural discourse and verbal politeness has a crucial explanatory function. Similar to our study, Colston’s investigation concerns antonymic adjectives only, but unlike our study his test items are designed to raise positive and negative expectations towards the content of the test items. Colston’s approach predicts asymmetry in the interpretations of negated and non-negated adjectives in contexts describing negatively and positively expected events. The results of his experiments show that positively expected events turn out to create asymmetric meanings. This is to say that a term with a negative orientation (‘the food was bad’) is synonymous with a negated positive adjective (‘the food was not good’), whereas a direct positive term (‘the food was good’), does not have the same meaning as the negated negative term (‘the food was not bad’). When events have negative expectations, however, this asymmetry disappears and the interpretations tally with the interpretations predicted by Horn (2004), i.e. bad = not good and not good = bad. According to Colston, the explanation for the discrepancy between events of positive and negative expectation is verbal politeness, which is one of the contextual assumptions that addressees consider in understanding indirect remarks made in negatively expected contexts. According to the norms in politeness theory (Brown and Levinson, 1987), people are expected to speak and behave in a socially positive manner. The experiments in our study do not capitalize specifically on adjectives with positive and negative connotations or on positive and negative expectations. In fact, most of our antonymic pairs are neutral in character. Only a small minority of them (two pairs) may be considered to be evaluative, and the contexts are not designed to be perceived with positive or negative expectations.

It is obvious from the above treatments of the negator that it has a potential to operate on both bounded and unbounded meaning structures, and as has already been discussed, adjectival meanings are, strictly speaking, not either bounded or unbounded. True, some meanings have a strong bias towards one or the other, e.g. ‘identical’ is strongly bounded and ‘long’ is strongly unbounded. Expressions such as ?‘very identical’ and ?‘totally long’ come across as infelicitous. But, it is also true that there are very many meanings that do not have a strong bias for one or the other reading in their use potential. On the occasion of use, coercion of an adjective with a weak bias towards a bounded reading into a scalar reading is readily at hand. These bounded or

unbounded readings become fixed when adjectives are qualified by degree modifiers, e.g. ‘absolutely clear’ with an ‘either-or’ reading of *clear* and ‘very clear’ with an unbounded scalar reading of *clear*. When weakly biased adjectives are modified by *quite* which is a degree modifier that may take on either a scaling function similar to that of ‘fairly’ or an ‘either-or’ reading similar to ‘totally’, contextual cues are crucial to the interpretation. This means that out of context the interpretation of *quite clear* is vague.

Like *quite*, *not* seems to be capable of invoking boundedness as well as unboundedness in the adjectives it modifies, and like *quite*, *not* is both possible and natural with either unbounded or bounded readings of adjectives. In combination with unbounded adjectives, *not* may give rise to various different interpretations along the scale of width. *Not wide* may not necessarily mean ‘narrow’ but may position itself somewhere in between ‘wide’ and ‘narrow’, e.g. as near synonyms of ‘fairly wide’ or perhaps ‘fairly narrow’. However, since scalarity may be eliminated in favour of a bounded reading with the aid of negation, *not wide* may also very well be interpreted as synonymous with its antonym ‘narrow’ occupying the opposite end of the scale of width. It is precisely to these problems that the present paper is devoted. The explicit questions are: how do speakers interpret antonyms with and without negation? Are negated unbounded adjectives judged to be in the same position on the scale as the lexicalized antonyms, i.e. is ‘not wide’ synonymous with ‘narrow’ or is it judged to be in any other position between ‘wide’ and ‘narrow’? Similarly, are negated bounded adjectives such as ‘not dead’ always judged to be synonymous to ‘alive’ as would be predicted by the strong bias of ‘dead’ and ‘alive’ as a bounded configuration, or are such combinations judged to point up a position somewhere in between ‘dead’ and ‘alive’? Finally, are the members of the antonymic pairs understood as symmetric reflections of one another by the subjects?

1.3. *The suppression versus the retention hypothesis*

The effect of negation on the representation of concepts in language production and comprehension has been given comparatively little attention in the psycholinguistic literature. In the studies that have been devoted to the psycholinguistic effects of negated concepts, there has been agreement on the role of the negator as an instruction to the addressee to suppress the negated concept – *the suppression hypothesis* (e.g. MacDonald and Just, 1989; Kaup, 2001; Kaup and Zwaan, 2003; Mayo et al., 2004). More precisely and in psycholinguistic terms, the consensus is that the negation marker reduces the level of activation of the negated information to at least a similar level as unrelated controls and significantly lowers than the positive equivalents.

The view that negated concepts are automatically suppressed is, however, not shared by Giora et al. (2005a, 2005b) and Giora (2006). They reject the assumption that suppression operates automatically and obligatorily. Their findings argue in favour of the retention hypothesis. They show that negated meanings are accessed and retained in memory. A negation marker is instead an instruction from a speaker to an addressee to mitigate or tone down the representation of the negated notion. Negated contexts do, however, inhibit initial lexical access of a negated meaning at the early stages of language processing. They thus argue against the suppression view of negation according to which the affirmative meanings that have been activated at the initial phase are automatically deactivated. Their results open up for a more subtle analysis of the processing of negated contexts in also allowing for features of the negated concept to be retained so that the end product yields a mitigated rather than eradicated concept (see also Horn, 1989:236–245). From the point of view of function, Giora (2006) claims that suppression and retention are

pragmatically motivated on all occasions rather than being automatic mechanisms. Hasson and Glucksberg (2006) and Kaup et al. (2006) assume a juxtaposition of the negated state of affairs with the representation of the described situation which suggests that both construals are needed for our understanding of negated meanings.

The experiments in the present study are not concerned with language processing as such, but focus on the end product of negation in terms of the subjects' judgements about how they interpret the various test items.

1.4. The boundedness hypothesis

Our hypothesis is that when *not* combines with bounded antonymic meanings, the function of *not* is that of expressing the absolute opposite meaning, i.e. *not dead* equals *alive*. When *not* combines with unbounded antonymic meanings such as *wide* and *narrow*, on the other hand, its function is to attenuate the meaning of modified adjectives. The predicted entailment patterns are the following:

- (i) UNBOUNDED MEANINGS
 'wide' ≠ 'not narrow'
 'narrow' ≠ 'not wide'
- (ii) BOUNDED MEANINGS
 'dead' = 'not alive'
 'alive' = 'not dead'

This hypothesis is based on a criterion of semantic harmony of boundedness between the modifier/operator and the modified element itself. It could be argued that these two hypotheses square with the suppression and the retention hypotheses of language processing. The hypothesis that *not* has the role of annihilating the modified lexical item when the meaning of that element has a bounded configuration and thereby activating its opposite would argue in favour of the suppression hypothesis while in the case of *not* in combination of scalar configurations the meaning of the modified lexical item is retained and modified according to the scale by *not*. This distinction agrees with Fillenbaum's finding (1966) concerning subjects' understanding of adjectives as being contradictory (bounded) or contraries (unbounded) in actual use. We are not making any claims about aspects of online processing since a statement about linguistic processing would also require additional types of experiments such as probe recognition tasks. In addition, there are pairs such as *empty* and *full* that are bounded, e.g. *totally empty/full* and *almost empty/full*. However, when the antonymic relation is foregrounded, the two notions are connected through a scale. This is also the case when they are negated as in *not empty* and *not full*. These expressions may not necessarily involve their respective opposite poles but may very well be interpreted as falling just a little bit short of 'maximally empty' and 'maximally full'. Since they are basically bounded they will be grouped together with the other bounded adjectives in this study.

