Split scope of negative indefinites

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Abstract Negative indefinites, i.e. expressions like English *nobody* and *no boy*, give rise to split scope readings where another operator takes scope in between the negative and the indefinite meaning component. Split readings are puzzling under the standard analysis of negative indefinites as negative quantifiers. This article surveys recent approaches to split scope.

1. The puzzle: split scope readings

Negative indefinites are indefinite expressions that are morphologically marked for negation, e.g. English *nobody, nothing, no boy* etc. and their counterparts in other languages. Under the standard analysis (Montague 1973, Barwise and Cooper 1981), negative indefinites in languages like English, German and Latin denote negative quantifiers, i.e. their lexical entry contains an existential quantifier in the scope of negation, as shown in (1) for the pronoun *nobody* and the determiner *no*.

(1) a. [[nobody]] = λP. ¬∃x [person(x) ∧ P(x)]
b. [[no]] = λQ.lP. ¬∃x [Q(x) ∧ P(x)]

There are, however, cases where the negative and the existential meaning part of a negative indefinite are separated by another semantic operator. Consider the following German example, where a negative indefinite occurs embedded under the intensional verb *muss* 'must'.

(2)	Bei der Operation	muss	kein	Anästhesist	anwesend	sein.	[German]
	at the operation	must	no	anaesthetist	present	be	

(3) a. 'It is not required that an anaesthetist is present during the operation.'
b. 'It is required that no anaesthetist is present during the operation.'
c. 'No anaesthetist is required to be present during the operation.'

The most prominent reading of this sentence is the one paraphrased as (3a), i.e. that the presence of an anaesthetist is not obligatorily required. As it is not about a particular anaesthetist, but rather about the presence of some anaesthetist or other, this corresponds to a *de dicto* reading of the indefinite, i.e. the restrictor noun *Anästhesist* 'anaesthetist' takes narrow scope with respect to the modal. At the same time, the modal is interpreted in the scope of negation, expressing the absence of an obligation. As in this reading the modal takes scope in between the negation and the existential quantifier, the negative indefinite *kein Anästhesist* 'no anaesthetist' is split into a negation and an indefinite, which take scope from different positions. For this reason, such readings have been dubbed split scope readings.

Under the standard analysis of negative indefinites as negative quantifiers, the negation and the existential quantifier form a lexical unit and take scope from the same position. Consequently, only the readings that are paraphrased as (3b) and (3c) can be derived, but not the split scope reading (3a). In (3b), the negative quantifier as a whole takes scope below the modal. This reading, which expresses a necessity of the absence of anaesthetists, i.e. a prohibition of their presence, is only marginally available for sentence (2). In (3c), the negative quantifier takes scope above the modal, which brings the modal in the scope of negation. But as the indefinite too outscopes the modal, this corresponds to a *de re* reading, i.e. it is about the obligatory presence of

particular anaesthetists. Although this reading is possible, it does not correspond to the most natural interpretation of (2), which is the reading with split scope of the negative indefinite.

To convince yourself that the split reading is different from both the narrow and the wide scope reading of a negative quantifier, it is instructive to consider cases where neither the narrow nor the wide scope reading of a negative quantifier is available. A case in point is the following variant of our previous example.

(4) Es braucht kein Anästhesist anwesend sein. [German]
it need no anaesthetist present be
'It is not required that an anaesthetist is present during the operation.'

In this case, the presence of the expletive *es* precludes a wide scope interpretation of the indefinite subject and only the *de dicto* reading is available (cf. Milsark 1977, Heim 1987). At the same time, because the modal verb *brauchen* 'need' is a negative polarity item, it has to be interpreted in the scope of negation. Thus, both the narrow and the wide scope reading of the negative quantifier are impossible. The sentence is nevertheless perfectly fine and expresses the split reading as paraphrased.

Split scope readings of negative indefinites have been discussed primarily for German (Bech 1955/57:§80; Jacobs 1980, 1982; Kratzer 1995: sec. 2.5; Penka 2011; Abels and Martí 2010) and Dutch (Rullmann 1995, de Swart 2000) where they are abundant, but they also occur in English (Potts 2000) and the Scandinavian languages (Penka 2011). The following examples illustrate split readings in English, Dutch and Norwegian.

(5) The company need fire no employees. [from Potts 2000]
'The company is not obligated to fire any employees.'

(6) Ze hoeven geen verpleegkundige te ontslaan. [Dutch, from Rullmann 1995: 194]
they need no nurse to dismiss
'They don't need to dismiss any nurse.'

(7) Vi skylder han ingen nye sjanser. [Norwegian, from Svenonius, 2002: 125]
we owe him no new chances
'We don't owe him any new chances.'

There is some interlingual variation with respect to the precise set of contexts in which split readings occur. While all of the above languages allow split readings across intensional verbs, (some varieties of) German and Dutch also allow them with respect to universal quantifiers. This is illustrated by the following example, which under the indicated intonation pattern of the rise-fall contour expresses the reading paraphrased, where the universal quantifier takes scope in between the negation and the indefinite.

