The Degree to which No Quantifier Must Decompose

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ABSTRACT

It has been a long-standing problem in both syntactic and semantic theory as to how the meanings of the German determiner *kein* ("no"), and its Dutch counterpart *geen,* are generated, especially when these lexical items appear in constructions with other scope-bearing elements (SBE). A number of proposals have attempted to account for this phenomenon by using either lexical decomposition (Jacobs 1980; Penka and Zeijlstra 2005; among others) or non-decompositional approaches (de Swart 2000; Geurts 1996; *a.o.*). In this paper, we outline why both proposals fall short of accounting for all the data. Using the notion of DegP movement (Heim 2001, 2006; Hackl 2000), we propose an alternative approach to account for the ambiguities observed by de Swart (2000). We argue that lexical decomposition will account for the Negative Indefinite data, while Heim (2000; 2006) and Hackl's (2001) DegP movement will be able to account for the split readings of gradable adjectives and monotone-increasing intensional predicates.

1. PHENOMENA

It has been a long-standing problem in both Syntactic and Semantic theory as to how the meanings for the German determiner *kein* "no" and its Dutch counterpart *geen* are generated when these lexical items appear in constructions with other scope-bearing elements (SBE). Ambiguities arise when negative indefinites such as *kein* and *geen* interact with other quantifiers or are embedded under intensional verbs, as can be seen in (1)-(2), respectively:

(1) *Alle Ärtze haben kein Auto*
all doctors have no car
a. All doctors are such that they have no car. $(\forall > \neg > \exists)$
b. #No car is such that all doctors have it. $(\neg > \exists > \forall)$
c. Not all doctors have a car. $(\neg > \forall > \exists)$

(2) *Du musst keine Krawatte anziehen.*
You must no tie wear
a. It must be the case that you wear no tie. $(\text{must} > \neg > \exists)$
b. ?There is no tie such that you must wear it. $(\neg > \exists > \text{must})$
c. It is not the case that you must wear a tie. $(\neg > \text{must} > \exists)$

The universal quantifier and the intensional verb can either scope above the negative indefinite (1)a and (2)a or below the negative indefinite (1b and 2b). In this paper, we will concentrate on the 'split' reading that occurs when a SBE appears in between the two elements of the negative indefinite; in such constructions, it appears as if the negative operator (*Op*$\neg$) has split away from the existential quantifier ($\exists$), as in (1)c and (2)c.

To account for the split reading, many theories have been put forth as an attempt to explain this phenomenon. In sections 2 and 3, we will provide an overview of the current theories.

Jacobs (1980) argues that in order to have a split reading, the negative indefinites must undergo "lexical decomposition," thus, the two operators (*Op*¬ and ∃) occupy two separate nodes in a syntactic representation and are completely syntactically autonomous. Other approaches, such as de Swart (2000) and Geurts (1996), have avoided lexical decomposition in order to maintain lexical integrity and account for the data by appealing to a complex notion of higher-order quantification such as quantification over properties (de Swart 2000) and abstract individuals (Geurts 1996). In section 4, we will argue that the Lexical Decomposition approaches will better account for negative indefinites such as *kein*. In the next section, section 5, we account for the other data found in de Swart (2000) by presenting DegP movement from Heim (2000, 2006) and Hackl (2001). Section 6 presents an environment in which higher-order quantification accounts and DegP movement predict ambiguity and a lack thereof, respectively; from this, we will conclude that DegP movement better accounts for the data, as the ambiguity in fact does not seem to arise for those quantifiers wherein DegP is involved, but does arise for *kein*. Section 7 will provide a short conclusion to the paper.

2. THE LEXICAL DECOMPOSITION APPROACH

This section reviews a proposal whereby the split readings for *kein*-sentences arise from the operators ¬ and ∃ being syntactically autonomous. This permits split readings on the basis of movement of *kein*'s negation to a higher node while its existential quantification remains *in situ*.

Jacobs (1980) discusses the problem of representing the determiner *kein* in Montague grammar, given the assumption from Link (1967) that Lexemes must be represented atomically in the meanings of sentences and must never decompose into autonomous syntactic components.

Jacobs points out that, if one accepts Link's principle, and one were to suppose that the denotation in for the determiner *kein* is as in (3), where negation outscopes existential quantification, and which takes both restrictor and scope arguments,

(3) [[*kein*]] = $\boldsymbol{\lambda P[\lambda Q\ [\neg \exists\ x[P(x)\ \&\ Q(x)]]]}$

then sentences involving quantified subjects and *kein*-quantified objects should have two meanings, as follows:

(4) *Alle Ärzte haben kein Auto.*
all doctors have no car
a. All doctors are such that they do not possess any car.
b. # There does not exist a car such that all doctors have it.

These are schematized as (5) below, which assumes that *kein Auto* "no doctor" must have a denotation for *kein* as in (3), and must be interpreted atomically to yield only the readings in (4):

(5)

Alle Ärzte haben kein Auto *alle Ärzte* *haben kein Auto* *kein Auto* *haben* *kein* *Auto*	*Alle Ärzte haben kein Auto* *kein Auto* *alle Ärzte haben* *kein* *Auto*
"All doctors are such that they do not have a car"	# "There is no car such that all doctors have it"
$([\forall x\,[Arzt'(x) \rightarrow \neg\exists y[Auto'(y) \;\&\; hat'(y)(x)]]])$	$(\neg\exists\, y[\forall x\,[Auto'(y) \rightarrow [Arzt'(x) \;\&\; hat'(y)(x)]]])$

The second reading in (4) is pragmatically anomalous: knowledge of the number of doctors in the world precludes them all from owning the same car. Thus quantifier raising produces a reading unavailable to German speakers. On the other hand, the reading in (6) below does seem to be possible, and depending on prosody, preferable for native speakers of German:

(6) It is not the case that all doctors have a car.

