Degree expressions and the autonomy of syntax^{*}

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Abstract

This paper argues for the autonomy of syntax. So-called degree expression come in two sorts: some are heads selecting an AP, others are adjoined to any suitable host. These two classes yield to a unitary semantics, which explains their largely complementary distribution. Hence, they can only be distinguished in syntactic terms, in particular c-selection. A further argument for an autonomous syntax comes from cases in which degree expressions are not in complementary distribution. It is demonstrated that the syntactic relation of specifier-head agreement explains such cases, and that this explanation cannot be reduced to a semantic fact.

1 Introduction

The elimination of D-structure and S-structure in the minimalist program gives new focus to the question whether the syntax, the computational system that relates sound and meaning, is autonomous. In particular, one might argue that a model in which semantics directly interfaces with phonology is to be preferred on conceptual grounds over a model in which there is a syntactic interlingua. This means that if one wants to argue for the existence of an autonomous computational system one must do so on the basis of empirical arguments.

The strongest arguments to this effect demonstrate that a system external to the syntax must make reference to irreducibly syntactic properties. This sheds a new light on the discussion regarding the notions of c-selection and s-selection, as introduced by Grimshaw (1979). It is clear that the type of complement a head may select is at least in

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part determined by its semantic properties. Therefore heads are said to s-select their internal arguments. In many cases, however, a head also requires a complement of a particular syntactic category, a phenomenon known as c-selection. Trivially, if there were no syntactic component, there could not be c-selection either. In such a model all apparent cases of c-selection should reduce to s-selection. By contrast, if there is a syntactic component, it would be very surprising if no lexical entry made reference to the categories on which it operates. Thus, an argument for c-selection is an argument for the existence of an autonomous syntax.

Considerations of theoretical simplicity may lead one to pursue a theory in which categorial selection is derived from semantic selection. At present it is unclear whether such an approach is feasible. Grimshaw originally argued that the distinction between syntactic and semantic selection must be made on the grounds that semantic selection does not uniquely determine syntactic selection. Later work, in particular by Pesetsky (1982), argued that the occasional mismatch between s-selection and c-selection can be attributed to independent syntactic principles, a position recently disputed by Odijk (1997). These authors have all considered the selectional properties of lexical heads, and more specifically verbs. However, in recent years a number of functional heads have been identified. These provide a new testing ground for the hypothesis that c-selection can be derived from s-selection. It seems quite plausible that a determiner selects a noun phrase because it requires a complement of a particular semantic type. A similar proposal presents itself with regard to the relation between VP and particles expressing tense.

Despite its initial reductionist appeal, we believe that a theory deriving c-selection from s-selection is fundamentally flawed. Although there may be cases in which the type of complement a head takes is uniquely determined by its semantics, there is a residue of c-selection that cannot be reduced in this way. In this paper we will present one argument to this effect based on the syntax of degree expressions. We will show that from a syntactic point of view two classes of degree expressions must be distinguished. One class is migratory in that its distribution is not restricted to the extended adjectival projection. In fact, it can be attached to any predicate. The other class is nonmigratory: it exclusively attaches to APs. If the syntactic properties of lexical items is determined by their semantically. A close examination of their interpretive functions reveals however that this is not the case. It appears that quite the opposite is true: the two classes have largely identical semantics. The difference between migratory and nonmigratory degree expressions must therefore be due to c-selection. The syntactic status of the migratory class is that of a modifier – that is, adjunct or specifier – which attaches to any

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suitable semantic object. The nonmigratory class, on the other hand, consists of functional degree heads which c-select AP.

As it turns out, then, a lexical entry can contain an instruction to the syntax concerning the categories it can be merged with. This then is a case of a component external to the computational system making crucial reference to its, apparently non-semantic, vocabulary. Thus, the distribution of degree expressions supports the autonomy of syntax.

The bulk of this paper deals with making a case for c-selection. In sections 2 and 3 we give an overview of the data that motivate a syntactic bifurcation in the set of degree expressions, based on their combinatory possibilities and on certain movement and substitution asymmetries. Despite the basic syntactic distinction that must be made between the two types of degree expressions, they almost always seem to exclude each other (that is, they are in near complementary distribution). This, we argue in section 4, is because the two classes yield to a broadly unitary semantic characterization which generally precludes iteration. The distinction between the two classes must therefore be purely syntactic.

Once the syntactic and semantic properties of degree expressions have been established we will be in a position to provide a further argument in favour of an autonomous computational system. Although degree expressions are largely in complementary distribution, there is a well-defined subset of cases in which they cooccur. We argue in section 5 that this possibility arises as a result of a syntax-semantics mapping rule that crucially refers to the essentially syntactic relation of specifier-head agreement: only if two degree expressions are in such a relation can they be combined. So, not only the lexicon but also the semantic component must refer to properties of syntactic representations, thus corroborating their reality.