(8) /ALLE Ärzte haben KEIN\ Auto. [German, from Jacobs 1980:126]
all doctors have no car
'It is not the case that all doctors have a car.'

Another context in which split readings across universal quantifiers are possible in German are so called inverse linking constructions, where a quantifier embedded in a prepositional phrase takes scope over the modified DP (May 1977). The following example has a reading denying that Dr. Murx can solve every problem, where different problems might have different solutions. In this reading, the universal quantifier takes scope in between negation and the indefinite.

(9) Auch Dr. Murx hat keine Lösung für alle Probleme [German, from Jacobs 1980:130]
also Dr. Murx has no solution for all problems
'Dr. Murx doesn't have a solution for every problem either.'

This article reviews approaches to the scope splitting effect of negative indefinites. These can be grouped according to whether the assumption that negative indefinites form a lexical unit and denote negative quantifiers is basically maintained or whether they are assumed to consist of two separate elements, a negation and an indefinite. The latter fall again in two different camps. According to decompositional approaches, the negation and the indefinite are merged to form a complex element, while agreement approaches assume that negative indefinites are lexical units that have to be licensed by an independent negation. Negative quantifier approaches have to employ extra machinery to derive split readings, while the challenge for decompositional and agreement approaches lies in spelling out the precise relation between the negation and the indefinite.

2. Decompositional approaches

To explain the existence of split readings in German and Dutch, Jacobs (1980, 1982, 1991), Kratzer (1995) and Rullmann (1995) propose that negative indefinites are underlyingly morphologically complex and are made up of a negation and an indefinite that can take scope separately. This way, the negation can take wide scope with respect to some other operator, while the indefinite takes narrow scope. The two components become unified during the derivation to form a negative indefinite. Rullmann appeals to neg-incorporation as proposed by Klima (1964), where sentential negation is assumed to incorporate into an indefinite to form a negative indefinite; Jacobs and Kratzer postulate a PF-rule that amalgamates a sentential negation and an adjacent indefinite. This rule is argued to apply obligatorily in German as a general indefinite cannot occur right adjacent to the negative particle, cf. (10a).[1] Instead, a negative indefinite has to be used, cf. (10b).

(10) a. *Peter hat nicht ein Auto. [German]
Peter has not a car
b. Peter hat kein Auto.
Peter has no car
'Peter doesn't have a car.'

The data in (10) would follow from an obligatory rule according to which negation is incorporated or amalgamated into an adjacent indefinite.[2] However, neither of these rules is spelled out in detail, and I will thus provide a more general discussion how a decomposition analysis could be fleshed out to account for split readings.

[1] A general indefinite can occur adjacent to the negative particle if the negation is interpreted as contrastive or meta-linguistic (see Jacobs 1982).

[2] The phenomenon that general (and even negative polarity) indefinites cannot occur in the (immediate) scope of negation is, however, not restricted to German. It also occurs in Russian (see Pereltsvaig 2006), where an analysis in term of obligatory incorporation of negation is not possible: as Russian is a negative concord language, semantic negation and negative indefinites do not stand in a one to one relation. This suggests that the ban of general (and negative polarity) indefinites from the scope of negation is due to morphological blocking by a more highly specified item (see Jäger 2010 for such an analysis for German).

What is crucial to derive split readings is that negative indefinites consist of two distinct elements at the level of representation where meaning is computed, i.e. at LF. This leaves certain options regarding when and how unification of both elements takes place. One option is to assume that the negation originates in the position of the indefinite and gets into the higher position from which it takes scope via LF-movement. But this requires certain unorthodox assumptions about LF-movement, as generally, due to their semantic type, movement of adverbs does not affect the interpretation if movement leaves behind a trace that is interpreted. This might make one suspicious about deriving split readings as resulting from LF-movement of a negation out of a negative indefinite.

This leaves the option that negation and the indefinite are separate units at the point where the derivation branches off into PF and LF. In the syntactic component and at LF, each element occupies the position from which it takes scope, and unification takes place on the PF branch. The framework that lends itself to formulating such a post-syntactic process is Distributed Morphology (Halle and Marantz, 1999; Harley and Noyer 1999). However, the rule that would be needed to form negative indefinites, namely lowering of a negation (feature) into an adjacent indefinite, does not seem to correspond to any of the usual processes of Distributed Morphology like affixation or clitisation. A further problem lies in the fact that this process would have to be able to skip an intervening preposition or DP, as negative indefinites can occur inside prepositional phrases or embedded in DPs even if they give rise to a split reading. This is illustrated in the following examples.

(11) Peter wartet [auf keinen Polizisten] [German, from Jacobs 1991:595]
Peter waits on no policeman
'Peter isn't waiting for a policeman.'