Link's principle, combined with the denotation in (3) however, allows us only the readings in (4).

As can be seen in (5), there is no way to force the negation to take scope over the universal quantifier without the existential quantifier also taking wide scope; and there is no way to give the existential quantifier narrow scope with regards to the universal quantifier without also assigning narrow scope to the negation. Thus, Jacobs argues, we will never be able to achieve the reading in (6) above without abandoning either Link's principle or the denotation in (3) for negation.

Jacobs claims that it would be possible to account for the problematic reading of (4) by assigning the denotation in (7) to *kein*, wherein it expresses wide-scope negation, and narrow-scope existential quantification over some predicate Q:

(7) $\lambda Q[\lambda R[\lambda T[\sim T(\lambda x(\exists y[Q(y) \;\&\; R(y)(x)]])]]]]$

This will then permit the problematic reading, as shown in (8):

(8)
$$\lambda Q[\lambda R[\lambda T[\sim T(\lambda x(\exists y[Q(y) \;\&\; R(y)(x)]])]]]]\;(Auto')\;(hat')\;(\lambda Q[\forall z[\ddot{A}rzt'(z) \rightarrow Q(z)]])$$
$$\lambda R[\lambda T[\neg T(\lambda x(\exists y[Auto'(y) \;\&\; R(y)(x)])]]](hat')(\lambda Q[\forall z[Arzt'(z) \rightarrow Q(z)]])$$
$$\lambda T[\neg T(\lambda x(\exists y[Auto'(y) \;\&\; hat'(y)(x)])]\;(\lambda Q[\forall z[Arzt'(z) \rightarrow Q(z)]])$$
$$\neg\lambda Q[\forall z[Arzt'(z) \rightarrow Q(z)]]\;(\lambda x(\exists y[Auto'(y) \;\&\; hat'(y)(x)])$$
$$\neg\forall z[Arzt'(z) \rightarrow \lambda x\,[\exists y[Auto'(y) \;\&\; hat'(y)(x)]](z)]$$
$$\neg\forall z[Arzt'(z) \rightarrow \exists y[Auto'(y) \;\&\; hat'(y)(z)]$$

> 'It is not the case that for all things such that they are doctors, there exist some car such that a doctor owns it.'

However, because this ambiguity is observed with more sentence structures than those that are quantifier-initial, such as those involving modals, among others, this remains an unappealing option: it would lead to a proliferation of meanings. A separate denotation for *kein*, different from either of the meanings expressed in either (3) or (7) would have to be created to contend with each environment that produces split readings. We would also need to maintain the original denotation for *kein* in order to account for the meanings in (4)a). This is therefore an unappealing option.

On the other hand, the solution that Jacobs proposes is fairly intuitive and does not lead to a proliferation of meanings. Dispensing, then, with Link's principle, we can allow the negation to take scope separately over the universal quantifier, as follows in (9):

(9) *Alle Ärzte haben kein Auto*

Alle Ärzte haben NEG ein Auto

NEG *alle Ärzte haben ein Auto*

$(\neg \forall[Arzt'(x) \rightarrow \exists y\ [Auto'(y)\ \&\ hat'(y)(x)]])$

This solution requires no proliferation of meanings for *kein*, and can in fact generate the problematic readings for all of the above sentences for which we would have had to generate a new meaning for *kein* in order to account for the wide scope of negation and the narrow scope of the existential. Though this is not the only means by which one might generate the split readings, as we shall see in Section 3 below, we will show in Sections 4-6 that there are plausible reasons to maintain that this formulation in fact captures the phenomenon better than formulations that do not appeal to Lexical Decomposition.

3. THE NON-LEXICAL DECOMPOSITION APPROACH

This section presents two approaches which do not rely on Lexical Decomposition in order to derive the split reading, appealing instead to Higher Order Quantification. The first, in 3.1, is de Swart's (2000) notion that it is possible to quantify over properties. The second, in 3.2, is Geurts' (1996) idea that *kein* in these cases is expressing negative quantification over abstract individuals. It will be shown in subsequent sections that these are inadequate characterizations of the phenomena at hand.

3.1 QUANTIFYING OVER PROPERTIES

De Swart (2000) argues against lexical decomposition stating that the approach detailed in Jacobs (1980) is too permissive.

If one appeals to lexical decomposition for *kein* based on data such as (1), then one should also appeal to lexical decomposition for other monotone decreasing quantifiers such as *at most two* and *few* because a split reading also arises in such contexts:

(10) Tom needs at most two blankets
There are at most two blankets such that Tom needs to have them (de re)
What Tom needs to have is at most two blankets (de dicto)
It is not the case that Tom needs to have more than two blankets (split)

(11) Ze hoeven wenig verpleegkundigen te ontslaan [Dutch]
They need few nurses to fire
For a group Y consisting of a few nurses y, it is the case that it
is necessary for them to fire each individual y member of Y (de re)
It is necessary for them to fire a few nurses (de dicto)
It is not necessary for them to fire more than a small number of nurses (split)

If we take the split reading of (1) as evidence that *kein* can be decomposed into *Op*¬ and *∃*, according to de Swart (2000), then we should conclude that the split reading in (10) suggests that *at most two* can be decomposed into *Op*¬ and *more than two*. Similarly, the split reading in (11) suggests that *few* should be decomposed into *Op*¬ and *more than a small number of*. De Swart argues that such an approach should be abandoned because it leads to a "proliferation of decomposition rules". Furthermore, this approach of lexical decomposition does not account for the fact that the split readings are restricted to monotone decreasing quantifiers and does not occur with monotone increasing quantifiers such as (12):

(12) Tom needs at least two blankets
a. At least two blankets are such that Tom needs to have them (de re)
b. What Tom needs to have is at least two blankets (de dicto)
c. #It is not the case that Tom needs fewer-than-two blankets (split)

Because (12)c is not an available reading for (12), de Swart (2000) argues that the split reading does not arise with any other monotone increasing quantifiers.