2 The Syntax of Degree Expressions

2.1 Two classes of degree expressions

Bresnan (1973) and Jackendoff (1977) identify a set of expressions that may accompany APs, indicating the degree to which the property expressed by the AP holds. These items, exemplified by *very* and *more*, head a degree phrase which occupies the specifier of AP. A modern version of such a proposal would perhaps treat all degree expressions as

degree heads selecting an AP. One of the merits of such an analysis, in addition to its simplicity, is that it explains that such words are in near complementary distribution:

- (1) a. John F. was very famous.
 - b. John F. was more famous than Marilyn.
 - c. *John F. was very more famous.
 - d. *John F. was more very famous.

However, Corver (1997a: 126-127) argues that a uniform analysis of degree expressions cannot be maintained. He observes the following contrast between what we would like to call class-1 and class-2 degree expressions. Class-2 expressions can be stranded when an AP is replaced by a pro-form whereas class-1 expressions cannot. This can be illustrated with the following data, mostly taken from Corver:

- (2) a. John is *fond of Mary*. *Maybe he is **too** *so*.
 - b. *The weather was *hot* in Cairo, **very** *so* indeed.
 - c. John is fond of Mary. *Maybe he is as so as Bill.
 - d. *John told me he was *afraid of spiders*, but I wonder how so he really is.
- (3) a. Of all the *careless* people, no one is **more** so than Bill.
 - b. The police searched the big room *carefully*, but the small room **less** *so*.
 - c. John is *good at mathematics*. He seems **enough** *so* to enter our graduate program.

At a purely observational level, these data imply that one must distinguish two classes of degree expressions, along the following lines:

(4) Class 1: too, as, very, how, ... Class 2: more, less, enough, ...

The question arises how these two classes of degree expressions are to be analyzed. Corver (1997a) proposes that both classes consist of functional heads in the extended adjectival projection, but that only heads of class 2 can license *so* pronominalization. More specifically, he proposes that in the following structure class-1 expressions occupy the Deg⁰ position, while class-2 expressions are inserted in Q:

 $(5) \qquad [_{DegP} Deg [_{QP} Q AP]]$

Corver argues for two further assumptions which make it possible to capture the above data. The first is that *so* can substitute for AP but not QP; the second is that, if no head is inserted in Q, A must raise to this position. As a result, *so* can replace the adjective only if a class-2 item is present, since only in that case the adjective may remain in AP.

Although this set of assumptions accounts for the data, a very simple alternative explanation suggests itself. In particular, it is not necessarily the case that a pro-form which replaces adjectival expressions is itself adjectival. As the examples in (6) demonstrate, *so* can in fact substitute for verbal, prepositional and nominal constituents as well. This indicates that *so* is categorially underspecified.

- (6) a. John *loves Mary*, and Peter does *so* too.
 - b. John is still very much on drugs, but he is less so than he was as a teenager.
 - c. John is a real gentleman he has always been so

It might well be the case, therefore, that class-1 items exclusively attach to APs, whereas class-2 items have a much freer distribution: they attach to any semantically suitable category. This would follow if class-1 expressions are functional heads in the extended adjectival projection and class-2 expressions are predicate modifiers (labelled here provisionally as ModP)¹. Thus, the latter occur in adjoined positions and the former head a functional projection we may call DegP:



2.2 Attachment to non-adjectival projections

On closer inspection, there is strong evidence for an analysis along these lines. As expected, both types of degree expressions can be attached to APs, but as soon as we turn to other categories there is a sharp contrast in grammaticality between attaching class-1

¹For ease of exposition we will represent class-2 expressions as adjuncts. Later on it will transpire that they can also be specifiers. These two types of elements can be viewed as one, if specifiers are designated adjuncts (cf. Hoekstra 1991 and Bittner and Hale 1996).

and class-2 items. As a first example of this, compare the data in (9) and (10) with those in (11) and (12):²

- (9) a. He is $[_{AP} more [_{AP} famous]]$ than I thought.
 - b. His paper is $[_{AP} less [_{AP} interesting]]$ than I thought.
 - c. He is $[_{AP} [_{AP} funny]$ enough] to be my buddy.
- (10) a. He is $[_{DegP}$ too $[_{AP}$ famous]] to leave town.
 - b. He is $[_{DegP}$ as $[_{AP}$ intelligent]] as Bill.
 - c. He is $\left[\int_{\text{DegP}} \text{very} \left[AP \right] \right]$ dependent on his parents].
 - d. I wonder $[_{DegP}$ how $[_{AP}$ rich]] he really is *t*.
- (11) a. He is $[_{PP} \text{ more } [_{PP} \text{ on } drugs]]$ than any of his friends.
 - b. He is $[_{PP}$ less $[_{PP}$ into syntax]] than he was before.
 - c. He is $[_{PP} \text{ enough } [_{PP} \text{ over the limit}]]$ to be arrested.
- (12) a. *He is $[_{DegP}$ too $[_{PP}$ under scrutiny]] to be elected at this time.
 - b. *He is $[_{DegP}$ as $[_{PP}$ over the limit]] as Bill.
 - c. *He is $[_{DegP}$ very $[_{PP}$ on drugs]] indeed.
 - d. *I wonder $[_{DegP}$ how $[_{PP}$ into syntax]] he really is *t*.