(12) Russland kann [die Haltung keines Staates] beeinflussen.[3]
Russia can the position no.GEN state.GEN influence
'Russia cannot influence the position of any state.'

Another challenge comes from topicalized negative indefinites. If one follows standard syntactic assumptions according to which negation is base-generated in a functional projection NegP somewhere in the TP-domain (Pollock 1989, Haegemann 1995 a.o.), negative indefinites are wrongly excluded from occurring in the prefield in German, which is generally analysed as CP. Even if one assumes that negation can be adjoined to CP (cf. Jacobs 1982, 1991), there is a problem with the scope of negation. Consider the following example:

(13) Keine böse Absicht behauptet er gehabt zu haben (, als er sie erschreckte) [German]
no bad intention claimed he had to have when he her scared
'He claimed not to have had a bad intension (when he scared her)'

As the translation makes clear, negation takes scope below the matrix verb (the claim he made is about a negated proposition). This reading cannot be derived by decompositional approaches, as they require the negation to be higher than the indefinite and consequently also higher than the matrix verb.[4]

[3] Source: Süddeutsche Zeitung, 27.3.1997, p.8, „Beschluss über UdSSR hat keine Rechtskraft".

[4] One option to deal with such cases, which has been proposed e.g. in Penka (2011), is to assume that sentences like (13) are instances of remnant VP movement. Under this analysis, what is topicalized in (13) is the embedded negated VP out of which the verbal material has been moved, as in (i).

In summary, an analysis of split readings in terms of lexical decomposition of negative indefinites into a negation and an indefinite expression is less straightforward than it might seem at first glance, and a fully worked-out analysis is yet missing.

3. Agreement approaches

Another kind of approach (Penka and von Stechow 2001; Penka 2011) is similar to decompositional analyses in assuming that the negation is an independent element and can thus take wider scope than the indefinite. It does, however, not assume that the negation and the indefinite are merged to form a unit at any level of representation. Rather, negative indefinites are analysed as lexical items that need to be licensed by sentential negation. A negative indefinite itself corresponds semantically to a general indefinite, i.e. its lexical entry does not involve negation. But negative indefinites obligatorily co-occur with a negation that takes sentential scope and is not realised phonetically.

This approach relates the split scope effect, which negative indefinites exhibit in languages like German and Dutch, to another phenomenon arising in connection with negative indefinites, albeit in a different set of languages. In so-called negative concord languages, negative indefinites do not always contribute negation to the semantics. In the following Spanish example, for instance, the negative indefinite *nada* 'nothing' does not introduce a negation in addition to the one expressed by the negative marker *no* 'not'.

(14) Juan no ha comido nada. [Spanish]
Juan not has eaten nothing
'Juan hasn't eaten anything.'

Under one analysis (most prominently Zeijlstra 2004), negative concord represents an instance of syntactic agreement, similar to subject-verb agreement, where one item contributes the semantic information and the other is a – possibly redundant - marker of that information. Negative indefinites in languages like Spanish are analysed as semantically non-negative elements carrying an uninterpretable negative feature [uNEG] that has to be checked by an interpretable negative feature [iNEG] on a c-commanding negation.[5] For illustration, the lexical

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(i) $[_{CP}\,[_{VP}$ NEG-eine böse Absicht $t_i]_j$ behauptet er t_j [gehabt zu haben$]_i]$

Reconstruction of this negated remnant VP at LF results in the intended reading. However, this solution is problematic as similar readings also arise with resultative and secondary predicates, which are not usually left behind by remnant VP movement. One such example, due to an anonymous referee is the following:

(ii) Keine Tür behauptet er rot angemalt zu haben.
no door claimed he red painted to have
'He claimed not to have painted any door red.'

[5] This differs from the original assumptions about pairs of interpretable and uninterpretable features in Chomsky (2000, 2001), where uninterpretable features have to c-command interpretable ones. But if the notion of interpretability is taken to be a semantic one, i.e. a semantic operator of a certain kind carries the respective interpretable feature, the operator has to be structurally higher than the agreeing elements bearing the corresponding uninterpretable feature. This is now often assumed in semantics; see e.g. von Stechow (2012) for an overview of

entry for Spanish *nada* 'nothing' is given in (15).

(15) Syntax: $\text{nada}_{[uNEG]}$; semantics: $[\![\text{nada}]\!] = \lambda P.\exists x [\text{thing}(x) \wedge P(x)]$

Because the presence of negation is marked by an element that agrees with it, the semantic negation itself may under certain conditions be realised as the phonetically silent operator Op¬. Zeijlstra (2004) argues this to be the case with preverbal negative indefinites in Spanish, which do not co-occur with a negative marker, as illustrated in (16).