If monotone increasing quantifiers were to decompose, the denotation of (12) would be illustrated as in (13):

(13) Tom needs at least two blankets
¬Need(t, ^λy [B(y) and fewer-than-two(y)])

Because the decomposed reading of other monotone increasing quantifiers does not hold, and the Lexical Decomposition approach of Jacobs (1980) cannot account for this restriction, Lexical Decomposition is too permissive.

Furthermore, Jacobs (1980) predicts readings that are not available. If a negative indefinite can decompose into two elements, *Op*¬ and *∃*, then they should be completely independent from one another. In this case, the reading where the existential quantifier outscopes negation should be available. This existential wide scope reading is not available for (14), but is available for (15):

(14) Anne wil geen Noor trouwen [Dutch]
Anne wants no Norwegian marry
There is no Norwegian x such that Anne wants to marry x (wide scope *geen*)
Anne wants for no Norwegian x to marry x (narrow scope *geen*)
It is not the case that Anne wants to marry a Norwegian (split)
#There is a Norwegian Anne does not want to marry (wide scope *een*)

(15) Anne wil niet met een Noor trouwen
Anne wants not with a Norwegian marry

The reading in (14)d is predicted by the lexical decomposition approach, yet it is not available, thus, the theory is too permissive.

De Swart (2000) proposes an alternative account for the split readings that involves quantification over individuals and quantification over properties:

(16) Hanna sucht kein Buch [German]
Hanna seeks no book
$\neg\exists\chi(\text{Book}(\chi) \wedge \text{Seek}(h,\chi))$ (de re)
$\text{Seek}(h,{}^\wedge\lambda\chi\neg\text{Book}(\chi))$ (de dicto)

For a sentence such as (16), the different readings can be accounted for if we quantify over individuals. (16)b expresses that Hanna is a not-book seeker, in other words, she seeks things that are not books. A weak NP in a predicative position expresses quantification over the individual and this gives rise to the *de dicto* reading. The split reading can be accounted for if we quantify over the property of book-seeking, as in (17):

(17) Hanna sucht kein Buch [German]
Hanna seeks no book (split)
no book
$= \lambda\mathcal{P}\neg\exists P(P = {}^\wedge\lambda y(\text{Book}(y)) \wedge {}^\vee\mathcal{P}(P))$
no book (seek)
$= \lambda\chi\neg\exists P(P = {}^\wedge\lambda y(\text{Book}(y)) \wedge \text{Seek}(\chi,P))$
no book (seek)(hanna)
$= \neg\exists P(P = {}^\wedge\lambda y(\text{Book}(y)) \wedge \text{Seek}(h,P))$
$\neg\text{Seek}(h, {}^\wedge\lambda y(\text{Book}(y))$

Following Zimmerman (1993), de Swart (2000) argues that intensional verbs such as *seek* are denoted as a relation between individuals and properties, *seek* is of the right type to be an argument of a higher-order quantifier. The derivation in (17) expresses that there is no property that is identified with the book property and which is such that Hanna seeks it. . This will generate the appropriate split reading.

Therefore, according to de Swart (2000), all weak NPs in predicative position have three possible derivations: a wide scope interpretation in terms of quantification over individuals (*de re*), a narrow scope interpretation in terms of quantification over a property (*de dicto*), and a wide scope interpretation in terms of quantification over properties (*split)*.

This approach can account for the distinction between monotone increasing and decreasing quantifiers discussed above. By using the same three derivational approaches of (16)-(17), de Swart accounts for the three-way ambiguity of monotone decreasing quantifiers, such as (10) above:

(18) Tom needs at most two blankets
$\neg\exists\gamma(\text{Blanket}(\gamma) \wedge \text{More-than-two}(\gamma) \wedge \text{Need}(t,\gamma))$ (de re)
$\text{Need}(t,{}^\wedge\lambda\gamma\neg(\text{Blanket}(\gamma) \wedge \text{More-than-two}(\gamma)))$ (de dicto)
$\neg\exists P(P = {}^\wedge\lambda\gamma(\text{Blanket}(\gamma) \wedge \text{More-than-two}(\gamma)) \wedge \text{Need}(t,P))$
$= \neg\text{Need}(t, {}^\wedge\lambda\gamma(\text{Blanket}(\gamma) \wedge \text{More-than-two}(\gamma)))$ (split)

When the same approach is used for monotone increasing quantifiers, such as (12), only a two-way ambiguity arises:

(19) Tom needs at least two blankets
$\exists\gamma(\text{Blanket}(\gamma) \wedge \text{At-least-two}(\gamma) \wedge \text{Need}(t,\gamma))$ (de re)
$\text{Need}(t,{}^\wedge\lambda\gamma(\text{Blanket}(\gamma) \wedge \text{At-least-two}(\gamma)))$ (de dicto
$\exists P(P = {}^\wedge\lambda\gamma(\text{Blanket}(\gamma) \wedge \text{At-least-two}(\gamma)) \wedge \text{Need}(t,P))$
$= \text{Need}(t, {}^\wedge\lambda\gamma(\text{Blanket}(\gamma) \wedge \text{At-least-two}(\gamma)))$ (split)

The split reading in (11c) reduces to the *de dicto* reading in (11b), thus the higher-order quantification approach of de Swart (2000) is not too weak in the way that she claims Jacobs (1980) is. It is possible to derive split readings for sentences involving intensional predicates, which, as Zimmerman (1993) pointed out, can take properties as arguments. In cases where the quantifiers involved are monotone increasing, the ambiguity is vacuous, producing the same truth-conditions as the *de dicto* reading. On the other hand, in cases where these quantifiers are monotone-decreasing, the split reading produces different truth conditions. However, as will be shown in Section 4, it is not obvious that de Swart's (2000) formulation can derive the split reading for sentences involving quantified subjects with *kein*-quantified objects.