So if a PP expresses a gradient property, a class-2 expression can be attached to it, but attachment of a class-1 expression is impossible.³ The same contrast can be witnessed in the case of definite and indefinite DPs expressing gradient properties. Of course, in most of their usages DPs denote a set of individuals rather than a gradient property. However, certain DPs yield the relevant semantics if used in an appropriate context. The DP *a linguist*, for instance, applies more to a person if that person has more

²We remain agnostic about the syntactic status of satellites such as *than I thought* in (9a) and therefore we will leave them unanalyzed in the bracketed structures.

³There are some PPs that do accept class-1 degree expressions. Examples are *too out of his mind to get a job* and *too in love to do any work*. The analysis of such examples is unclear, but we tentatively suggests that they are PPs converted into adjectives. It is certainly the case that these PPs cannot be broken up by movement. Constructions headed by *consider* provide a further test, as the predicative complement of this verb cannot be a PP, witness examples like **I consider him on drugs* and **I consider him under intense scrutiny*. Interestingly, exactly those PPs that tolerate class-1 items can occur in this context: *I consider him out of his mind* and *I consider him in love*.

characteristics prototypical of linguists. As (13) and (14) demonstrate, DPs used in this way can be modified by class-2 expressions but cannot be selected by Deg heads.

- (13) a. He is $[_{DP} \text{ more } [_{DP} \text{ a linguist}]]$ than a psychologist.
 - b. He is $[_{DP}$ less $[_{DP}$ a typical Hollywood celebrity]] than any of his neighbours.
 - c. He is $[_{DP} [_{DP} man]$ enough]] for Sue.
- (14) a. *He is $[_{DegP}$ too $[_{DP}$ a scientist]] to care about such problems.
 - b. *He is $\left[\sum_{\text{DegP}} as \right]_{\text{DP}}$ a typical Hollywood celebrity]] as Robin W.
 - c. *It's $[_{DegP}$ very $[_{DP}$ time for coffee]] now.
 - d. *I wonder $[_{DegP}$ how $[_{DP}$ man]] he really is *t*.

It is perhaps less of a surprise that the action expressed by a VP can be interpreted as gradable. When this is the case, the familiar pattern reappears: only class-2 modifiers can be attached.

- (15) a. He [$_{VP}$ [$_{VP}$ likes venison] more] than his family does.
 - b. He $[_{VP} [_{VP}]$ lives like a celebrity less] than he would like to.
 - c. He $[_{VP} [_{VP} loves Mary]$ enough] to marry her.
- (16) a. *He [$_{DegP}$ too [$_{VP}$ likes venison]] for his own good.
 - b. *He $[_{DegP}$ as $[_{VP}$ lives like a typical Hollywood celebrity]] as Robin W.
 - c. *He $[_{DegP}$ very $[_{VP}$ loves Mary]] indeed.
 - d. *I wonder [$_{DegP}$ how [$_{VP}$ expect to be nominated] he really does *t*.

Finally, the contrast between class-1 and class-2 items can be illustrated with degree phrases headed by *too*. What is special about such degree phrases is that they allow a gradient interpretation themselves (see section 4 for discussion). As expected, *too*-phrases allow attachments of a class-2 element but not of another Deg head. The existence of this possibility is especially clear if an appropriate context is provided. For instance, suppose John is shorter than Bill. They are trying on the same sweater, which is too small for either of them. Then one can felicitously say:

(17) John is too tall for this sweater, and Bill is too tall for it as well. But it seems to me that John is $[_{DegP}$ less $[_{DegP}$ too tall for this sweater]] than Bill.

With some effort, similar examples can be constructed with *more* and *enough*. In the same context, however, one cannot use (18), or comparable constructions with *too*, *as* and *how*.

(18) *John is $[_{DegP}$ very $[_{DegP}$ too big for this sweater]] indeed.

The example in (17) is of some importance, because it shows that the two classes of degree words are not in complete complementary distribution. In other theories this fact can only be accommodated by making the additional claim that class-2 elements can be modifiers of degree phrases. This possibility follows without stipulation in the theory proposed here.