(16) a. Nadie vino. [Spanish]
nobody came
b. $\text{Op}\neg_{[iNEG]}$ $\text{nadie}_{[uNEG]}$ vino

If this analysis of negative indefinites is extended to languages not exhibiting negative concord, the existence of split readings in these languages falls out immediately. Whereas split readings in negative concord languages are expressed transparently, i.e. the negative marker occupying a higher position is present in addition to the negative indefinite, cf. (17a), the semantic negation in non-negative concord languages is obligatorily covert and only the negative indefinite is pronounced. The underlying structure is assumed to be the same, but the morpho-phonetic realisation to be different; compare the analysis of (17a) in (17b) to the corresponding German sentence in (18) (where an embedded clause in V-end word order is considered to abstract away from V2-movement in German, which does not affect semantic interpretation).

(17) a. No tiene por que estar presente ningún médico. [Spanish]
not has for COMP be present no doctor
'It is not required that a doctor be present.'
b. $\text{no}_{[iNEG]}$ tiene [por que estar presente $\text{ningún}_{[uNEG]}$ medico]

(18) a. … weil kein Arzt anwesend sein muss [German]
because no doctor present be must
'It is not required that a doctor be present.'
b. $\text{Op}\neg_{[iNEG]}$ [[$\text{kein}_{[uNEG]}$ Arzt anwesend sein] muss]

Penka (2011) argues that negative indefinites in non-negative concord languages place another restriction on the licensing negation besides requiring it to be realised covertly. While a negative indefinite in negative concord languages can occur anywhere in the c-command domain of a semantic negation, negative indefinites in non-negative concord languages have to be adjacent to the covert negation in the surface structure. This condition precludes the derivation of split readings for sentences like (19), for which they are not attested.

(19) … weil er immer kein Essen mitbringt [German]

the use of uninterpretable features in the semantic analysis of several phenomena like tense and comparative constructions. There is also recent work in syntax refining the notion of agreement features which is compatible with the kind of features assumed for the analysis of negative concord (e.g. Pesetsky and Torrego 2007).

because he always no food brings
'because he always brings no food.', i.e. 'because he never brings food.'
NOT: 'because he doesn't always bring food.'

(20) a. [er Op¬$_{[iNEG]}$ immer [$_{VP}$ [kein$_{[uNEG]}$ Essen] mitbringt]]]
b. [er immer Op¬$_{[iNEG]}$ [$_{VP}$ [kein$_{[uNEG]}$ Essen] mitbringt]]

(20a) is not a possible structure for (19), as the negative indefinite is not adjacent to the covert negation, and only structure (20b) corresponding to a reading with narrow scope of negation with respect to the universal quantifier is possible. In German a universal quantifier can take scope in between the covert negation and the negative indefinite only in certain context, namely in inverse linking constructions as in (21a) and under the rise-fall contour, cf. (22a).

(21) a. … weil wir keinen Pfleger für jeden Patienten anstellen können [German]
because we no nurse for every patient employ can
'It is not possible that we employ a nurse for every patient.'
b. LF: Op¬ [can [every patient 1 [we employ [no nurse for t_1]]]]

(22) a. /ALLE Gäste haben KEIN\ Essen mitgebracht. [German]
all guests have no food brought
'It is not the case that all guests brought food.'
b. LF: Op¬ [all guests [have brought no food]]]

In these cases adjacency between the covert negation and the negative indefinite can be assumed to hold in the surface syntax. But at LF, the universal DP takes scope from a position in between negation and the negative indefinite, as the LFs (21b) and (22b) show.[6] In inverse linking constructions and under the rise-fall contour split scope arises because the universal quantifier takes inverse scope, an option that is otherwise heavily restricted in German. The fact that split readings across universal quantifiers are restricted to contexts where inverse scope is possible, suggests that split scope is due to a universal quantifier moving into a position in between negation and the indefinite.[7] This is readily accounted for in approaches assuming that structures with negative indefinites involve two separate elements at LF, a negation and an indefinite, as decompositional and agreement approaches do. The fact that the adjacency condition seems to hold at a surface representation level, whereas other material can intervene in between negation and the indefinite at LF, also supports analyses that view the formation or the licensing of negative indefinites as a morpho-phonological or a syntactic process.

Intensional verbs, in contrast, never disrupt adjacency between a negative indefinite and its licensing negation, because of V-end word order in German. But in the Scandinavian languages, which have VO word order, negative indefinites cannot occur in object position in embedded clauses or in case the verb morphology involves a participle. This is illustrated in the following contrast from Norwegian (taken from Christensen, 1986):

[6] For LF representations, I follow Heim and Kratzer (1998). To enhance readability, English-style LFs are used and QR applying for type reasons only is neglected.

[7] To be more precise, the quantifier taking inverse scope in inverse linking constructions is generally assumed to be subject to QR (May 1977). In sentences with the rise-fall contour topicalized material is reconstructed to its base position due to pragmatic requirements associated with the rise-fall contour (see Büring 1997).

(23) a. Jon leser ingen romaner. [Norwegian]
Jon reads no novels
'Jon doesn't read (any) novels.'
b. *Dette er en student som leser ingen romaner.
this is a student who reads no novels
'This is a student who doesn't read (any) novels.'
c. *Jon har lest ingen romaner.
Jon has read no novels
'Jon hasn't read (any) novels.