3.2 QUANTIFICATION OVER ABSTRACT INDIVIDUALS

Geurts (1996) also avoids lexical decomposition, stating that it is "one of the less respectable denizens of the modern semanticist's tool kit" (Geurts 1996: 67). According to Geurts, lexical decomposition entails that interpretation can be sensitive to the internal structure of words and may operate on some of its parts.

Geurts presents an alternative account, in which *kein* is only negation; thus, it is not a quantifier, nor does it contain a quantifier. Under this approach, the existential quantification does not come from the determiner *kein*, but from another source. He demonstrates that this might be the case by showing an ambiguity with plural NPs and a universal quantifier because German bare plurals may be interpreted as having a silent existential quantifier:

(20) Alle Professoren haben Knallfrösche gekauft
all professors have firecrackers bought

(21) [all x: professor x] ([some y: firecracker y] (x bought y))

When (20) is negated, as in (22), the negative quantifier may be interpreted in the scope of the universal quantifier or outside the scope of the universal ((23)a and b, respectively):

(22) Alle Professoren haben keine Knallfrösche gekauft

(23) a. [all x: professor x] (~[some y: firecracker y] (x bought y))
b. ~[all x: professor x] ([some y: firecracker y] (x bought y))

Therefore, Geurts (1996) can account for the split reading of (22) without using lexical decomposition. This approach can be extended to singular *kein*-NPs without too much trouble when one considers that the domain of a quantifier is not always a set of concrete individuals. For example, (24) can be interpreted as referring to the exact copy (concrete), or to the book in general (abstract):

(24) I have read that book

Quantifying over individuals and abstract individuals will predict split readings as a consequence of the standard system of quantification. Returning to the Jacobs sentence (1), repeated here as (25), we can also break *Auto* into a hierarchy of concrete and abstract individuals:

(25) Alle Ärtze haben kein Auto
all doctors have no car

An abstract individual CAR can be expressed as models (*Peugeot 205, 305…, Citroen AX, BX…, etc.).* In the middle of the three-layered hierarchy is the set of car models (denoted by the set of M) also know as the Taxonomic reading (cf. Krikfa et al. 1995), and the "base" of the hierarchy is actual concrete cars. This three-way distinction can be illustrated in (26):

(26) a. A car stopped in front of my house (concrete individual)
b. The jury was impressed most by a French
car- namely, the Citroen ZX (the set of car models)
c. A car is a vehicle (abstract individual CAR)

Using this notion of abstract individuals, Geurts (1996) is able to capture the three-way ambiguity in constructions with negative indefinites without appealing to lexical decomposition. If *kein* is a regular quantifier, we will expect at least two ambiguities for (25) above, as can be seen in (27):

ks its values from: for each x, there is no concrete car that y owns; for any y ϵ M, there is no element in the set of M such that x owns it; or there is no abstract individual CAR such that x owns it. Each of the three sets will yield the proper reading for (27)a. To yield the proper reading for (27)b, on the other hand, y must pick its values from the set of M[1]. If y quantifies over concrete cars, the reading is strange and should be excluded on pragmatic grounds.

The split reading of (25) will arise if we use *kein* as an ordinary quantifier that quantifies over the set {CAR}, as in (28):

(28) ~[all x: doctor x]([some y: car y](x owns y)) (abstract individual CAR)

The derivation for (28) above reads: "that for no y ϵ {CAR}, it is true that all doctors are y-owners." Thus, Geurts (1996) is able to account for the split reading by avoiding lexical decomposition and simply quantifying over concrete individuals.

In the following section, we will show how these two higher-order quantification accounts fail to derive the split readings for all of the environments in which it occurs.

4. HOW NON-LEXICAL DECOMPOSITION APPROACHES FAIL TO ACCOUNT FOR THE DATA

In this section, we will re-evaluate the Non-Lexical Decomposition approaches by highlighting the ways in which they cannot account for the broad range of data as Lexical Decomposition can.

4.1 HOW DE SWART (2000) FAILS TO ACCOUNT FOR THE DATA

As noted above, de Swart (2000) proposes, following Zimmerman (1993), that since intensional predicates can be seen to take properties as arguments, that quantification over properties is enough to derive the split reading for *kein* when it acts as the object of an intensional predicate such as *seek*. This, she claims, can also explain the third, split reading observed with both *kein* and other monotone-decreasing quantifiers in object position in the scope of intensional predicates. As shown above, this result is indeed borne out: assuming that both *kein* and other monotone-decreasing quantifiers involve negation and can involve quantification over properties, this account does predict the desired ambiguities. Moreover, it also predicts that there should be no split reading with regards to any monotone-decreasing quantifiers in object position with other quantifiers in subject position.

[1] This causes several problems. First of all, this reading is not available for German speakers, yet Geurt still accounts for the reading by quantifying over the set of M. Secondly, Geurt first says that if y ranges over M, the interpretation, which would mean 'it is not the case that all doctors are Citroën XM owners,' is not available (p.79). But a few sentences later, he claims that y must range over M for (27)b. The problems with this argument, however, are not important to the scope of this paper. It is sufficient to know only that Geurts quantifies over abstract and concrete individuals in order to account for split readings without appealing to lexical decomposition.

However, this account also predicts that there should be no split reading for the Jacobs sentence (4) above, repeated below:

(4) *Alle Ärzte haben kein Auto.*
all doctors have no car
a. All doctors are such that they do not possess any car.
b. # There does not exist a car such that all doctors have it.