Giora et al. (2005a, 2005b) present the results of a number of experiments that support the view of negation as mitigation. Based on these data, Giora (2006) suggests a functionally oriented proposal of negation in text. She argues for a *functional equivalence hypothesis*, which states that the role of the negator may be either one of mitigation of the negated concept, i.e. *not warm* communicates 'less than warm' rather than 'cold' or one of eliminating the positive

concept resulting in its absolute opposite, if the textual function of the negated expression calls for such an interpretation. This is also true of affirmatives. Giora's results are indirectly supported by Holleman's (2000) data which show that speakers are sensitive to the hedging function of negation in that they prefer negated positive meanings to negative items, e.g. *not succeeding* to *failing* for unfavourable descriptions. This asymmetry was shown to apply across the board irrespective of whether the items were scalar or not (cf. Colston, 1999). Such results are consistent with the functional equivalence hypothesis but seem to be inconsistent with the predictions of *the boundedness hypothesis*. This may, however, be an apparent inconsistency due to a difference in the treatment of scalarity by Holleman and us. Both Holleman's study and Giora's functional equivalence hypothesis have pragmatic discursal orientation. The present study, however, points up the role of the semantics in the interpretation of these expressions in sentences out of global context and with this purpose it puts the spotlight on our understanding of adjectival antonyms with and without negation as well as adjectival antonyms modified by moderating and approximating degree modifiers (*ganska* 'fairly' and *nästan* 'almost'). In search for an explanation, we thereby put special emphasis on the role of boundaries in the semantics of these expressions and the implications that such configurations might have for language comprehension.⁴

Paradis (1997:147–157) investigated the scaling force of the English moderators *quite*, *rather*, *pretty* and *fairly* in combination with ten antonymic adjectives. The investigation involved two experiments where two different intonation patterns were contrasted. 25 × 2 subjects judged the scaling force of the above moderators on a 9-point scale. The total mean force of the four modifiers was 6.07 when the adjectives carried the nuclear tone and 4.71 when the tone accent was on the modifier. The experiments thus showed that the scaling force of all the modifiers was higher when the nucleus went on the adjectives in which case all the modifiers had a slight reinforcing effect. The scaling force was lower when the moderating adverbs carried nucleus. Under that condition, all of them except *rather* was judged lower than 5. *Rather* has the strongest boosting power of the four and *fairly* is the more attenuating. By and large, in both experiments the moderators were placed around the middle of the 9-point-scale.

2. Aim and hypothesis

The aim of this study is to account for the role of the negator of unbounded and bounded antonyms in Swedish as well as to match the role of the negator (*inte* 'not') with the role of two degree modifiers, one unbounded (*ganska* 'fairly') and one bounded (*nästan* 'almost'). Our main hypothesis and its corollary predictions are as follows:

2.1. Hypothesis

Negation effects are sensitive to boundedness. When the negator combines with a bounded antonym, it operates on the boundary configuration resulting in an absolute opposite, but, when the negator combines with an unbounded antonym, it operates as a scalar, unbounded configuration, resulting in attenuation rather than elimination of the negated concept.

⁴ In a similar vein also within the cognitive framework, Yamanashi (2000:243–254) puts forward the view that the notion of negation is dependent on experience of spatial cognition. Evidence for this view is based on the Japanese negation marker *nai*. The study extends from direct to indirect negatives whose meanings are taken to be metaphorical applications of basic cognitive construals such as containment, boundedness and subjectivity.

2.2. Predictions

- There will be consistency within the group of unbounded antonyms with respect to the participants' judgements that $X \neq \text{inte } Y$ and $Y \neq \text{inte } X$ ('X' \neq 'not Y' and 'Y' \neq 'not X').
- There will be consistency within the group of bounded antonyms with respect to the participants' judgements that $X = \text{inte } Y$ and $Y = \text{inte } X$ ('X' = 'not Y' and 'Y' = 'not X').
- The negated unbounded antonyms, *inte X* and *inte Y* will correspond to *ganska Y* and *ganska X*, respectively (*not narrow* \approx *fairly wide* and *not wide* \approx *fairly narrow*).
- The negated bounded antonyms, *inte X* and *inte Y* will not correspond to *nästan Y* and *nästan X*, respectively (*not dead* \neq *almost alive* and *not alive* \neq *almost dead*).
- The judgements of the members of each antonym pair will be symmetrical, both with and without negation.
- The response times for modified antonyms, *not* + antonym as well as degree modifier + antonym will be longer than the response time for bare antonyms.

3. Material and procedure

In order to test our hypothesis, two experiments were set up. Experiment 1 investigated how native speakers of Swedish interpreted unbounded antonyms in negated and non-negated contexts. Experiment 2 investigated native Swedish speakers' interpretations of bounded antonyms in negated and non-negated contexts. In addition, Experiment 2 tested how both bounded and unbounded antonyms were interpreted when modified by degree modifiers such as *nästan* 'almost' in combination with bounded antonyms and *ganska* 'fairly' with unbounded antonyms.

The experimental software used in both the experiments was E-prime, which is a commercially available Windows-based presentation program with a graphical interface, a scripting language similar to Visual Basic and response collection.⁵ E-prime conveniently logged the ratings as well as the response times in separate files for each of the participants.

The real purpose of the study was not revealed to the participants. They were asked to participate in a readability test. The experiments were carried out on line. The information and the tasks were presented on the computer screen in the following order:

- questions about personal data (name, age, sex, occupation, native language and parents' native language);
- practical instructions such as how to do the mouse-clicks and information about the fact that the test was self-paced;
- two practice trials;
- judgement tasks: Experiment 1: 80 judgement tasks and Experiment 2: 85 judgement tasks.

As Fig. 1 shows, the top sentence presented the participants with statements such as *Vägen längs kusten är inte bred* 'The road along the coast is not wide'. All test sentences consisted of two phrases: a noun phrase (NP) and a verb phrase (VP). The NP consisted of a noun and a prepositional phrase (PP) and the VP of a copula (COP) and an adjective (ADJ) with or without negation (NEG), i.e. N PP COP (NEG) ADJ. The statement was followed by a question *Vilken typ*

⁵ Read more about E-prime on <http://www.pstnet.com/products/e-prime/>.

Vägen längs kusten är inte
bred.

Vilken typ av väg är det?

□ □ □ □ □ □ □ □ □ □ □

stig motorväg

Fig. 1. An example of a task from the experiment (screen dump).

av väg är det? ‘What is the road like?’. The task of the participants was then to grade how wide they thought the road was on the scale consisting of eleven boxes. We deliberately avoided using either of the antonyms, i.e. in this case neither ‘wide’ nor ‘narrow’, in the question or as end-points of the scale. The scale end-points were designated with tags such as *stig* ‘path’ and *motorväg* ‘motorway’. None of the end-points were numerical. No global context was provided, and no attempt was made to control individual contextual interpretations. The constraints that the participants had to consider were the out-of-context statements expressed by the top sentence in combination with the two end-points on the 11-point scale. In other words, the participants had to activate a more specific context themselves, which means that the contexts were bound to differ across the individuals. The structure of the distracters was not the same as for the Test sets because we did not want to make the experiments monotonous. *Selma hatar Otto* ‘Selma hates Otto’ is an example of a distracter. The question asked was *Hur är Selmas känslor för Otto?* ‘What are Selma’s feelings for Otto’, and the end-points of the scale were *kalla* ‘cold’ and *varma* ‘hot’. The participants in the two experiments did not overlap.

In both the experiments, repeated-measures ANOVA analyses were performed on the four conditions, i.e. X polarity and Y polarity with and without negation. The two ANOVA analyses that were performed in the experiments were a subject analysis and an item analysis. In the subject analysis each participant was the basic element for analysis. All responses for the individual participant were averaged within each of the four conditions yielding four numbers per participant. After that, a repeated-measures ANOVA was performed on these data. In the item analysis each item is the basic element for analysis. The ranks given by each participant in each condition were averaged resulting in four numbers for each item, and then a repeated-measures ANOVA was performed on these data. Finally, Tukey’s post hoc test was used to compare the differences between groups. The same procedure was used for the response times.

4. Experiment 1: unbounded antonyms with and without negation

Experiment 1 investigated the interpretation of ten Swedish unbounded antonym pairs and their negated equivalents. Our hypothesis was that *not* in the context of unbounded adjectives would not be interpreted as a logical operator in natural language, i.e. ‘not narrow’ \neq ‘wide’. Rather, ‘not’ in combination with unbounded adjective meanings would be interpreted as an attenuating degree modifier. That is, *not narrow* is by and large synonymous with ‘fairly wide’ and *not wide* is approximately the same as ‘fairly narrow’.

4.1. Participants

Thirty-one informants participated in the experiment: 14 men and 17 women. They were between 18 and 73 years of age. All of the them had some kind of relation to Lund University; they were students, administrative staff, teachers, and caretakers. Their native language was Swedish.

4.2. Stimuli

Ten unbounded adjectives and their antonyms were included in the test set. The adjective pairs represented two different morphological roots, i.e. they were not derived, as for example *possible-impossible*.

Table 1 shows Test set 1 consisting of ten Swedish unbounded antonym pairs and their translation equivalents in English. The first column gives the member of the antonymic pair whose meanings are lacking in the designated property. We refer to them as category *X*. The second column shows the members of the pair that has much of the property designated. They are referred to as *Y*. The division into *X* and *Y* is thus motivated in the sense that *X* has little of LENGTH, DARKNESS, WIDTH, HEIGHT, etc. The two columns to the right list the end-points of the 11-point scales.