Surveying the data introduced above, we conclude that class-2 degree expressions have a much wider distribution than their class-1 counterparts, which only attach to APs. Since the underspecified pro-form *so* is not an AP (although it can of course replace APs), class-1 items cannot attach to it. This readily explains the data introduced at the beginning of this section.

2.3 Omission of the adjective

As we have suggested above, contrasts in the distribution of class-1 and class-2 degree expressions can be derived if the former are functional heads and the latter modifiers: only class-2 modifiers can be attached to the categorially underspecified pro-form *so* and to non-adjectival projections. These two are the first of at least six differences between class-1 and class-2 elements that support our analysis. The third concerns the extent to which a degree item can occur in the absence of an AP. One would not expect this possibility to be available to functional heads, as these c-select a particular lexical complement. Modifiers, however, are maximal projections which do not have such s-selectional requirements and may hence be used on their own. This prediction can be tested if we turn to expressions that generally allow non-nominal subjects, such as *Black is beautiful*. It turns out that class-1 degree items cannot be used in this environment, which suggests that they are heads, whereas their class-2 counterparts can.⁴ The latter, then, must be phrases:

 $^{^{4}}$ *How*, being an exclamative or a question marker, cannot be used in this context for independent reasons.

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- (19) a. *Too is inadvisable.
 - b. *Half as would be acceptable.
 - c. *Very might be offensive.
- (20) a. More is not always better.
 - b. In fact, less is more.
 - c. Enough is enough.

2.4 Adjunction

The fourth argument supporting our analysis concerns a restriction on adjunction-bymovement. As Chomsky (1986) argues, it is not allowed to adjoin by movement to selected categories. If this restriction holds of the selected complement of a degree head, an asymmetry is predicted to exist. In general, APs should allow adjunction of an extracted phrase, but not if selected by a Deg head. This prediction cannot be tested in English, but it can in Dutch, as this language allows the prepositional complement of an adjective to be shifted leftward. A simple example of this movement occurs in (21).

- (21) a. Hij is [_{AP} afhankelijk van zijn vader]. *he is dependent on his father*
 - b. Hij is [AP van zijn vader [AP afhankelijk t]]. *he is on his father dependent*

Now consider the facts in (22), which show that PP-shift to a position c-commanding the class-1 item *te* 'too' is possible, whereas adjunction between the AP and the class-1 element yields an ungrammatical result. That this position does not qualify as a landing site for PP-shift is expected if class-1 items are selecting heads.

- (22) a. Hij is [DegP te [AP afhankelijk van zijn vader]] om een eigen zaak te beginnen.
 he is too dependent on his father for a own business to start
 - b. Hij is [DegP van zijn vader [DegP te [AP afhankelijk t]]] om een eigen zaak te beginnen. *he is on his father too dependent for a own business to start*

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 - c. *Hij is [_{DegP} te [_{AP} van zijn vader [_{AP} afhankelijk *t*]]] om een eigen zaak te beginnen. *he is too on his father dependent for a own business to start*

These data are in contrast with those in (23). A shifted PP can freely adjoin either higher or lower than a class-2 item. Crucially, (23c) is grammatical, confirming, on the assumptions made above, that the class-2 item *meer* 'more' does not select the category it is attached to.

- (23) a. Hij is [AP meer [AP afhankelijk van zijn vader]] dan ik dacht. *he is more dependent on his father than I thought*
 - b. Hij is $[_{AP}$ van zijn vader $[_{AP}$ meer $[_{AP}$ afhankelijk t]]] dan ik dacht. *he is of his father more dependent than I thought*
 - c. Hij is $[_{AP} \text{ meer } [_{AP} \text{ van zijn vader } [_{AP} \text{ afhankelijk } t]]]$ dan ik dacht. *he is more of his father dependent than I thought*

Corver (1997b), who was the first to analyze these data, argues that class-2 modifiers are functional heads heading a QP located between DegP and AP. He further assumes that PP-complements can be base-generated on either side of the selecting adjective:

 $(24) \qquad [__{\text{DegP}} __ Deg [__{\text{QP}} __ Q [__{\text{AP}} ... PP A PP]]]$

These assumptions suffice to derive the orders in (21), (22a) and (23a,c). In addition, Corver argues that if no class-2 item is inserted in Q^0 , the adjective raises to this position, a movement which would seem to explain the ungrammaticality of (22c). The PP is simply stranded to the right of the adjective:

(25) $[_{\text{DegP}} _ Deg [_{QP} _ [_Q A] [_{AP} ... PP t_A PP]]]$

Other data, however, force the conclusion that the PP can move leftward across Q^0 (cf. (23b) and (22b)). This raises the non-trivial question why it cannot target a position between Deg⁰ and Q⁰ (say spec-QP).