In order for de Swart's account to rule out the monotone-decreasing quantifier-object quantified-DP-subject split reading, it relies on the fact that normal transitive verbs do not take properties as arguments. Since this is the case, to attempt to express the Jacobs sentence (4) in terms of property quantification results in a type mismatch given the denotation of *have* in (29):

(29) $[have'] = \lambda y_e \lambda x_e\, [have'(y)(x)]$

Haben must take two entities as inputs, not properties as input. de Swart thus predicts that the Jacobs sentence should only have two readings, as we did before under Link's principle. However, we know that one of these two readings does not obtain, and that in its place we find the split reading. How might we proceed, then, on de Swart's account?

If we were to outlandishly posit that any verb can take a property as its object, we achieve de Swart's goal of accounting for the Jacobs sentence. This requires a meaning postulate as in (30):

(30) $\forall x \forall y \forall P((P(y) \wedge \text{have}(y)(x)) \rightarrow \text{have}(P)(x))$

We can then eventually generate the split reading as in (31)

(31) $\neg\exists P\ (P = \lambda y\ (\text{car}(y)) \wedge (\forall x\ (\text{doctors}(x) \rightarrow (\text{have}\ (x, (P))$
There exists no property such that it is the property is equal to that of being a car, and for all x, if x is a doctor then x has a y with that property.

= 'It is not the case that all doctors have a car.'

However, on this account we over-generate ambiguity once again: there is no principled reason to prevent the purported negation-over-properties in monotone-decreasing quantifiers such as the one in (32) from taking scope over the quantified-DP subject as the parallel case in (33) shows:

(32) Alle Ärzte haben höchstens 4 Autos.
All doctors have at-most 4 cars.

(33) $\neg\exists P\ (P = \lambda y\ (\text{car}(y) \wedge \text{more-than-4}(y)) \wedge (\forall x\ (\text{doctors}(x) \rightarrow (\text{have}\ (x, \exists y(P(y))$
There exists no property such that it is the property of being more than 4 cars, and for all x, if x is a doctor then x has a y with that property.

= # 'It is not the case that all doctors have more than 4 cars.'

The split reading in (33) is not one that can be obtained. Permitting properties as inputs to extensional predicates is, therefore, not an option. The Jacobs sentence remains unexplained under de Swart's framework. For this construction, it seems, Jacobs' (1980) Lexical Decomposition approach seems to account better for the data. de Swart's (2000) higher-order quantification approach seems untenable.

4.2 HOW GEURTS (1996) FAILS TO ACCOUNT FOR THE DATA

Penka and Zeijlstra (2005) point out several flaws for the Geurts's approach to Negative Indefinites[2]. One of which is the argument that Geurts cannot account for split reading in idioms containing *kein*.

Arguing for a Lexical Decomposition approach to Negative Indefinites based on idioms, Penka and Zeijlstra (2005) argue that Geurts (1996) cannot account for the split reading that arises in idioms containing *kein*, such as (34):

(34) *Mir kannst du keinen Bären aufbinden*
me.DAT kan you no bear up-tie
'You can't fool me'

The idiom in (34) is the negative version of the original idiom with *ein*:

(35) *Mir kannst du einen Bären aufbinden*
me.DAT can you a bear up-tie
'You can fool me'

Geurts (1996) can only account for the split readings through quantification over abstract individuals, and this will only yield the literal reading of the idiom in (34), and never the idiomatic reading.

As we have seen above, Non-Lexical Decomposition approaches fail to account for the data, while Lexical Decomposition can account for the distribution of *kein*. Therefore, we argue that Lexical Decomposition is necessary to account for Negative Indefinites. But what about the *at most* and *few* constructions of de Swart (2000)? We argue that this split reading data can be accounted for not by the assumption that these quantifiers involve negative quantification over properties or by Lexical Decomposition into negation and a quantifier meaning *more than n*, but instead by DegP movement. In the following section presents

[2] Also, it appears at first glance as if Geurts cannot account for the following data:
(i) *Alle Ärzte haben zwei Auto*
all doctors have two cars
a. All doctors are such that they have two cars
b. There exists no two cars such that all doctors own them
Krifka (1995) provides a possible solution to this problem by arguing that English mass and count nouns have a classifier built into the number word. However, because there are additional arguments against Geurts (1996) besides the data in (1), we will leave this point aside for now and direct the reader to the relevant literature.

arguments from Heim (2000, 2006) and Hackl (2001) in favour of Degree Quantification as an approach to these cases.

5. ACCOUNTING FOR NON-MONOTONE-INCREASING AMBIGUITIES: DEGP MOVEMENT

Recall that the split-reading examples from de Swart (2000) were interactions between quantifiers such as "at most four" and "exactly 2 towels" and intensional predicates. Her cases were those such as (36) below:

(36) A muslim can marry at most four women.
a. It is not the case that a muslim can marry more than four women.
b. It is the case that a muslim is allowed to marry four women
c. At most four women are such that a muslim can marry them.

Crucially, the problematic nature of these sentences relies on the denotation of non-monotone-increasing quantifiers as containing negation and a monotone-increasing quantifier as in (37):

(37) [[at most n]] = $\lambda x \lambda P \neg \exists P(P = (\lambda \mathbf{P} \lambda y \mathbf{P}(y) \wedge \text{more-than-n}(y)))$

From this it seems that we should find truth-functional ambiguities with sentences involving quantified subjects and monotone-decreasing quantified objects headed by quantifiers other than *kein*. However, as noted above this result does not obtain - the sentence below in (38) does not have a split reading:

(38) Every student has at most three books.
\# Not every student has three or more books.

As we shall see in this section, the problem here lies in the denotation given to these other monotone-decreasing and non-monotone quantifiers. They do not, in fact, involve the assertion of the non-existence of a property of having more-than-three books, as de Swart claims. Instead, the observed ambiguities and lack of ambiguity can best be explained on the basis of DegP scope.