Each adjective in the Test set appeared both with and without negation. In addition to the 40 test items, there were also 48 distracters. The test items and the distracters were randomized for each participant and appeared one at a time on the screen as in Fig. 1. See Appendix A for a complete list of the sentences used as stimuli.

4.3. Results and discussion

The averages of the ratings by the informants are shown in Table 2. The mean rating of the *X* member of the antonym pair is 3.25, and the rating for its negated antonym *inte Y* ('not *Y*') is 4.19, *inte X* ('not *X*') is 7.12 and *Y* is 8.63. The standard deviations given in Table 2 showed that the judgements made by the participants vary between 1.35 and 1.62, suggesting that there is a high degree of consensus across the participants' interpretations of the stimuli.

Table 1

Test set 1: Ten Swedish unbounded adjectives and their antonyms in the leftmost columns and their corresponding end-points in the columns to the right

Adjectives having little of the designated property (<i>X</i>)	Adjectives having much of the designated property (<i>Y</i>)	End-points □□□□□□□□□□	
		' <i>X</i> '	' <i>Y</i> '
<i>kort</i> 'short'	<i>lång</i> 'tall'	<i>pyssling</i> 'pixie'	<i>jätte</i> 'giant'
<i>ljus</i> 'light'	<i>mörk</i> 'dark'	<i>vit</i> 'white'	<i>svart</i> 'black'
<i>smal</i> 'narrow'	<i>bred</i> 'wide'	<i>stig</i> 'path'	<i>motorväg</i> 'motorway'
<i>låga</i> 'low'	<i>höga</i> 'high'	<i>busskur</i> 'bus-shelter'	<i>skyskrapa</i> 'skyscraper'
<i>lätt</i> 'light'	<i>tung</i> 'heavy'	<i>fjäder</i> 'feather'	<i>elefant</i> 'elephant'
<i>tunn</i> 'thin'	<i>tjock</i> 'thick'	<i>genomskinlig</i> 'transparent'	<i>ogenomskinlig</i> 'opaque'
<i>fult</i> 'ugly'	<i>vackert</i> 'beautiful'	<i>motbjudande</i> 'repulsive'	<i>tilltalande</i> 'attractive'
<i>kall</i> 'cool/cold'	<i>varm</i> 'warm/hot'	<i>isigt</i> 'icy'	<i>kokhett</i> 'boiling'
<i>fattig</i> 'poor'	<i>rik</i> 'rich'	<i>uteliggartiliv</i> 'homeless'	<i>kungligt</i> 'royal'
<i>ledsna</i> 'sad'	<i>glada</i> 'happy'	<i>grät</i> 'cried'	<i>skrattade</i> 'laughed'

Table 2

Ratings of unbounded adjectives *X* and *Y* and their negated antonyms *inte X* and *inte Y*

Condition	Mean	S.D.
<i>X</i>	3.25	1.50
<i>inte Y</i>	4.19	1.35
<i>inte X</i>	7.12	1.62
<i>Y</i>	8.63	1.51

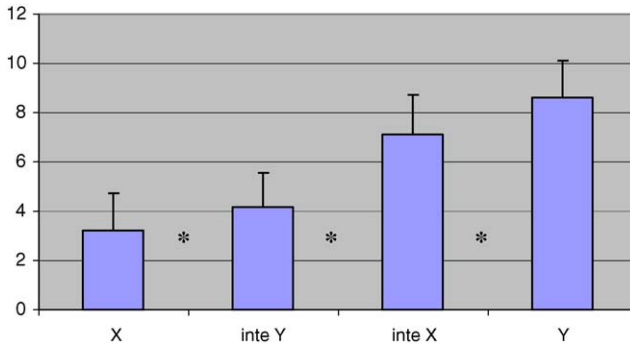


Fig. 2. Ratings of unbounded adjectives and their negated antonyms.

According to the repeated-measures ANOVA, the differences between the four conditions were significant both in the subject analysis ($F_1[3,90] = 374.039, p < .001$) and in the item analysis ($F_2[3,27] = 238.869, p < .05$). Post hoc comparisons using Tukey's HSD procedure suggested that the four conditions should be separated in four subgroups as shown in Fig. 2. There were significant differences between the non-negated adjectives in the test set and their negated antonyms, *X* versus *inte Y* ('not *Y*') and *Y* versus *inte X* ('not *X*'), as well as between *inte X* ('not *X*') and *inte Y* ('not *Y*'). Thus, *X* and *inte Y* ('not *Y*') were not interpreted as synonyms, neither were *inte X* ('not *X*') and *Y*.⁶ As predicted, the judgements were '*X*' \neq '*not Y*' and '*Y*' \neq '*not X*'. What happened was that the negator in combination with an unbounded adjective had the effect of moving the interpretation to the opposite side of the scale as compared to where the non-negated adjective would be positioned. The judgements were symmetrical; both *inte X* ('not *X*') and *inte Y* ('not *Y*') were located somewhere in the middle of the opposite side of the scale.

Furthermore, the means for the response times (RT) varied between 6.58 and 8.87 s, which indicates that, generally, the subjects spent quite a bit of time thinking before they made their decisions about the interpretations. The standard deviations for the RTs were large for all four groups. They varied between 3.93 and 5.64 s. In this context, it deserves to be noted again that the experiment was self-paced and since we did not in any way control for time, we do not want to put too much importance to these results. However, the numbers presented in Table 3 are interesting in that they show that the negated expressions took significantly longer to judge, which is a result that we interpret as a sign of them being more complex and therefore more difficult to process.

⁶ The asterisks in Fig. 2, and in all Figures mark significant differences between the bars, and the vertical lines on top of the bars signify the standard deviations across the responses made by the participants.

Table 3

Mean response times (in s) and standard deviations for the unbounded adjectives and their negated antonyms

Condition	Mean	S.D.
X	6.58	4.43
Y	6.90	3.93
inte X	8.87	5.66
inte Y	8.69	5.61

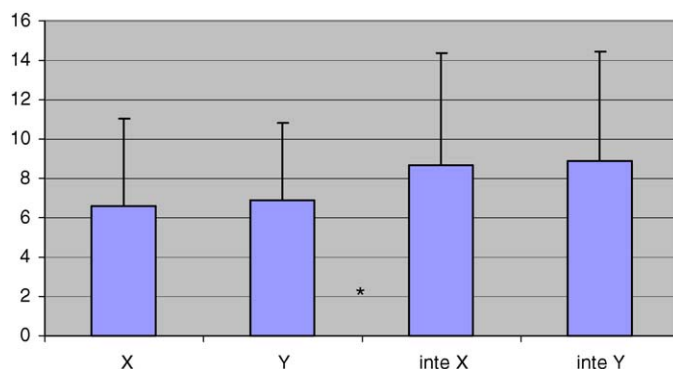


Fig. 3. Mean response times (in s) and standard deviations for the unbounded adjectives.

Again the differences were tested in a subject analysis as well as in an item analysis. The overall effect was significant in the subject analysis ($F_1[3,90] = 19.778, p < .001$) and in the item analysis ($F_2[3,27] = 26.514, p < .05$). Post hoc comparisons using Tukey's HSD procedure suggested that the four conditions be separated in two subgroups, the two negated conditions and the two non-negated conditions (Fig. 3).

In sum, our hypothesis that 'not' in front of unbounded adjectives would not evoke the meaning of an absolute opposite was confirmed for all antonym pairs, individually as well as a group. Rather, 'not' seemed to be interpreted as having an attenuating effect (see section 5.3.2). Furthermore, the results of Experiment 1 showed that there was a high degree of consensus across the subjects concerning the interpretation of the expressions included in the test. The response times for the negated expressions were significantly longer than for the non-negated items, which is an indication that they are more difficult to process.

5. Experiment 2: bounded antonyms with and without negation and bounded as well as unbounded adjectives with approximating/moderating degree modifiers

Experiment 2 investigated the participants' interpretations of bounded antonyms with and without negation. Our hypothesis was that the negator in the context of bounded antonyms functions as an absolutive operator, i.e. 'X' entails 'not Y' and 'Y' entails 'not X'. This means that *död* = 'inte levande' (*dead* = 'not alive') and *levande* = 'inte död' (*alive* = 'not dead'). Experiment 2 also investigated the scaling potential of both bounded and unbounded antonyms in combination with the degree modifiers *nästan* 'almost' and *ganska* 'fairly', respectively.