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2.5 Topicalization

The fifth and the sixth argument supporting the claim that class-1 elements are heads and class-2 elements modifiers are related to Abney's (1987: 64ff) generalization that functional heads cannot be separated from their complement by movement. Both arguments are based on asymmetries in topicalization in Dutch. This is a movement to the specifier position of CP, and hence it affects maximal projections only. A fifth contrast between the two types of degree expressions is now predicted: topicalization of class-2 expressions should be possible, but topicalization of Deg heads is ruled out. The data in (26) and (27) show that there is indeed a sharp contrast in the expected direction.⁵

- (26) a. Hij lijkt me [_{DegP} te [_{AP} afhankelijk van zijn vader]] om een eigen zaak te beginnen.
 - he seems to-me too dependent on his father for a own business to start
 *Te lijkt hij me [DegP t [AP afhankelijk van zijn vader]] om een eigen zaak te beginnen.
 too seems he to-me dependent on his father for a own business to star
- (27) a. Hij lijkt me [AP meer [AP afhankelijk van alcohol]] dan van andere drugs. *he seems to-me more dependent on alcohol than on other drugs*
 - b. ?Meer lijkt hij me $[_{AP} t [_{AP} afhankelijk van alcohol]]$ dan van andere drugs. *more seems he to-me dependent on alcohol than on other drugs*

⁵ Richard Hudson (p.c.) points out that in principle *meer* in (27b) could have been moved from a VPadjoined position. This would mean that the examples in (26) and (27) do not form a minimal pair anymore, although (27b) still shows that *meer* is a maximal projection. We can control for the origin of *meer* by providing a context which forces the AP-adjoined reading. Suppose that we are working in a detoxification clinic for alcohol and drugs addicts and that in this clinic we have developed a scale from 1 to 10 which expresses a patient's dependence on a particular drug. We could then felicitously say:

 ⁽i) Hoeveel punten meer lijkt hij je [AP t [AP afhankelijk van alcohol]] dan van andere drugs. *how many points more seems he to-you dependent on alcohol than on other drugs* This example, and in particular the sharp contrast with (26b), shows that the movement under discussion is indeed allowed. There are contexts in which this type extraction leads to a less felicitous result (cf. Corver 1997a). However, if this were due to head status of class-2 elements, one would expect severe ungrammaticality for all cases, contrary to fact.

A final prediction concerns topicalization of AP. Suppose that traces must be properly head-governed, and that, in general, functional heads do not qualify as proper head governors (although they do of course create a minimality barrier for external government).⁶ It should then generally be impossible to front the complement of a functional head. In other words, we expect that class-2 degree items can be stranded by topicalization of AP, whereas class-1 degree items cannot. This is true:⁷

- (28) a. *Intelligent lijkt hij $[_{DegP}$ te $[_{AP} t]$] om enigszins normaal te functioneren. intelligent seems he too for more-or-less normally to function
 - b. Intelligent vind ik hem $[_{AP} meer [_{AP} t]]$ dan de gemiddelde Nederlander. *intelligent find I him more than the average Dutchman*

We have now seen six differences in the behaviour of class-1 and class-2 degree expressions. (i) Class-1 items do not attach to pro-forms that replace AP; class-2 items do. (ii) Class-1 items select an AP; class-2 items can be combined with any category of the appropriate semantic type. (iii) Class-2 items can appear without an AP; class-1 items cannot. (iv) Class-1 items block adjunction to their sister; class-2 items do not. (v) Class-1 items cannot be topicalized; topicalization of class-2 items is allowed. (vi) Topicalization of AP cannot strand a class-1 item, but it can strand an item of class 2. These differences can all be reduced to one factor, namely the syntactic status of the two types of degree expressions as heads and modifiers respectively.

3 Much-support

3.1 Much as a dummy

The analysis we have proposed suggests that a degree head can never be combined with a non-adjectival phrase. A DegP, however, can be used as a modifier to some other

⁶For reasons we cannot discuss here this generalisation does not extend to modals and auxiliaries, which license VP-preposing.

⁷Again one may wonder whether *meer* is attached to the AP or the VP in (28b). We can control for this by adding the modifier *zeker tien IQ punten* 'certainly ten IQ points' which forces an AP-adjoined reading.

⁽i) Intelligent vind ik hem [AP zeker tien IQ punten meer [AP t]] dan de gemiddelde Nederlander. *intelligent find I him at least ten IQ points more than the average Dutchman*

category as long as an AP is present which satisfies the degree head's selectional restrictions:



This structure is trivially instantiated in examples such as *Her husband is too obviously after Liz's money*. Here *too* determines the degree of obviousness, not that of being after Liz's money.