Penka (2011) argues that this restricted distribution of negative indefinites in Scandinavian follows from the adjacency condition, as (a part of) a verb in base position blocks adjacency between the negative indefinite and the covert negation, which occupies a position outside of VP. [8]

The analysis of negative indefinites in terms of syntactic agreement offers a unified cross-linguistic analysis of negative indefinites that can explain split scope as well as negative concord and a curious gap in the distribution of negative indefinites in the Scandinavian languages. Further evidence that even in English, negative indefinites are not negative quantifiers, i.e. they are not semantically negative, comes from elliptical contexts. According to standard analyses of ellipsis, the second conjunct of e.g. (24a) contains unpronounced material that is identical to material in the first conjunct, as indicated in (24b). But if *no sister* is analysed as a negative quantifier, there are two negations in the semantic representation, which cancel each other out, i.e. the clause is predicted to mean that Mary has a sister.

(24) a. John has no sister, and Mary doesn't either.
b. Mary doesn't ~~have no sister~~ either.

For the agreement analysis of negative indefinites, the interpretation of (24b) is easy to explain, as the negative indefinite unpronounced in the ellipsis does not contribute negation. What needs to be said under this analysis is that in English, either the negative indefinite or its licensing negation is pronounced, but not both.

As the agreement approach shares some characteristics with decompositional analyses, some of the problems discussed in section 2 carry over. The adjacency condition proposed by Penka (2011) turns out to be problematic when taking into account cases like (11) above, where a preposition or a definite DP intervenes between a negative indefinite and the closest position a sentential negation could occupy.[9] Another problem lies in the fact that negation can take lower scope if a negative indefinite occurs in topic position as in example (13) above. This should not be possible if a covert negation operator has to c-command a negative indefinite in the surface syntax.

[8] This raises the question why negative indefinites are in principle possible in object position in English (although they often seem dispreferred and negative polarity items are used instead), although English has VO word order. This seems to be due to peculiarities of VP-formation in English rather than to differences in the licensing of negative indefinites (see Penka (2011) for discussion and Kayne (1998) for an analysis in terms of predicate raising in English).

[9] Penka (2011) attributes the ability of prepositions to intervene between a covert negation operator and a negative indefinite to prepositional phrases being extended projections of DP (Grimshaw 1991). This allows the [uNEG]-feature on the negative indefinite to percolate up to the prepositional phrase.

In summary, while the agreement approach might seem attractive as it relates split scope effects to other phenomena exhibited by negative indefinites, it is not without problems either.

4. Negative quantifier approaches

In contrast to decompositional and agreement approaches, some semantic analyses of split scope maintain the assumption that negative indefinites denote negative quantifiers. In order to derive split readings, a special meaning rule is invoked, which differs from the standard denotation assigned to negative indefinites. The split reading comes about if the negative quantifier does not quantify over individuals but rather over an entity of a different semantic type. In the analysis of Geurts (1996), split readings are derived via quantification over kinds; de Swart (2000) makes use of higher order quantification, and Abels and Martí (2010) propose an analysis in terms of quantification over choice functions. As the first two analyses share certain properties, I will group them together for the purpose of discussion and evaluation.

4.1. Quantification over abstract individuals or higher types

Geurts (1996) proposes that split readings result from quantification over kinds rather than individuals. To see how this accounts for split readings, consider the derivation of example (8), repeated below as (25), where a universal quantifier splits the negative indefinite. The starting point is LF (26a) where the negative quantifier takes wide scope with respect to the universal quantifier.

(25) /ALLE Ärzte haben KEIN\ Auto.
all doctors have no car
'It is not the case that all doctors have a car.'

(26) a. no car 1 [all doctors have t_1]
b. $\neg \exists x \in D_{NQ}$ [car(x) $\wedge$ $\forall$y[doctor(y) $\rightarrow$ own(y,x)]]
c. $\neg \forall$y[doctor(y) $\rightarrow$ own(y, CAR)]]
d. $\neg \forall$y[doctor(y) $\rightarrow \exists$z [car(z) $\wedge$ own(y,z)]]

This LF expresses the truth-conditions (26b), which however depend on the domain of quantification D_{NQ} the negative quantifier ranges over. Assuming that it ranges over concrete individuals, the resulting truth conditions are pragmatically weak, saying that no particular car is owned by all doctors. But if the negative quantifier ranges over abstract individuals e.g. car brands, a stronger meaning results, namely that not all doctors own the same brand of car. For the split reading, Geurts proposes that the quantification domain of the negative quantifier corresponds to the singleton set containing the kind-level individual CAR. Assuming that the predicate *car* holds of the kind-level individual CAR, this comes down to (26c), which says that not all doctors stand in the own-relation to the kind CAR. Crucially, the assumption that the negative quantifier ranges over a singleton set renders the existential quantification inert. But existential quantification is brought in again by the assumption that *own* is a projecting property, i.e. if a property *P* holds of a concrete individual *x*, *P* also automatically holds of all abstract individuals *x* instantiates. This makes (26c) equivalent to (26d), the truth conditions of the split reading.