Table 4

Test set 2: five Swedish bounded adjectives and their antonyms in the left columns and their corresponding end-points in the right columns

Adjectives lacking the designated property (X)	Adjectives having the designated property (Y)	End-points <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
		‘X’	‘Y’
<i>tomt</i> ‘empty’	<i>fullt</i> ‘full’	<i>inget alls</i> ‘nothing at all’	<i>maximalt</i> ‘maximal’
<i>fel</i> ‘wrong’	<i>rätt</i> ‘right’	<i>inte alls</i> ‘not at all’	<i>helt och hållet</i> ‘completely’
<i>död</i> ‘dead’	<i>levande</i> ‘alive’	<i>inte alls</i> ‘not at all’	<i>helt och hållet</i> ‘completely’
<i>steril</i> ‘sterile’	<i>fertil</i> ‘fertile’	<i>inte alls</i> ‘not at all’	<i>maximalt</i> ‘maximal’
<i>bundna</i> ‘bound’	<i>fria</i> ‘free’	<i>inte alls</i> ‘not at all’	<i>maximalt</i> ‘maximal’

5.1. Participants

Thirty-two participants between 19 and 56 years of age took part in the ratings. As in Experiment 1, they were students and staff at Lund University. None of them had participated in Experiment 1. All the participants were native speakers of Swedish.

5.2. Stimuli

Five Swedish bounded adjectives and their antonyms were included in the test set for Experiment 2. The test words were inserted in sentences of the same structure as in Experiment 1: N PP COP (NEG) ADJ.

While there are numerous adjectives that qualify as members of the test set in Experiment 1, the strongly biased bounded adjectival antonyms that qualify as members of the test set for Experiment 2 are very few indeed. The adjectives in Test set 2 (see Table 4) are all natural and compatible with totality modifiers, such as *helt* ‘totally’ and *nästan* ‘almost’ (Paradis, 2001:50). Again, we avoided morphologically derived words.

Apart from the 20 test sentences (5 × 4) with negated and non-negated bounded adjectives, there were 12 sentences (6 × 2) with the modifier *ganska* ‘fairly’ and 5 sentences (5 × 1) with *nästan* ‘almost’ (see Table 5), as well as 48 distracters, which in total makes 85 judgement tasks. See Appendix A for the full sentences used as stimuli. In each antonym pair, we excluded the

Table 5

The adjectives modified by *ganska* ‘fairly’ and *nästan* ‘almost’ in the test set

Unbounded adjectives with degree modifier	Bounded adjectives with degree modifier
<i>ganska kort</i> ‘fairly short’	<i>nästan fullt</i> ‘almost full’
<i>ganska lång</i> ‘fairly tall’	<i>nästan rätt</i> ‘almost right’
<i>ganska ljus</i> ‘fairly light’	<i>nästan död</i> ‘almost dead’
<i>ganska mörk</i> ‘fairly dark’	<i>nästan steril</i> ‘almost sterile’
<i>ganska smal</i> ‘fairly narrow’	<i>nästan fria</i> ‘almost free’
<i>ganska bred</i> ‘fairly wide’	
<i>ganska låga</i> ‘fairly low’	
<i>ganska höga</i> ‘fairly high’	
<i>ganska fult</i> ‘fairly ugly’	
<i>ganska vackert</i> ‘fairly beautiful’	
<i>ganska ledsna</i> ‘fairly sad’	
<i>ganska glada</i> ‘fairly happy’	

Table 6
Ratings for the bounded adjectives and their negated antonyms

Condition	Mean	S.D.
X	1.36	0.87
<i>inte Y</i>	3.06	2.49
<i>inte X</i>	7.39	2.99
Y	9.66	2.43

members of the pairs that were not natural with *nästan* ‘almost’. For instance, *nästan fertile* ‘almost fertile’ does not make sense. *Nästan tom* ‘almost empty’ is acceptable, but we excluded it because we only wanted one degree modifier + adjective from each pair.

5.3. Results and discussion

The results from Experiment 2 are presented in three different sections: The first section 5.3.1, deals with bounded adjectives and their negated antonyms, the second, 5.3.2, with degree modifiers with unbounded adjectives and their negated antonyms and the third, 5.3.3, with degree modifiers with bounded adjectives and their negated antonyms.

5.3.1. Bounded antonyms with and without negation

The results of the ratings of the bounded adjectives and their negated antonyms are presented in Table 6 and Fig. 4. The mean rating for X was 1.36, its negated antonym, *inte Y* ‘not Y’, 3.06. *inte X* ‘not X’ was rated 7.39 and Y 9.66. The standard deviations of the bounded adjectives varied between 0.87 and 2.99. They varied more than the standard deviations for the unbounded adjectives which were all between 1.35 and 1.62. On the other hand, there was greater agreement on the judgement of condition X (0.87) meanings lacking a certain property.

As in Experiment 1 the overall differences across the four conditions were tested in two separate analyses of variance, one by subjects and the other one by items. The overall effect was significant in the subject analysis ($F_1[3,93] = 526.417, p < .001$) and in the item analysis ($F_2[3,12] = 31.838, p < .05$). Post hoc comparisons were carried out again using Tukey’s HSD procedure. In the subject analysis, the four means should be regarded as four different subgroups, but in the analysis by item, the four conditions could be separated into two subgroups: on the one hand X and *inte Y* ‘not Y’ and on the other *inte X* ‘not X’ and Y, as is shown in Fig. 4. The reason for the different result in the post hoc comparison may be due to the fact that there were many

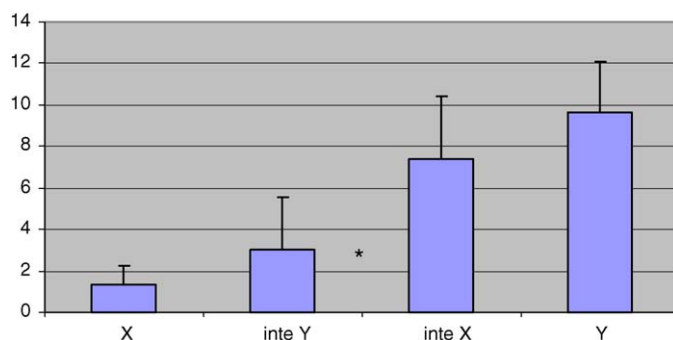


Fig. 4. Mean ratings of bounded adjectives and their negated antonyms.

more subjects than adjectives. Had these numbers been more equal, then the results might have been more similar. It may also be noted that for both the unbounded and bounded adjectives, *X* and *inte Y* ('not Y') are more similar than *inte X* ('not X') and *Y*. These results have not been pursued further here, but will be investigated in greater detail in future studies.

Taking a closer look at the individual word pairs in the Test set we found that for two of the adjectives all of the participants were in total agreement on the ratings. This was the case for *tom* 'empty' and *död* 'dead', which both had standard deviations of 0 in their non-negated forms. This was not the case for the rest of the adjectives in the test set, i.e. for *full* 'full', *fel* 'wrong', *rätt* 'right', *levande* 'alive', *steril* 'sterile', *fertil* 'fertile', *bundna* 'bounded' and *fria* 'free' and for all the negated forms. The reason for the full agreement on the interpretations of *tom* 'empty' and *död* 'dead' must be that these meanings are strongly non-scalar. They are also zero-oriented which makes it hard to lay their meanings out on a scale. Another thing that was not consistent across the bounded antonym pairs was the ordering of the interpretations. As Fig. 4 shows, the overall order of the interpretations of the negated and non-negated antonyms was $X - inte Y - inte X - Y$ ($X - \text{not } Y - \text{not } X - Y$) in the whole test set. This was, however, not the case for *tom* 'empty' – *full* 'full', for which the pattern was instead $X - inte X - inte Y - Y$ ($X - \text{not } X - \text{not } Y - Y$). The results of our experiment for the bounded adjectives showed that there were in fact four types of bounded meaning structures.

- (i) **DÖD – LEVANDE (DEAD – ALIVE)**
död 'dead' = *inte levande* 'not alive'
levande 'alive' = *inte död* 'not dead'
- (ii) **FEL – RÄTT (WRONG – RIGHT)**
fel 'wrong' = *inte rätt* 'not right'
rätt 'right' \neq *inte fel* 'not wrong'
- (iii) **BUNDNA – FRIA (BOUND – FREE)**
bundna 'bound' \neq *inte fria* 'not free'
fria 'free' = *inte bundna* 'not bound'
- (iv) **TOM – FULL (EMPTY – FULL)**
tom 'empty' \neq *inte full* 'not full'
full 'full' \neq *inte tom* 'not empty'

Our prediction about the judgements of bounded adjectives was borne out for (i) DÖD-LEVANDE (DEAD – ALIVE) where the entailment relation 'not X' = 'Y' and 'not Y' = 'X' held good (Fig. 5).