A more interesting case involves the interaction of syntax with what might perhaps be called semantic planning. Suppose that selection from the lexicon is largely driven by whatever semantic structure is targeted. It is then possible for a situation to arise in which two items that should combine semantically cannot be merged directly for syntactic reasons. More specifically, consider what happens if a semantic structure is planned in which *too* determines the degree of some non-adjectival XP. This will lead to selection of Deg⁰ and X⁰ from the lexicon, even though these two elements cannot combine syntactically. To circumvent this dilemma, an adjectival head must be introduced, which can be used to satisfy Deg⁰'s c-selectional properties. However, given the targeted interpretation, this adjectival head must not saturate the s-selectional requirements of the degree head – these are to be applied to XP. Of course, such a strategy will only succeed if the adjective has a sufficiently weak semantics, on a par with dummy *do*. In sum, semantic planning may require the selection of two lexical items that do not allow direct merger. This syntactic problem then triggers insertion of a dummy adjective.

If this strategy is available, the question arises when an adjective qualifies as a dummy. One view of dummies, advocated in Grimshaw 1997, is that they are regular lexical items of which the lexical-conceptual structure is partly or completely suppressed. Given that suppression of semantic content is costly, two things follow. First, the insertion of dummies is a last resort operation. Second, the lexical item used as a dummy should have very weak semantics, so that suppression is minimized. In view of its semantic paucity, then, it is not surprising that *much* is used as a dummy in English. The structure in (29) is instantiated in the examples below (compare with the ungrammatical examples in (12), (14) and (16)):

- (30) a. He is $[_{PP} [_{DegP} too [_{AP} much]] [_{PP} under scrutiny]]$ to be elected at this time.
 - b. He is $[_{PP} [_{DegP} as [_{AP} much]] [_{PP} over the limit]]$ as Bill.
 - c. He is $[_{PP} [_{DegP} very [_{AP} much]] [_{PP} on drugs]]$ indeed.
 - d. I wonder $[_{PP} [_{DegP} how [_{AP} much]] [_{PP} into syntax]]$ he really is *t*.
- (31) a. He is $[_{DP} [_{DegP} too [_{AP} much]] [_{DP} a scientist]]$ to care about such problems.
 - b. He is $[_{DP} [_{DegP} as [_{AP} much]] [_{DP} a typical Hollywood celebrity]] as Robin W.$
 - c. It's $[_{DP} [_{DegP} very [_{AP} much]] [_{DP} time for coffee]]$ now.
 - d. I wonder $[_{DP} [_{DegP} how [_{AP} much]] [_{DP} man]]$ he really is *t*.
- (32) a. He $[_{VP} [_{VP} likes venison] [_{DegP} too [_{AP} much]]]$ for his own good.
 - b. He $[_{VP} [_{VP} lives like a typical Hollywood celebrity] [_{DegP} as [_{AP} much]]]$ as Robin W.
 - c. He $[_{VP}[_{VP} \text{ loves Mary}] [_{DegP} \text{ very } [_{AP} \text{ much}]]]$ indeed.
 - d. I wonder $[_{VP} [_{DegP} how [_{AP} much]] [_{VP} expect to be nominated] he really does$ *t*.

The left-branching structure proposed for these examples is corroborated by the fact that the Deg head and dummy *much* can be moved as a constituent, although this may require appropriate contextualisation. Some examples are given below:

- (33) a. No one knows $[_{\text{DegP}}$ how $[_{\text{AP}}$ much]] he really is $[_{\text{PP}} t [_{\text{PP}} \text{ on drugs}]]$.
 - b. They call him King of the Jungle, but only the size of his bowie-knife will tell [$_{DegP}$ how [$_{AP}$ much]] he really is [$_{DP}$ t [$_{DP}$ King of the Jungle]].
 - c. He is seen by many as the typical husband of a celebrity, but only the size of the divorce settlement will tell $[_{DegP}$ how $[_{AP}$ much]] he really is $[_{DP} t [_{DP}$ the typical husband of a celebrity]].
 - d. No one knows $[_{DegP}$ how $[_{AP}$ much]] he really $[_{VP} t [_{VP}$ lives like a celebrity]].

So, the approach we have defended not only explains the distribution of class-1 versus class-2 degree expressions, but also that of the dummy adjective *much*. In (30) through (32), insertion of *much* is forced by the c-selectional properties of Deg heads. A further prediction is that *much* must appear when an adjective is replaced by the categorially underspecified pro-form *so*. As we have already seen, *so* cannot satisfy the c-selectional requirements of class-1 items, a problem which is overcome by insertion of *much* (compare with the ungrammatical examples in (2)):

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- (34) a. John is fond of Mary. Maybe he is $[_{XP} [_{DegP} too [_{AP} much]] [_{XP} so]]$.
 - b. The weather was *hot* in Cairo, $[_{XP} [_{DegP} very [_{AP} much]] [_{XP} so]]$ indeed.
 - c. John is fond of Mary. Maybe he is $[_{XP} [_{DegP} as [_{AP} much]] [_{XP} so]]$ as Bill.
 - d. John told me he was *afraid of spiders*, but I wonder [_{XP} [_{DegP} how [_{AP} much]] [_{XP} so]] he really is.