5.1 HEIM AND HACKL'S DEGP MOVEMENT

According to Heim (2000, 2006) and Hackl (2001), both gradable adjectives and gradable quantifiers have in common an operator, referred to as DegP, which expresses a relation between degrees and properties. Though the movement of this operator is severely limited, it does introduce some truth-functional ambiguities. DegP is present in any gradable adjective or quantifier in either the comparative (headed by [-er]) or superlative (headed by [-est]) degree. As we shall see, those ambiguities which it does introduce are precisely those which de Swart points to as an argument against lexical decomposition; and those cases which it disallows are precisely those problematic cases which are not ambiguous, but which de Swart's approach predicts should result in ambiguity.

A denotation, then, for the comparative morpheme [-er] as in "taller" (Heim 2000) would be as in (39):

(39) $[[\textit{-er}]] = \lambda P_{<d,t>}.\lambda d.\ \max(P) > d$

As arguments, they take gradable adjectives such as "tall" and a degree-restrictor such as "than one foot." Gradable adjectives themselves are monotone in the sense of (40):

(40) $\forall x \forall d \forall d'.[f(d)(x) \wedge d' < d \rightarrow f(d')(x) = 1]$

For a monotone-increasing quantifier in the comparative degree, such as "more than n," we have the following (Hackl 2001) denotation (41):

(41) $[[\textit{more than n}]] = \lambda D_{<d,t>}.\ \max(\lambda d.\ D(d) = 1) > n$

And finally, for a monotone-decreasing quantifier in the superlative degree, such as "at most n," we have the denotation (Hackl 2001) in (42):

(42) $[[\textit{at most n}]] = \lambda D<d,t>.\neg \exists d[d>n \ \&\ D(d)=1]$

Crucially, all of these relations require a lower degree argument. For Heim, this argument is picked up from the adjective. On the other hand, for the quantifiers, this argument is expressed as *d-many* in Hackl's writings, and has the denotation in (43):

(43) $[[\textit{d-many}]] = \lambda d.\lambda P<e,t>.\lambda Q<e,t>.\ \exists x\ [|x| = d \ \&\ P(x) = 1 \ \&\ Q(x) = 1]$

The possibility of these operators taking scope at different points in a sentence, then, will allow the ambiguities that de Swart (2000) wishes to claim as cases of property quantification. As will be shown, if we consider the limitations of the scope-taking possibilities for DegP, as well as the monotonicity of its arguments, we will successfully be able to allow exactly those ambiguities she wishes to allow, as well as omitting the ambiguities which do not arise.

Gradable adjectives in the comparative degree cannot show truth-functional ambiguity in sentences involving other quantified DPs (44):

(44) Exactly 2 girls are taller than 5'.
[exactly 2 girls]$_1$ [-er than 5']$_2$ t_1 are t_2 tall.
$|\{x: girl(x)\ \&\ \max\{d: tall(x, d)\} > 5| = 2$
The number of girls such that they possess a degree of tallness greater than 5' is exactly 2.
\# [-er than 5 feet]$_2$ [exactly 2 girls]$_1$ t_1 are t_2 tall.
$\max\{d: |\{x: girl(x)\ \&\ tall(x, d)\}| = 2\} > 5'$ (Heim 2001)
The degree to which there is a set of exactly 2 girls such that they possess it is > 5'.

The absent second reading for this sentence says that the degree of height such that exactly 2 girls have it is greater than 5'. The meaning given would be true in a universe where everybody is over 5’ tall, but there are two girls who are 20’ tall. No native speaker of English derives this reading, though it seems that it should be possible.[3]

What is at work, here, according to both Heim and Hackl, is Kennedy’s Generalization (45):

(45) *Kennedy’s Generalization*

If the scope of a Quantified DP contains the trace of a DegP, it also contains that DegP itself.

This prevents readings such as b above, and more generally any reading where the degree of a gradable adjective or a gradable quantifier takes scope above a quantified DP. This generalization, then, accounts for the class of non-observed split-readings between monotone-decreasing gradable quantifiers in object position and quantified subjects.

This does not in and of itself rule out all of the cases of split-readings that de Swart wishes to exclude: cases of ambiguity involving intensional predicates and monotone increasing quantifiers will not be caught by this generalization. However, as will be seen below, the absence of truth-functional ambiguity does not necessarily indicate the absence of possible scope ambiguity.

In the case of monotone increasing modals and DegPs quantifying over monotone gradable adjectives we see that the ambiguity is vacuous. Due to the monotonicity of gradable adjectives as noted in (40) both scope configurations have the same truth-values, as in (46):

(46) The paper is required to be longer than 10 pages.

a) $\forall\ w \in$ Acc: max {d: $long_w$ (p, d)} > 10 pp

In all accessible worlds, the paper must be of a length greater than 10 pages.

b) max {d: $\forall\ w \in$ Acc: $long_w$ (p, d)} > 10 pp

The minimum length for the paper is greater than 10 pages in all accessible worlds.

Both of these readings are equivalent: in either case, the paper’s length requirements end up being longer than 10 pages.

A similar result is obtained for monotone increasing gradable quantifiers (47):

(47) John is needs to read at least 10 papers.

a) $\forall\ w \in$ Acc: (max d (John reads at least d-many papers)) > 10

In all accessible worlds, the maximum number of papers that John reads is greater than 10.

b) max d (d-many papers ($\forall\ w \in$ Acc: John reads *t*)) > 10

The number of papers such that John reads them in all accessible worlds is greater than 10.

c) max d ($\forall\ w \in$ Acc: John reads at least d-many papers) > 10

[3] It is worth noting here, that Heim (2000) also shows that there is no observed truth-functional ambiguity for DegP > monotone quantified subjects, but that this may also be due to the fact that gradable adjectives are monotone as well.