According to the judgements made by the participants, *död* 'dead' and *inte levande* 'not alive' form one group that differs significantly from *inte död* 'not dead' and *levande* 'alive'. The interpretational ordering made by the participants is *död* – *inte levande* – *inte död* – *levande* 'dead' – 'not alive' – 'not dead' – 'alive'.

As Figs. 6 and 7 show, *fel* 'wrong' and *rätt* 'right' and *steril* 'sterile' and *fertil* 'fertile' were interpreted in the same way by the participants. *Fel* 'wrong' and *inte rätt* 'not right' were not judged to be significantly different and the same holds for *steril* 'sterile' and *inte fertil* 'not fertile'. Both *rätt* 'right' and *fertil* 'fertile', on the other hand, may easily be conceived of in a scalar fashion and accordingly the participants judge *inte fel* 'not wrong' to differ significantly from *rätt* 'right', and *inte steril* 'not sterile' from *fertil* 'fertile'. In other words, the participants' judgements showed that there is a scaling potential on the 'Y'-side of the domain. The antonymic

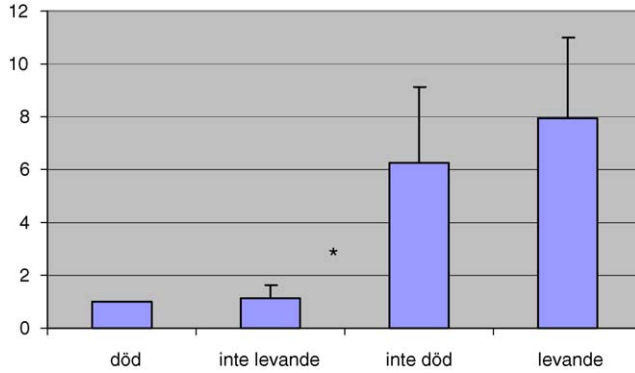


Fig. 5. Mean ratings of *död-levande* 'dead-alive' and their negated antonyms.

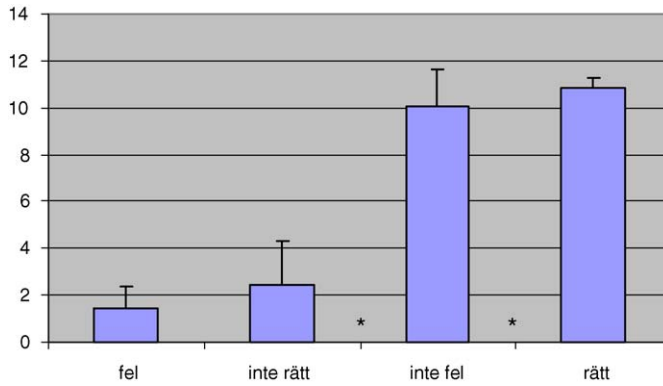


Fig. 6. Mean ratings of *fel-rätt* 'wrong-right' and their negated antonyms.

relation was asymmetrical with respect to its configurational potential. *Fel* 'wrong' and *steril* 'sterile' were more strongly biased towards a bounded totality reading, while *rätt* 'right' and *fertil* 'fertile' tended towards a scalar interpretation. The interpretational ordering made by the participants was again $X - \text{inte } Y - \text{inte } X - Y$ (X – not Y – not X – Y).

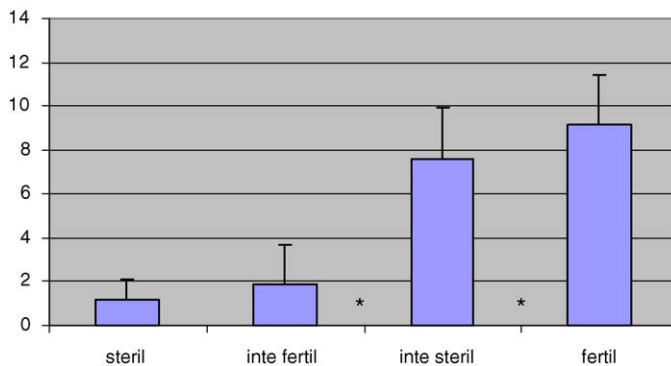


Fig. 7. Mean ratings of *steril-fertil* 'sterile-fertile' and their negated antonyms.

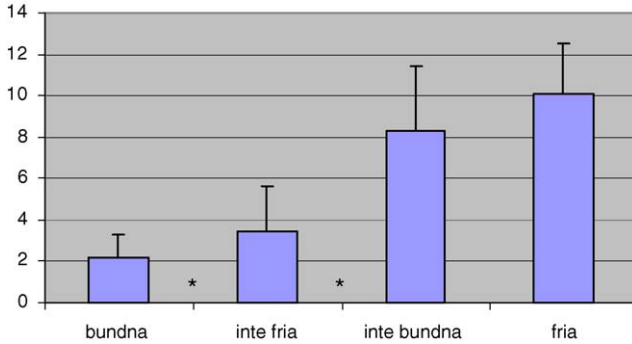


Fig. 8. Mean ratings of *bundna-fria* 'bound-free' and their negated antonyms.

Fig. 8 shows a mirror image of Figs. 6 and 7. The order is again $X - inte Y - inte X - Y$ ($X - not Y - not X - Y$). The difference between the *bundna* 'bound' and *inte fria* 'not free' is significant, but there was no significant difference between *inte bundna* 'not bound' and *fria* 'free'. This means that there is a scaling potential on the 'X'-side of the domain and the antonymic relation was asymmetrical in its configuration.

Finally, in the case of the fourth type of bounded antonym pairs, *tom* 'tom' and *full* 'full', our predictions were not borne out at all, see Fig. 9.

As Fig. 9 shows, the order of the interpretations of the negated antonyms was reversed as compared to the rest of the bounded adjectives and in fact to all the adjectives in this study. Instead of the pattern $X - inte Y - inte X - Y$, the order was $X - inte X - inte Y - Y$ ('X' - 'not X' - 'not Y' - 'Y') for *tom* 'empty' - *full* 'full'. Moreover, the differences between all four test items differed significantly. The explanation for the judgements made by the participants is that 'empty' and 'full' are both bounded end-points which do not exhaust the full domain, but require a scale structure in between them. The pivotal point is halfway between the end-points. 'Full' requires a maximum degree of fullness and similarly 'empty' requires a maximum degree of emptiness. The role of the negator for this type of antonymic relation is to express non-totally. The negator resembles 'almost' in being located at the same side of the 11-point scale, which is not the case for any other adjective in either of the test sets. *Nästan full* 'almost full' and *inte full* 'not full' were both located in the upper part of the scale, while the pattern for *nästan rätt* 'almost right' and *inte rätt* 'not right' are on opposite sides of the scale (see section 5.3.2).

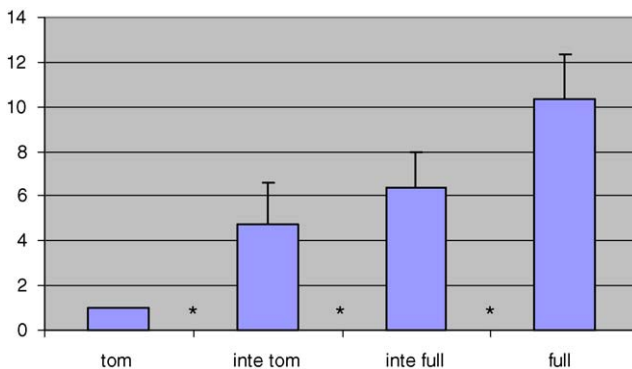


Fig. 9. Mean ratings of *tom-full* 'empty-full' and their negated antonyms.

Table 7

Mean response times (in s) for the bounded adjectives and their negated antonyms

Condition	Mean	S.D.
<i>X</i>	5.18	3.27
<i>Y</i>	5.85	3.63
<i>inte Y</i>	7.85	6.32
<i>inte X</i>	8.60	5.03

Similar to Experiment 1, the negated adjectives take longer to process than the non-negated. Table 7 shows that the mean RTs for the non-negated test items, *X* and *Y*, are less than 6 s, while the means for *inte Y* ‘not *Y*’ is 8.60 s, and *inte X* ‘not *X*’ is 7.85 s. The ratings in terms of standard deviations varied between 3.27 and 6.32 which was slightly more than the response times for the unbounded adjective with standard deviations from 3.93 to 5.66. Again, the differences were tested in two separate analyses of variance: one by subject and the other by items. The main effect was significant in the subject analysis ($F_1[3,93] = 15.519, p < .001$) and in the item analysis ($F_2[3,12] = 9.584, p < .05$). The post hoc comparisons suggested that the two negated conditions took longer time than the two non-negated conditions, even though the difference between the *inte Y* ‘not *Y*’ and *Y* was not significant in the item analysis, which again might be due to the small number of items within each condition. As Fig. 10 shows, the pattern is more of a continuum. Like for the unbounded readings, the negated adjectives took longer to respond to.