Again the proposed left-branching structure allows for the Deg head and its dummy complement to undergo phrasal movement:

- (35) a. They say John is very *fond of Mary*, but [$_{DegP}$ how [$_{AP}$ much]] he really is [$_{XP} t [_{XP} so$]] is unclear to me.
 - b. They say he is *on drugs*, but $[_{DegP}$ how $[_{AP}$ much]] he really is $[_{XP} t [_{XP} so]]$ no one knows.
 - c. They call him *King of the Jungle*, but only the size of his bowie-knife will tell [$_{DegP}$ how [$_{AP}$ much]] he really is [$_{XP} t [_{XP} so$]].
 - d. He is seen by many as *the typical husband of a celebrity*, but only the size of the divorce settlement will tell [$_{DegP}$ how [$_{AP}$ much]] he really is [$_{XP} t [_{XP} so$]].
 - e. They say he *lives like a celebrity*, but no one knows $[_{DegP}$ how $[_{AP}$ much]] he really does $[_{XP} t [_{XP} so]]$.

One reason why the examples in (33) and (35) are of some interest lies in the fact that they differentiate between the analysis proposed here and one along the lines of Corver (1997a,b). Corver assumes that dummy *much* is inserted as the head of a functional projection, QP, which is located between DegP and AP. Thus, the presence of dummy *much* will always give rise to a right-branching structure. This would incorrectly preclude the type of movement found in (33) and (35). The only way in which the above examples could be accommodated in Corver's analysis would be if we were not dealing with dummy *much*, but its semantically charged variant. In that case Corver claims that *how much* forms a constituent located in the specifier of QP. An analysis involving the semantically charged variant of *much* is invalidated, however, by the fact that none of the predicates in (33) and (35) tolerate modification by this adjective:

- 16 Doetjes, Neeleman & van De Koot
- (36) a. *John is much fond of Mary.
 - b. *He is much on drugs.
 - c. *He is much King of the Jungle.
 - d. *He is much the typical husband of a celebrity.
 - e. *He much lives like a celebrity.

To summarize briefly, dummy *much* is inserted to allow for merger of a Deg head and a category that does not satisfy its selectional requirements. This results in a left-branching structure, which accounts for the extraction data discussed above.

3.2 Much-support as a last resort

As we mentioned earlier, it follows from Grimshaw's approach to dummies that their insertion is a last resort operation. In the case at hand, this implies that insertion of *much* is blocked if direct merger of a degree expression is possible. Two sub-cases present themselves. Obviously, Deg heads (that is, class-1 items) can be attached to APs, so if an adjective is taken from the lexicon, *much* insertion is ruled out. Compare the examples in (37) with those in (10)):

- (37) a. *He is $[_{AP} [_{DegP} too [_{AP} much]] [_{AP} famous]]$ to leave town.
 - b. *He is $[_{AP} [_{DegP} as [_{AP} much]] [_{AP} famous]]$ as Bill.
 - c. *He is $[_{AP} [_{DegP} very [_{AP} much]] [_{AP} famous]]$ indeed.
 - d. *I wonder $[_{AP} [_{DegP} how [_{AP} much]] [_{AP} famous]]$ he really is t.

Some further representative contrasts are given in (38).⁸

- (38) a. He painted the door $[_{DegP}$ too $[_{AP}$ red]] to Mary's taste.
 - a'. *He painted the door $[_{AP} [_{DegP} too [_{AP} much]] [_{AP} red]]$ to Mary's taste.
 - b. He is $[_{DegP}$ as $[_{AP}$ tall]] as his brother.
 - b'. *He is $[_{AP} [_{DegP} as [_{AP} much]] [_{AP} tall]]$ as his brother.

⁸Note that in all these examples we are dealing with dummy *much*. There are some adjectives that accept the semantically charged variant of *much* as a modifier. These of course accept *too much*, etc., as well, as was originally observed by Corver (1997a). An example is *too much different*, which exists alongside *much different*. The possibility of modification by *much* extends to certain VPs and PPs, as in *he much prefers this painting* and *he is much into syntax*.

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- c. His shirts are $[_{DegP}$ very $[_{AP}$ loud]] indeed.
- c'. *His shirts are $[_{AP} [_{DegP} very [_{AP} much]] [_{AP} loud]]$ indeed.
- d. I wonder $[_{\text{DegP}}$ how $[_{\text{AP}}$ ill]] he really is t.
- d'. *I wonder $[_{AP} [_{DegP} how [_{AP} much]] [_{AP} ill]]$ he really is t.