Under de Swart's (2000) analysis, split readings are derived via quantification over higher types, i.e. in the split cases negative quantifiers range over properties. As a concrete example, she gives the meaning for *no book* under the higher order interpretation as in (27a).

(27) a. $[\![\text{ no book }]\!] = \lambda Q_{<<s,<e,t>>,t>}. \neg \exists P_{<s,<e,t>>} [(P = \lambda w.\lambda x.x \text{ is a book in } w) \wedge Q(P)]$
b. $[\![\text{ no }]\!] = \lambda P_{<s,<e,t>>}.\lambda Q_{<<s,<e,t>>,t>}. \neg Q(P)$

While this meaning is presumably supposed to resemble the usual negative quantifier meaning in (1), note that the existential quantifier is in fact vacuous, and the meaning of the determiner *no* can be rendered more transparently as in (27b). As in Geurts' analysis, the negative quantifier contributes just negation. It is also evident that the option of other material taking scope in between negation and the restrictor property is explicitly built into the lexical entry. With this, the split reading can be derived immediately for cases where the verb takes a property as argument, in particular for transitive intensional verbs like *seek* (cf. Zimmermann, 1993). For verbs taking individuals as arguments, de Swart assumes a process of existential closure to apply in the scope of the predicate. The split reading can then be derived from an LF where the negative quantifier takes wide scope with respect to the scope splitter as illustrated in (29) for sentence (28). ($\exists$ in the LF representation is used to abstract away from the details of the existential closure mechanism, and $w_@$ stands for the actual world.)

(28) The company need fire no employees.

(29) a. no employees 1 [the company need fire $\exists$ t_1]
b. $(\lambda Q_{<<s,<e,t>>,t>}. \neg Q (\lambda w.\lambda x. \text{employees}_w (x)))$ (1 [the company need fire $\exists$ t_1])
c. $\neg$ (1 [the company need fire $\exists$ t_1]) $(\lambda w.\lambda x. \text{employees}_w(x))$
d. $\neg \forall w \in \text{Acc}(w_@)$: $\exists x$ [$\text{employees}_w(x) \wedge \text{fire}_w$ (the company, x)]

Although diverging in details, Geurts' and de Swart's analyses share one central assumption, namely that for split readings the negative quantifier contributes just negation and existential quantification comes in via some other mechanism. This also has the consequence that both analyses have some problematic aspects in common.

One problem is that although Geurts' and de Swart's analyses are in principle able to derive split readings, they do not restrict the mechanism responsible for these. All that is required is that the negative quantifier takes wide scope with respect to the operator intervening in the interpretation between the negation and the indefinite, and that the special interpretation in terms of quantification over kinds or properties applies. Empirically, however, split readings generally arise with respect to intensional verbs, but with respect to universal quantifiers only under the rise-fall contour and in inverse linking constructions. As discussed in section 3 this suggests that split scope across universal quantifiers is due to the universal quantifier taking inverse scope, rather than QR of the negative quantifier. What Geurts and de Swart would have to say to restrict the derivation of split readings is that negative quantifiers can only QR across a universal quantifier in case the universal quantifier occupies a different position in the surface structure. It is not clear that such a restriction can be formulated at all, and in any case, it would seem to miss the level of representation that is relevant. Thus, these negative quantifier approaches overgenerate split readings, specifying a mechanism that derives them, but not appropriately restricting its application.

At the same time, the analyses undergenerate, in the sense that they cannot derive readings that are empirically attested. As de Swart (2000) points out, her analysis cannot derive intermediate scope readings, i.e. in cases with more than one semantic operator, the existential quantifier is restricted to narrowest scope if negation takes wide scope. This is due to the fact that the property serving as restrictor for the negative quantifier in the higher-order translation can only be interpreted as the argument of a lexical predicate, but not of a predicate derived by QR. The same restriction holds for Geurts' analysis, in this case because the existential quantifier

comes in via the definition of a projecting property, which can only be a lexical predicate. Empirically, however, the indefinite is not restricted to narrowest scope if negation takes wider scope. The following German sentence for instance has a reading where the restrictor noun *Norweger* 'Norwegian' is interpreted *de re* with respect to the embedded modal *wollen* 'want', although negation outscopes the outer modal *kann* 'can'. (This is the paraphrased reading, whose availability is witness by the given continuation being felicitous.)

(30) Fiona kann keinen Norweger heiraten wollen. [Sie kennt gar keinen Norweger.]
Fiona can no Norwegian marry want. She knows at-all no Norwegian
'Fiona can't want to marry a Norwegian. [She doesn't know any Norwegian at all.]'