To sum up, the data for the bounded adjectives showed that there was less consistency across the interpretations for the bounded adjectives and their negated variants than for the unbounded data set. On the other hand, in two cases, the participants were in total agreement about the ratings. Moreover, we expected *inte X* ‘not *X*’ to be interpreted as *Y* and vice versa, which was the case for *död* ‘dead’ and *levande* ‘alive’ only, not for any of the other pairs. The interpretations of ‘wrong’ and ‘right’, ‘sterile’ and ‘fertile’, ‘bound’ and ‘free’ and their negated variants revealed an asymmetric pattern. The judgements about *tom* ‘empty’ and *full* ‘full’ proved to be symmetrical but divided the domain in an ‘empty’/‘not empty’ side and a ‘not full’/‘full’ side. This means that the prediction about symmetry was wrong for the bounded adjectives. The relative order between the test items was $X - inte Y - inte X - Y$ ($X - not Y - not X - Y$), while for the bounded word pairs that signify end-points, the order was instead $X - inte X - inte Y - Y$ ($X - not X -$

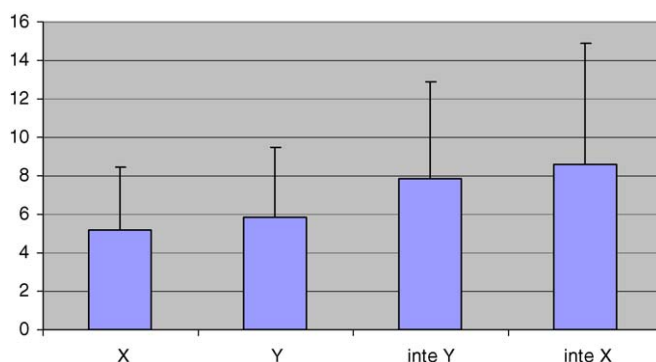


Fig. 10. Mean response times (in s) for the bounded adjectives and their negated antonyms.

Table 8

Ratings for the unbounded adjectives, their negated antonyms and the adjectives modified by *ganska* 'fairly'

Condition	Mean	S.D.
<i>X</i>	3.32	1.49
<i>ganska X</i>	3.61	1.12
<i>inte Y</i>	4.21	1.28
<i>inte X</i>	7.22	1.66
<i>ganska Y</i>	8.03	1.45
<i>Y</i>	8.82	1.36

not *Y* – *Y*). Another observation was that some of the adjectival meanings were more strongly biased as bounded meanings, whereas others easily lent themselves to be laid out on a scale.

By and large the response times were not longer for the bounded data set than for the unbounded data set, but there was more variation across the participants, i.e. larger standard deviations. Again, the negated test items took significantly longer to process than the bare adjectives.

5.3.2. Unbounded and bounded antonyms with degree modifiers

The results of the ratings involving the ratings of the unbounded adjectives in Experiment 1 and the unbounded adjectives modified by *ganska* 'fairly' in Experiment 2 are presented in Table 8 and Fig. 11. The difference between the six conditions *X* – *ganska X* – *inte Y* – *inte X* – *ganska Y* – *Y* (*X* – fairly *X* – not *Y* – not *X* – fairly *Y* – *Y*) were tested in a variance analysis by item only, since the participants were not the same. The overall differences were significant in the item analysis ($F_2[5,25] = 132.994, p < .05$). The post hoc analysis showed that the differences at the end-points *X* – *ganska X* and *ganska Y* – *Y* (*X* – fairly *X* and fairly *Y* – *Y*) were not significant, and the differences between *ganska X* – *inte Y* ('fairly *X* – 'not *Y*') and *inte X* – *ganska Y* ('not *X*' – 'fairly *Y*') were not significant either. However, there was a clear distinction between the two poles, where, on both sides, the condition without modification had the strongest expression followed by the adjective modified by the degree modifier *ganska* 'fairly' followed by the negated adjective. As predicted, there were no significant differences between 'fairly' + adjective and 'not' + adjective.

The final comparison concerned the bounded adjectives in Experiment 2 with negation and with *nästan* 'almost'. *Nästan* was tested with only five of the adjectives, one member of each pair

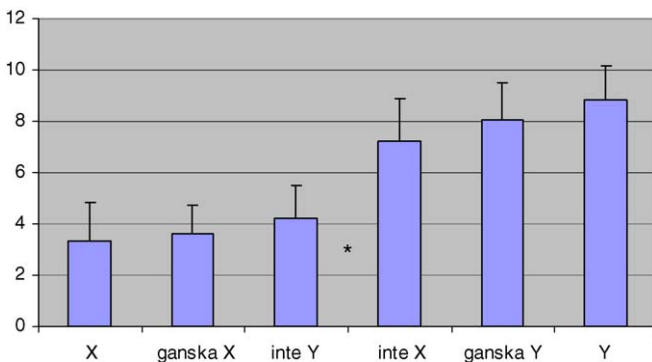


Fig. 11. Mean ratings of unbounded adjectives, their negated antonyms and the adjectives modified by *ganska* 'fairly'.

Table 9
Ratings for the bounded adjectives, their negated antonyms and the adjectives modified by *nästan* ‘almost’

Condition	Mean	S.D.
X	1.36	0.87
<i>inte Y</i>	2.41	1.29
<i>nästan X</i>	3.06	2.49
<i>inte X</i>	7.39	2.99
<i>nästan Y</i>	8.13	2.26
Y	9.66	2.43

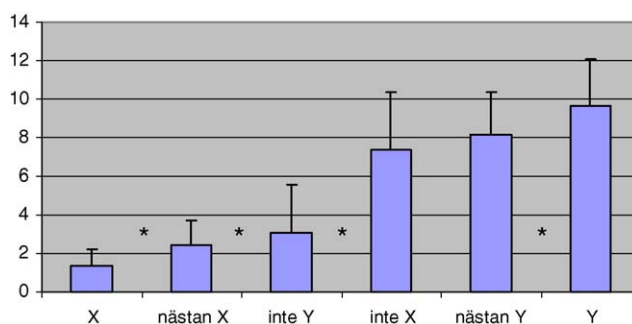


Fig. 12. Mean ratings of bounded adjectives, their negated antonyms and the adjectives modified by *nästan* ‘almost’.

(*nästan full* ‘almost full’, *nästan rätt* ‘almost right’, *nästan död* ‘almost dead’, *nästan steril* ‘almost sterile’, *nästan fri* ‘almost free’), since it does not combine very well with four of the antonyms, e.g. *nästan levande* ‘almost alive’. Table 9 lists the ratings for the bounded adjectives, their negated antonyms and the adjectives modified by *nästan* ‘almost’. Unlike for *ganska* ‘fairly’, the differences were tested in a subject analysis of variance only. This was possible since the test items were all in Experiment 2 and the subjects were the same. No repeated item analysis was performed since *nästan* did not combine with all members of the antonym pairs. The overall effect was significant in the subject analysis ($F_1[5,155] = 381.660, p < .001$). The results of the post hoc comparisons were that all the differences were significant except for the difference between *inte X* and *nästan Y* ‘not X’ and ‘almost Y’ (Fig. 12).

Table 10 and Fig. 13 show that the mean RTs for the unbounded adjectives with and without negation and with the modifier *ganska* ‘fairly’ form a continuum. The figures in the post hoc analysis show that X, Y, *ganska Y* (‘X’, ‘Y’ and ‘fairly Y’) form one group, and *ganska X*, *inte X*

Table 10
Mean response times (in s) for the unbounded adjectives, their negated antonyms and the adjectives modified by *ganska* ‘fairly’

Condition	Mean	S.D.
X	6.58	4.43
Y	6.90	3.93
<i>ganska Y</i>	7.15	4.13
<i>ganska X</i>	7.69	5.41
<i>inte Y</i>	8.69	5.61
<i>inte X</i>	8.87	5.66

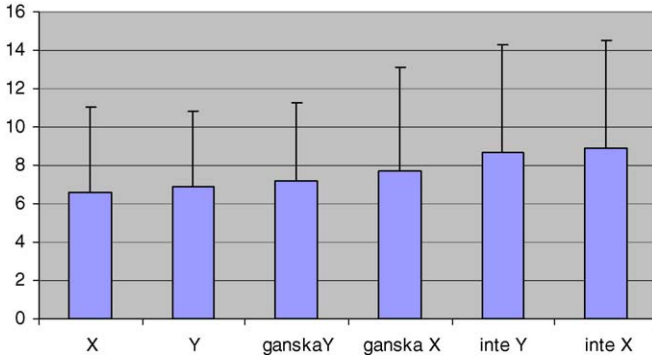


Fig. 13. Mean response times (in s) for the unbounded adjectives, their negated antonyms and the adjectives modified by *ganska* 'fairly'.