The maximum number such that it is the case that John reads this many papers in all accessible worlds is greater than 10.

Here, (a) and (c) are have equivalent truth-conditions, wherein the number of papers that John reads is greater than 10 in all accessible worlds; on the other hand, (b) states that there is a specific set of 10 papers that he reads in all accessible worlds, and thus is rendered true under different circumstances.

As evidenced by these derivations, the DegP formulation, like de Swart's, produces a vacuous ambiguity: just as the "split" property reading for intensional predicates and upward entailing quantifiers reduced in her account to the de dicto reading, so too does the wide-scope DegP, narrow-scope *d-many* reading reduce to the narrow scope reading of the quantifier as a whole with regards to monotone increasing intensional predicates such as "require." This lack of ambiguity for gradable adjectives and intensional predicates, then, is just as attributable to DegP scope as it might be to quantification over properties.

However, we can observe truth-functional ambiguity for the modal "required" and monotone-decreasing gradable quantifiers such as "at most 10," as in (48), depending on the scope-site for DegP:

(48) The paper is required to be at most 10 pages.

a. $\forall w \in$ Acc: $\neg \exists$ d[d > 10 pages & d-long$_w$(paper)]

In all accessible worlds, there is no degree greater than 10 pages such that the paper is that long.

b. $\neg \exists$ d[$\forall w \in$Acc: d> 10 pages & d-long$_w$ (paper)]

There is no degree greater than 10 pages such that the paper is that long in all accessible worlds.

(Amounts to: It is not required that the paper be 10 pages or longer.)

This seems to derive the split reading.

For the faint of heart, more clear-cut cases where DegP takes scope independently of its associated existential quantification are as below in (49) & (50):

(49) At MIT one needs to publish fewer than 3 books in order to get tenure.

(50) At MIT one needs to come up with fewer than 5 brilliant ideas to get tenure.

In both of these cases, were we to take the phrase "fewer than 3 books" as taking either high or low scope with regards to the modal "need", we would incorrectly interpret the sentence. When "fewer than 3 books" takes wide scope, we would have to assume that these books or ideas already exist, which is impossible with verbs of creation such as "publish" and "come up with". The reading on which "fewer than 3 books" takes narrow scope with regards to the modal, too, is illicit, since it would punish those who came up with more. The only reading available for these sentences is the one on which the DegP "fewer than 3" takes wider scope than "need", but that "need" outscopes "d-many books": the reading on which it is not necessary to publish more than 3 books or to come up with more than 5 brilliant ideas in order to get tenure. This, once again, is essentially a split reading such as those de Swart (2000) wishes to explain via property quantification.

Thus far we have explained the same cases de Swart manages to explain, using degree quantification rather than quantification over properties. We will now move on to explaining those cases which de Swart cannot explain: the unobserved split reading for monotone-decreasing gradable quantifiers and monotone-decreasing intensional predicates. In the next section, we will see a case where the Property and Degree quantification frameworks make different predictions. It will be shown from this that DegP is better able to account for the data, and therefore that the arguments against Lexical Decomposition of the German determiner *kein* hold little weight.

6. PREDICTIONS OF DEGREE AND PROPERTY QUANTIFICATION

In this section, it will be shown that the assumption that gradable quantifiers express degree quantification as well as existential quantification correctly predicts no ambiguity with regards to these quantifiers taking scope over monotone decreasing intensional predicates. However, the same is not true of de Swart's Property quantification approach, which predicts that an accessible split reading should in fact arise for these scope configurations.

According to Heim (2000), relying on Rullman (1995)'s semantics for gradable adjectives, cases of DegP taking scope over monotone-decreasing predicates lead to a presupposition failure as in (51):

(51) Mary isn't taller than 4 feet.
a. It is not the case that the degree to which Mary is tall exceeds 4 feet
not [-er than 4'] Mary is t tall
$\neg\max\{d: \text{tall}(m, d)\} > 4$ ft

b. The degree to which Mary is not-tall exceeds 4 feet
[-er than 4'] Mary is not t tall
$\max\{d: \neg\text{tall}(m, d)\} > 4$ ft

Rullman's framework for the comparative morpheme presupposes that a predicate specify a defined maximal degree. 'Not-tall,' however, has an infinite maximum value: if one is not-tall to degree 4', one is also not-tall to degree 4'1". The possible ambiguity here, therefore, is blocked. This result holds for all monotone-decreasing intensional predicates. In all cases where DegP might take scope over a downward entailing intensional predicate, therefore, this reading is blocked. For instance, this predicts ambiguity of antecedent size for elided sentences with monotone-increasing (52), but not monotone-decreasing verbs (53), where the ellipsis is allowed by high DegP scope[4]:

(52) John wanted to drive faster than Mary did {want to drive/drive}.
a. [-er than Mary drove] John wanted to drive *t* fast.
b. [-er than Mary wanted to drive] John wanted to drive *t* fast.

(53) John refused to drive faster than Mary did {*refuse to drive/drive}.

[4] That DegP is the elided constituent in question can be shown by the illicitness of ellipsis over similar structures lacking DegP:
(i) *John wanted to drive cars that Mary did.

a. [-er than Mary drove] John refused to drive *t* fast.
b. # [-er than Mary refused to drive] John refused to drive *t* fast.

The second reading for (53) is illicit, specifically because this is the presupposition-failure reading: there is no maximal degree to which you can refuse to drive fast.

This same lack of ambiguity is also observed for sentences involving DE intensional predicates and Hackl's DegP quantified quantifiers[5]:

(54) John wanted to write more books than Mary did {want to write/write}.
a. [-er than Mary wrote] John wanted to write *d-many* books.
b. [-er than Mary wanted to write] John wanted to write *d-many* books.