To summarize, the approaches of Geurts (1996) and de Swart (2000), which account for split scope via quantification over kinds or properties, face the challenge of generating split readings in all and only the contexts in which they are empirically attested.

4.2 Quantification over choice functions

A different approach maintaining that negative indefinites are negative quantifiers is given by Abels and Martí (2010). It crucially builds on certain non-standard – but independently proposed – assumptions about the interpretation of quantifiers. First, adopting the copy theory of movement, it is assumed that different parts of a moved constituent can be interpreted in different copies (see Sauerland, 1998, 2004). For the split reading of example (31), the DP *no employees* is QR-ed across the modal verb and the determiner is interpreted in the higher and the restrictor noun in the lower copy, cf. (32).

(31) The company need fire no employees.

(32) no ~~employees~~ [the company need fire ~~no~~ employees]

This LF intuitively corresponds to the split reading, as the negative element outscopes the modal verb while the restrictor noun takes narrow scope. But in order to interpret this LF, further assumptions are needed. Again following Sauerland (1998, 2004), Abels and Martí (2010) assume that all natural language determiners denote quantifiers over choice functions, i.e. functions that apply to a set of individuals and return a member of the set. Moreover, determiners do not take two arguments, the restrictor and the scope, but only one, namely a set of choice functions. The meaning of the determiner *no* under these assumptions is given in (33), where CH(f) signifies that f is a choice function.

(33) $[\![\text{ no }]\!] = \lambda R_{<<<e,t>,e>,t>}.\ \neg \exists f_{<<e,t>,e>}\ [CH(f) \wedge R(f)]$

Assuming that QR leaves a choice function variable in the trace position that is bound by the movement index, the determiner meaning takes the rest of the structure as its argument. If world indices are furthermore explicitly represented in the structure, the full LF of the split reading corresponds to (34a) where the world index of the restrictor noun *employees* is bound by the intensional verb *need.* This LF expresses the truth conditions (34b) where the negative quantifier over choice functions and thus negation has widest scope. At the same time, because the property serving as argument for the choice function varies with worlds, it does not make a claim about actual employees but rather corresponds to a *de dicto* interpretation.

(34) a. no 1 [the company need$_w$ fire $t_{1<<e,t>,e>}$ employees$_w$]

b. $\neg\exists f_{<<e,t>,e>}$ [CH(f) ∧ ∀w ∈ Acc($w_@$): $fire_w$ (the company, f($employees_w$))]

Under this analysis, the apparent narrow scope of the indefinite is due to binding of the world variable of the restrictor noun by the intensional verb, an instance of what Kratzer (1998) calls pseudoscope. While binding of world variables by modal operators is assumed to be generally available, binding by quantifiers over individuals is only possible if the restrictor involves a bound pronoun. Consequently, split readings across universal quantifiers (as in (8) and (9)) cannot be derived straightforwardly in this way. As they only arise in a subset of the languages that allow split scope across modals and require special contexts, Abels and Martí (2010) consider split readings across universal quantifiers a distinct phenomenon and do not analyse them.

5 Split readings of other decreasing quantifiers

A prima facie appealing aspect of approaches that derive split readings while maintaining the assumption that negative indefinites are negative quantifiers lies in the fact that these analyses can easily be extended to other quantificational noun phrases. It has been observed that split readings are not restricted to negative quantifiers, but do also arise with other downward monotone and non-monotone quantifiers (see de Swart 2000, Hackl 2000, Abels and Martí 2010). The following examples illustrate split readings with *fewer than three* and *at most four* ((35a) is due to Hackl 2000, (35b) is from de Swart 2000).[10]

(35) a. At MIT one needs to publish fewer than three books in order to get tenure.
'At MIT one doesn't need to publish more than two books in order to get tenure.'
b. A muslim can marry at most four women.
'A muslim cannot marry more than four women.'

As the paraphrases indicate, these sentences have a reading in which the modal is in the scope of negation and the restrictor noun is interpreted *de dicto*. In contrast to split readings with negative indefinites, however, the quantificational expression involved in the paraphrases is more complex. This makes a decompositional analysis implausible, as e.g. *fewer than three* would have to be decomposed into negation and *more than two*, which is not morphologically transparent. The same problem arises for the agreement approach. But under approaches that derive the split reading via a special quantification mechanism, the meaning of downward monotone quantifiers can be stated in a way that is akin to negative quantifiers and results in split readings. These lexical entries involve negation in as far as they make a claim about the maximal cardinality of groups of individuals, i.e. they negate the existence of groups of individuals of higher cardinality. Under de Swart's (2000) analysis, for instance, the meaning rule for *fewer than three books* can be rendered as in (36), where X is a variable over plural individuals and |X| denotes X's cardinality (i.e. the number of atomic individuals in X).