Table 11

Mean response times (in s) for the bounded adjectives, their negated antonyms and the adjectives modified by *nästan* 'almost'

Condition	Mean	S.D.
X	5.18	3.27
Y	5.85	3.63
<i>nästan</i> X	5.75	3.18
<i>nästan</i> Y	6.77	3.91
<i>inte</i> Y	7.85	5.03
<i>inte</i> X	8.60	6.32

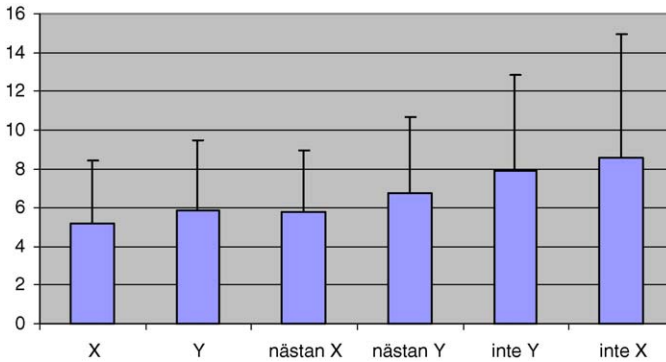


Fig. 14. Mean response times (in s) for the bounded adjectives, their negated antonyms and the adjectives modified by *nästan* 'almost'.

and *inte* Y ('fairly X', 'not X' and 'not Y') form another group overlapping with the first one. In spite of the fact that there were overlaps, it is interesting to note that the negated adjectives took the longest to process, and that the adjectives with *ganska* took longer to process than the bare adjectives, but they were processed faster than the negated ones. The same pattern held for the bounded antonyms, see Table 11 and Fig. 14, even though the picture for the subgroups

was even more complex for them. Our explanation for the relatively longer response times for the negated adjectives than for the adjectives modified by the degree words *ganska* and *nåstan* was that in the case of negated expressions two counterfactual situations have to be judged against one another.

These results confirmed our hypothesis that the RTs for all modified antonyms were longer than for the bare antonyms, but at the same time they indicated that the negator is more complex to process than *ganska*. These tendencies for response times were also confirmed by Kaup and Zwaan (2003), MacDonald and Just (1989), Giora et al. (2005a), Hasson and Glucksberg (2006) and Kaup et al. (2006).

6. General discussion

The goal of this study was to test our hypothesis and predictions about how negated and non-negated adjectival antonyms are interpreted. More specifically, the study centred on the role of the negator of unbounded and bounded antonyms in Swedish. Some research has been carried out on the effect of negation in language processing, and two main hypotheses have been discussed in the literature. There has been general agreement that the negator is a signal to the addressee to suppress what is in the scope of the negator. Suppression is an automatic mechanism, which applies in all contexts. The suppression hypothesis has recently been challenged by the retention hypothesis, which predicts that the concept may be retained and mitigated and there is no automatic suppression. Rather, there are functional constraints on the processing and interpretation of negated concepts, and hence the negator may function as either a logical operator or a mitigator (Giora, *this issue*). The results of our investigation support the functional hypothesis. But, we also take a step further into the construals of negated meanings expressed as the boundedness hypothesis. BOUNDEDNESS is a type of configuration that is applicable to a whole range of meanings. It has a particularly clear effect on combinations of ‘not’ + adjectives and ‘degree modifiers’ + adjectives. In the case of unbounded meanings of adjectives, the boundedness hypothesis predicts that *narrow* does not mean the same as ‘not wide’. The role of the negator is more like the role of an attenuating degree modifier. In combination with bounded antonymic meanings, on the other hand, the negator is predicted to be interpreted in the same way as a logical operator in formal literalist approaches to meaning, i.e. expressing the absolute opposite p versus $\neg p$. The overall results of the experiments supported the boundedness hypothesis:

- (i) UNBOUNDED MEANINGS
 ‘narrow’ \neq ‘not wide’
 ‘wide’ \neq ‘not narrow’
- (ii) BOUNDED MEANINGS
 ‘dead’ = ‘not alive’
 ‘alive’ = ‘not dead’

Viewed as two sets of data, unbounded and bounded adjectives were interpreted differently by the participants, and with respect to the individual pairs none of the bounded adjective pairs were judged in the same way as the unbounded pairs.

There were, however, differences between the two types of antonyms in the consistency of the judgements made by the participants across the individual pairs. All the individual unbounded antonyms were judged in the same way by the participants, i.e. the individual patterns were the

same as the pattern for all the unbounded adjectives as a group, as shown in Fig. 2. The bounded meanings proved to be less robust as a test set. There were very few strongly biased bounded meanings; the exceptions were ‘dead’ and ‘empty’, for which all of the participants were in total agreement that neither ‘dead’ nor ‘empty’ could be laid out on a scale. All the other bounded meanings, however, were judged to be adaptable to partial configurations. As was noted in the theoretical discussion, it is almost always possible to coerce a bounded reading into an unbounded reading, i.e. laying it out on a scale, and the picture proved much more complex for the bounded meanings than for the unbounded meaning. The bounded meaning structures will have to be investigated more closely in future work and the test set will have to be extended in order to make stronger conclusions. The results of this investigation left us with four combinatorial types of negator and adjectival antonyms:

- (i) ‘dead’ = ‘not alive’ and ‘alive’ = ‘not dead’
- (ii) ‘wrong’ = ‘not right’ but ‘right’ \neq ‘not wrong’
- (iii) ‘bound’ \neq ‘not free’ but ‘free’ = ‘not bound’
- (iv) ‘empty’ \neq ‘not full’ and ‘full’ \neq ‘empty’

‘Dead’ and ‘alive’ behaved in the way predicted for bounded antonym pairs, which none of the other pairs did. ‘Dead’ and ‘not alive’ mean the same thing and so do ‘alive’ and ‘not dead’. The next two types of antonyms were not symmetrical. ‘Wrong’ and ‘not right’ were not significantly different, while ‘right’ and ‘not wrong’ were. ‘Fertile’ and ‘sterile’ were judged in the same way as ‘wrong’ and ‘right’. Furthermore, ‘bound’ differed significantly from ‘not free’ but ‘free’ was not judged to differ from ‘not bound’. Finally, ‘empty’ was judged to differ significantly from ‘full’ and vice versa. On the surface it looks like ‘empty’ and ‘full’ behaved in the same way as the unbounded adjectives did. This was not the case, however, since neither ‘not empty’ nor ‘not full’ were located on the opposite side of the scale by the participants. The order of the four conditions on the 11-point scale was ‘X’ – ‘not Y’ – ‘not X’ – ‘Y’ for all of the test items except for ‘empty’ and ‘full’, where the order was ‘empty’ – ‘not empty’ – ‘not full’ – ‘full’ (‘X’ – ‘not X’ – ‘not Y’ – ‘Y’).

Contrary to what has been suggested in the literature, all the unbounded antonyms in this study were ranked symmetrically with respect to the antonymic poles. Israel (2004:708) claimed that *She is not happy = She is sad*, but *She is not sad \neq She is happy*. In the case of *glad* ‘happy’ – *ledsen* ‘sad’, our results showed that the judgements were symmetrical. ‘Not happy’ \neq ‘sad’ and ‘not sad’ \neq ‘happy’. However, two types of bounded adjectives (ii) ‘wrong’ and ‘right’ and (iii) ‘bound’ and free’ were judged to be asymmetrical, i.e. *He was not right = He was wrong* but *He was not wrong \neq He was right*; *The horse was not bound = The horse was free* but *The horse was not free \neq The horse was bound*. Clearly, it is possible to create situational constraints that may be responsible for unexpected readings, e.g. Horn (1989:242) says “[t]wo expressions may denote the same objective reality but differ in terms of the conclusions they can be used to argue for; cf. *The glass is half empty* (\rightarrow we should fill it, or buy another) versus *The glass is half full* (\rightarrow we should, or can, empty it). This difference [...] is brought out on the scale reversal: a glass which is not half empty is more full than a glass that is not half full, since *not* here [...] equates ‘less than’”. In a similar way one might argue that a horse may be ‘not free’ because it is in a field with a fence. In other words there are alternative explanations for the judgements made by the participants. A plausible explanation for the judgements of ‘right’ and ‘wrong’ may be that speakers use the positive alternative for a more negative fact (cf. Colston, 1999 and Holleman, 2000 in sections 1.2 and 1.4). This is part of speakers’ knowledge of the interpretations of

subjective-evaluative words such as ‘right’ and ‘wrong’. Speakers use ‘not right’ instead of ‘wrong’ to be less offensive.