(55) John refused to write more books than Mary did {*refuse to write/write}.
a. [-er than Mary wrote] John refused to write *d-many* books.
b. # [-er than Mary refused to write] John refused to write *d-many* books.

In (55), the wide-scope reading where more books are such that John refused to write them than Mary refused to write them is, as in (51), again, nonsensical because of the verb of creation "write." Furthermore, the reading in (55) on which the number of books that John refused to write is greater than the number of books that Mary refused to write is also inaccessible, since again this would be the presupposition failure reading.

We see, then, that there is generally a constraint such that the configuration below in (56) is disallowed:

(56) DegP>Intensional Predicate$_{DE}$

From this generalization, we derive that no split reading should be observed for the sentence in (58), repeated as (57) below:
(57) John refused to eat at most 4 cookies.

The scope configuration which would be required to achieve the split reading, [at most 4] > refuse > [d-many] is ruled out by the generalization in (56).

On the other hand, de Swart's account predicts a split reading for the sentence in (58) involving a monotone-decreasing intensional predicate and a monotone-decreasing quantifier.

(58) John refused to eat at most 4 cookies.
$\text{refuse}(j, \forall y(\text{eat}(x,y) \rightarrow$
'4 cookies are such that John refused to eat them.' (at most 4 > refused)
$\neg\exists P(P = \lambda y\ (\text{cookie}(y) \wedge \text{more-than-4}(y)) \wedge \text{refuse}(\text{he}, (\exists x(\text{eat}(j, x) \wedge P(x))))$
$= \neg\text{refuse}(j, \exists x(\text{eat}(j, y) \wedge \text{cookie}(y) \wedge \text{more-than-4}(y))$
\# 'John did not refuse to eat 4 or more cookies.'

[5] It should be noted that here the high *d-many* readings would be anomalous, since they would refer to pre-existent books which John and Mary refused to write.

As would be the case for *kein* in such an environment, the split reading is predicted to occur, on her account, when negative quantification over properties takes high scope with regards to the monotone decreasing intensional predicate "refuse." However, speakers of English do not accept the split reading for this sentence: it seems we must preclude it from arising. We may not do so simply if we accept de Swart's account; a restriction against property quantification over monotone decreasing intensional predicates would have to be stipulated instead.

On the other hand, for speakers of German, it is possible to get a split reading for *kein* in just such a context (59):

(59) … (weil) er keine Kekse zu essen ablehnt.
since he no cookies to eat refuses.
$\neg\exists P(P = \lambda y\ (cookie(y) \wedge refuse(he, (\exists x(eat(he, x) \wedge P(x))))$
$= \neg refuse(he, \exists x(eat(he, x) \wedge cookie(x))$
'Since it is not the case that he refuses to eat a cookie.'

Once again, this is predicted to occur when property quantification takes high scope. However, even in German, the same split reading does not occur for other monotone-decreasing quantifiers (60), contrary to one's expectations if both quantify over properties:

(60) … (weil) er höchstens 4 Kekse zu essen ablehnt.
(since) he at most 4 cookies to eat refuses.
$\neg\exists P(P = \lambda y\ (cookie(y) \wedge more\text{-}than\text{-}4(y)) \wedge refuse(he, (\exists x(eat(he, x) \wedge P(x))))$
$= \neg refuse(j, \exists x(eat(j, y) \wedge cookie(y) \wedge more\text{-}than\text{-}4(y))$
"Since it is not the case that he refuses to eat 4 or more cookies."

From the data in (60), it seems we must preclude the split reading from arising for monotone-decreasing intensional predicates. On the other hand, the data in (59) indicates that we must allow the split reading for another monotone-decreasing quantifier, *kein,* in exactly the same contexts. On de Swart's account, there is no way to accomplish this, aside from a stipulation saying that the split reading is not permitted for a particular class of monotone-decreasing quantifiers in this context. However, this is neither predictive nor parsimonious. Thus we must conclude that de Swart's account is an inadequate characterization of the data: we cannot conveniently allow the split reading for *kein* but disallow it for the other monotone-decreasing quantifier cases in this construction.

The data in (60) and (59) show that de Swart's (2000) property quantification account cannot explain the lack of a split reading for monotone-decreasing gradable quantifiers and monotone-decreasing intensional predicates. On the other hand, Heim (2000, 2006) and Hackl (2001) can, on the basis of DegP movement. Moreover, DegP movement can be used to explain the other cases of observed and unobserved ambiguities: Kennedy's Generalization prevents DegP in object position from taking scope over a quantified subject; moreover, the scope taking and monotonicity behaviour of DegP in gradable quantifiers can explain the observed ambiguity for sentences involving gradable quantifiers and monotone-increasing intensional predicates. It seems we must abandon the idea that *kein* and other monotone-decreasing quantifiers quantify over properties, as it cannot account for all of the data. As it has already been shown that there is justification for allowing negation and existential quantification to take scope independently, we must conclude that Lexical Decomposition is the more explanatorily adequate account for this phenomenon.

7. CONCLUSION

In this paper, we have argued that Lexical Decomposition (Jacobs (1980), Penka and Zeijlstra (2005), a.o.) more accurately accounts for the split readings that Negative Indefinites such as the German *kein* and the Dutch *geen* give rise to. By highlighting the flaws and failures of the Non-Lexical Decomposition approaches, we hope to have shown that Non-Lexical Decomposition, whether it be high-order quantification over individuals and properties (de Swart 2000) or quantification over individuals and types (Geurts 1996), is not an adequate analysis for Negative Indefinites. Lexical Decomposition will account for the Negative Indefinite data, while Heim (2000; 2006) and Hackl's (2001) DegP movement will be able to account for the split readings of monotone-decreasing quantifiers in the surface scope of monotone-increasing intensional predicates.

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