(36) [[fewer than three books]] = $\lambda Q_{<<s,<e,t>>,t>}$. $\neg\exists P_{<s,<e,t>>}$ [(P = λw.λX.X are books in w ∧ |X| ≥ 3) ∧ Q(P)]

It can, however, be questioned whether it is desirable at all to derive split readings arising with quantificational noun phrases other than negative quantifiers in a unified way. First, there are empirical differences: whereas negative quantifiers also allow split readings

[10] Readings with wide or narrow scope of the entire quantifier are possible as well, but focusing on split readings only those are given in the paraphrases.

across universal quantifiers, albeit in restricted contexts, split reading arising with other quantificational noun phrases are possible only across intensional verbs (see de Swart 2000, Penka 2011 and Abels and Martí 2010).

Second, invoking special meaning rules for downward monotone quantifiers seems in fact superfluous to derive split readings for examples like (35). Similar readings also arise for adjectival *less*-comparatives and cases where *at most* modifies a measure phrase such as *20kg*, as in the following examples.

(37) a. John needs to drive less fast than Mary.
'John doesn't need to drive as fast as Mary.'
b. You are allowed to drive at most 50 miles per hour on this highway.
'You are not allowed to drive more than 50 miles per hour on this highway.'

Because the expressions that give rise to a reading where negation seems to take scope over the modal are not quantificational DPs, analyses based on generalized quantifier meanings are not applicable to the examples in (37). Proposals like Geurts (1996), de Swart (2000) and Abels and Martí (2010) do thus not provide a general account of the readings arising with expressions like *fewer/less than* and *at most*.

But there are analyses of *less*-comparatives and *at most* which account for the existence of the readings paraphrased in (37) and can straightforwardly be extended to the quantificational cases in (35). According to Heim (2000) the paraphrased reading of (37a) is due to the *less*-comparative taking scope over the modal ('the speed with which John needs to drive is less high than the speed with which Mary needs to drive'). This analysis is applied to comparative quantifiers like *fewer than three books* by Hackl (2000), who treats *fewer* as the *less*-comparative of *many*. *Many* is analysed as a counting quantifier, i.e. an existential quantifier with an additional degree argument specifying cardinality. The split reading of (35a) then results from the *less*-comparative taking scope over the modal while the quantificational DP, involving *many*, takes narrow scope ('the number of books one needs to publish is less than three'). A similar analysis can be given for *at most* (see Nouwen 2010 who also provides an elaborate discussions of the differences between comparative quantifiers and those involving *at most* or *at least*). As *at most* indicates a maximum, wide scope over a possibility modal results in a reading specifying an upper bound as in (37b) ('the maximal speed *v* such that you are allowed to drive *v* fast is 50 miles per hour'). If *at most* modifies a quantifier over individuals, a covert counting quantifier *many* is assumed that can take narrow scope, which gives rise to the split reading of (35b) ('the maximal number *n* such that a muslim can marry *n* women is four'). What is responsible for the existence of split readings arsing with *fewer than n* and *at most n* is thus that they are complex and consist of a degree operator and a quantifier over individuals. If the degree operator takes wide scope over a modal while the quantifier over individuals takes narrow scope, truth conditions equivalent to the split reading result.

The split readings arising with quantifiers involving *at most* or *fewer* can thus be reduced to a more general phenomenon. The quantifier cases in (35) can be regarded as special instances where *at most* or a *less*-comparative modifies a quantificational DP. The mechanism generating the readings paraphrased in (37) will then also derive split readings for the quantifier examples in (35). The option of split readings is thus inherent to the semantics of comparatives and *at most*-phrases,[11] and no special meaning rule for cases where these expressions modify a

[11] There are principled reasons why split readings arise with the negative polar expression, i.e. *less* and *at most*, but not the positive *more* and *at least*: In the latter cases, different scope does

quantificational DP is needed. The same presumably also holds for other cases that have been observed to give rise to split readings, e.g. *exactly* (Abels and Martí 2010).

In sum, split readings arising in connection with downward monotone quantifiers other than negative indefinites can be attributed to their being morphologically and semantically complex, and no special mechanism tailored to the quantifier cases is needed. While the analysis in terms of a degree operator modifying a quantifier over individuals could technically be extended to negative indefinites (*no* could e.g. be analysed as *less than one* or *at most zero*) this analysis would be unjustified by the lack of degree morphology on negative indefinites. This and the fact that split readings do not seem to be a unified phenomenon empirically, suggests that split scope of negative indefinites requires an analysis that is custom made for them.

5. Conclusion

Split readings where another operator takes scope in between the negative and the indefinite meaning component of a negative indefinite are puzzling under the standard analysis in terms of negative quantifiers. This article has surveyed recent approaches to split scope. A key issue in the discussion has been the question whether a certain approach can derive split readings in all and only the environments in which they occur. I also addressed the connection specific approaches make to other possibly related phenomena. Agreement approaches link split scope of negative indefinites to negative concord and distributional restrictions in the Scandinavian languages, while quantifier approaches might strive for a unified analysis of split scope of all downward monotone quantifiers.

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