Our predictions that the interpretations of ‘not Y’ and ‘not X’ correspond to ‘degree modifier X’ and ‘degree modifier Y’ were confirmed for the unbounded adjectives. There were no significant differences either between ‘not Y’ and ‘fairly X’ or ‘not X’ and ‘fairly Y’ for the unbounded antonyms. Our prediction that there would be significant differences between bounded negated adjectives and the bounded adjectives modified by ‘almost’ was not proven completely right. ‘Almost X’ and ‘not Y’ differed significantly, but there was no significant difference between ‘not X’ and ‘almost Y’. The results for the bounded antonyms were less clear than for the unbounded ones, partly because of the fact that there were fewer test items.

Our final prediction was that the response times for antonyms modified by the negator or by either of the degree modifiers ‘fairly’ or ‘almost’ would be longer than the response times for bare antonyms. The prediction was proven right to the extent that the response times for ‘not X’ and ‘not Y’ in both experiments were significantly longer than the response times for *X* and *Y*. The response times for degree modifier + adjective were longer than the response times for the bare antonyms *X* and *Y*, but shorter than the negated antonyms. These differences were, however, not significant. The longer response times for the negated test items may be explained by the necessity for the language user to construe both a factual and the counterfactual space (Langacker, 1991; Fauconnier and Turner, 2002).

7. Conclusion

This paper has demonstrated that the interpretations of negated adjectival meanings are sensitive to whether these meanings are based on an unbounded or a bounded configuration. Our hypothesis correctly predicted that when the negator combines with unbounded antonymic meanings, its function is to attenuate the meaning of modified adjectives rather than expressing the absolute opposite. It also correctly predicted the results for all the members of the bounded set, i.e. when the negator combines with bounded antonymic meanings, its role is to express the absolute opposite meaning. Unfortunately, the bounded test set was relatively small and for that reason we have to be cautious in our conclusions. Bounded meanings deserve more attention in future research. The picture for the individual unbounded adjectives was consistent. All of the antonym pairs were judged in the same way. This was, however, not the case for the bounded adjectives. The results of our investigation also highlighted the complex nature of negation in terms of long response times which may be explained by the necessity for the interpretation of the negated adjectives to deal with both a factual and a counterfactual space at the same time, which is not the case for bare antonyms or antonyms modified by degree modifiers.

All in all, meaning differences such as the ones evoked by the combination of opposite meanings expressed through lexicalized antonyms as well as negated antonyms can be best explained through a comprehensive model of meaning which does not shun away from language users’ constructs of meanings in natural language in favour of ingrained assumptions about the appropriateness of the notion of literalness. Our model has the advantage of being capable of handling meaning flexibility. Alternative readings of lexical items are formed in context through construals that operate on their content and configuration structures. More specifically for gradable adjectives, this means that on the occurrence of use, meanings may be construed on the basis of scales and/or boundaries due to the contextual requirements that form the current readings. The contextual reading is construed on the basis of the relevant portion of

the meaning potential of the lexical items motivated by context and communicational demands.

The results of our experiment have implications for semantic and psycholinguistic research in that they point up the untenable position that there is such a thing as literal meanings in our understanding of natural language. The negator does not have two meanings or two functions, one literal and one non-literal. The negator has different effects in combination with unbounded meaning structures and bounded meaning structures. Such differences cannot simply be explained away as ‘marked’ or ‘non-default’ and pushed into a remote corner of pragmatics but have clear repercussions on meaning proper with the consequence that a definite boundary between semantics and pragmatics cannot be maintained in any strict sense.⁷

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Appendix A. The test sentences

Statement	Question
Unbounded adjectives	
<i>Mannen i baren var (intel/ganska) kort/lång.</i> ‘The man in the bar was (not/fairly) short/tall’.	<i>Hur stor var mannen?</i> ‘How big was the man?’
<i>Tröjan i skyltfönstret var (intel/ganska) ljus/mörk.</i> ‘The sweater in the window was (not/fairly) light/dark’.	<i>Vilken nyans hade tröjan?</i> ‘What shade was the sweater?’
<i>Vägen längs kusten var (intel/ganska) smällbred.</i> ‘The road along the coast was (not/fairly) narrow/wide’.	<i>Vilken typ av väg var det?</i> ‘What type of road was it?’
<i>Byggnaderna i centrum var (intel/ganska) lågalhöga.</i> ‘The buildings in the center were (not/fairly) low/high’.	<i>Vilken byggnadshöjd motsvarade de?</i> ‘What height of building did they equal?’

⁷ For a criticism of *the standard pragmatic view* which proposes that people must analyze the literal meaning of ‘indirect’ utterances before the pragmatic information is called upon to infer the non-literal content see, e.g. Gibbs (2002), Giora (2003) and the untenability of disregarding encyclopaedic meaning in semantic analysis, e.g. Paradis (2003a, 2005a, 2005b).

Appendix A (Continued)

Statement	Question
<i>Paketet under julgranen var (inte) lätt/tungt.</i> 'The package under the Christmas tree was (not) light/heavy'.	<i>Hur mycket vägde det?</i> 'What was its weight?'
<i>Röken från skorstenen var (inte) tunn/tjock.</i> 'The smoke from the chimney was (not) thin/thick'.	<i>Hurdan var röken?</i> 'How was the smoke?'
<i>Vattnet i flaskan var (inte) kallt/varmt.</i> 'The water in the bottle was (not) cold/hot'.	<i>Vilken temperatur hade vattnet?</i> 'Which temperature did the water have?'
<i>Huset på torget var (inte/ganska) fullt/vackert.</i> 'The house by the square was (not/fairly) ugly/beautiful'.	<i>Hur var huset?</i> 'How was the house?'
<i>Gustav på Svartö var (inte) fattig/rik.</i> 'Gustav from Svartö was (not) poor/rich'.	<i>Hur levde han?</i> 'How did he live?'
<i>Barnen i skolan var (inte/ganska) ledsna/glada.</i> 'The children in school were (not/fairly) sad/happy'.	<i>Vad gjorde barnen?</i> 'What did the children do?'
Bounded adjectives	
<i>Glaset på bordet var (inte) tomt/fullt.</i> 'The glass on the table was (not) empty/full'.	<i>Hur mycket var det i glaset?</i> 'How much was there in the glass?'
<i>Slutsumman i deklarationen var (inte) fel/rätt.</i> 'The sum in the income-tax return form was (not) wrong/right'.	<i>Hur bra stämde siffrorna?</i> 'How well did the numbers match?'
<i>Flugan i fönsterkarmen var (inte) död/levande.</i> 'The fly on the windowsill was (not) dead/alive'.	<i>Hur aktiv var flugan?</i> 'How active was the fly?'
<i>Elefanten på Zoo var (inte) sterill/fertil.</i> 'The elephant at the Zoo was (not) sterile/fertile'.	<i>Hur produktiv var elefanten?</i> 'How productive was the elephant?'
<i>Renarna på fjället var (inte) bundna/fria.</i> 'The reindeer on the mountain were (not) bound/free'.	<i>Hur kunde renarna röra sig?</i> 'How could the reindeer move around?'
<i>Glaset på bordet var nästan fullt.</i> 'The glass on the table was (almost) full'.	<i>Hur mycket var det i glaset?</i> 'How much was there in the glass?'
<i>Slutsumman i deklarationen var nästan rätt.</i> 'The sum in the income-tax return form was almost right'.	<i>Hur bra stämde siffrorna?</i> 'How well did the numbers match?'
<i>Flugan i fönsterkarmen var nästan död.</i> 'The fly on the windowsill was almost dead'.	<i>Hur aktiv var flugan?</i> 'How active was the fly?'

Appendix A (*Continued*)

Statement	Question
<i>Elefanten på Zoo var nästan steril.</i> ‘The elephant at the Zoo was almost fertile/sterile’.	<i>Hur produktiv var elefanten?</i> ‘How productive was the elephant?’
<i>Renarna på fjället var nästan fria</i> ‘The reindeer on the mountain were almost free’.	<i>Hur kunde renarna röra sig?</i> ‘How could the reindeer move around?’

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