In addition, direct merger of a class-2 modifier with an XP is always possible, which precludes introduction of dummy *much*. This is illustrated by the data below:

- (39) a. *He is $[_{AP} \text{ more } [_{AP} \text{ much}]] [_{AP} \text{ famous}]]$ than I thought.
 - b. *His paper is $[_{AP} [_{AP} less [_{AP} much]] [_{AP} interesting]]$ than I thought.
 - c. *He is $[_{AP} [_{AP} funny] [_{AP} enough [_{AP} much]]]$ to be my buddy.
- (40) a. *He is $[_{PP} [_{AP} more [_{AP} much]] [_{PP} on drugs]]$ than any of his friends.
 - b. *He is $[_{PP} [_{AP} less [_{AP} much]] [_{PP} into syntax]]$ than he was before.
 - c. *He is $[_{PP} [_{AP} enough [_{AP} much]] [_{PP} over the limit]]$ to be arrested.
- (41) a. *He is $[_{DP} [_{AP} more [_{AP} much]] [_{DP} a linguist]]$ than a psychologist.
 - b. *He is [_{DP} [_{AP} less [_{AP} much]] [_{DP} a typical Hollywood celebrity]] than any of his neighbours.
 - c. *He is $[_{DP} [_{DP} man] [_{AP} enough [_{AP} much]]]$ for Sue.
- (42) a. *He [$_{VP}$ [$_{VP}$ likes venison] [$_{AP}$ more [$_{AP}$ much]]] than his family does.
 - b. *He [$_{VP}$ [$_{VP}$ lives like a celebrity] [$_{AP}$ less [$_{AP}$ much]]] than he would like to.
 - c. *He [$_{VP}$ [$_{VP}$ loves Mary] [$_{AP}$ enough [$_{AP}$ much]]] to marry her.

In short, dummy *much* is inserted to allow for merger of a Deg head and a category that does not satisfy its selectional requirements. This results in a left-branching structure, which accounts for the extraction data discussed above.

To summarize the argumentation so far, we started out by reviewing the data Corver (1997a) used to motivate a distinction between class-1 and class-2 degree expressions. We provided six arguments for analyzing class-1 items as degree heads and class-2 items as maximal projections which modify predicates of the appropriate semantic type. As we have seen, this analysis also allows a straightforward account of the role and distribution of the dummy adjective *much*.

In every analysis based on the observed syntactic bifurcation the question arises why class-1 and class-2 degree expressions are largely in complementary distribution, a fact

already mentioned in connection with Jackendoff's (1977) analysis. In the following section we will address this issue, arguing that class-1 and class-2 items share important semantic characteristics: both perform operations on ordered sets, yielding a singleton set in most cases. Given their shared semantics, we are led to the conclusion that the distinction between the two classes is irreducibly syntactic.

4 The semantics of degree expressions

4.1 Degree expressions as existential quantifiers

The (near) complementary distribution of elements in class (i) and class (ii) is illustrated below for *very* and *more* (repeated from (1)):⁹

- (43) a. John F. was $[_{DegP} very [_{AP} famous]]$.
 - b. John F. was [AP more [AP famous]] than Marilyn.
 - c. *John F. was $[_{DegP}$ very $[_{AP}$ more $[_{AP}$ famous]]].
 - d. *John F. was $[_{DegP} more [_{DegP} very [_{AP} famous]]]$.

As we have seen, class-1 and class-2 elements do not compete for the same syntactic position. This suggests that their incompatibility has a semantic source. We will now explore whether this is indeed the case.

Suppose that a bare AP expresses an ordered set of properties, the members of which only differ in gradation or strength. The adjective *tall*, for instance, denotes various degrees of tallness, ranging from a minimal to a maximal degree of tallness. For the AP to be turned into a predicate, an operation must apply by which a specific degree of tallness is selected from this set. That is to say, out of the ordered set of properties one property must be selected. In the case of bare APs, the relevant operation is an instantiation of existential closure which takes place in order to meet the LF wellformedness requirement just mentioned. Alternatively, an element attached to the AP acts as an existential quantifier over the ordered set of properties. We will show that such elements are found in both class 1 and class 2.

There are in fact expressions, which at first sight belong to neither class 1 nor class 2 and which also select a property from the ordered set. A straightforward example is *eight*

⁹This complementary distribution is not absolute, as shown by the grammaticality of *less too high*. We will analyze such examples in section 4.

miles in (44a) below. As (44b) demonstrates, further modification by a similar expression is impossible, as one would expect. Once the AP is made to express a property, the original set is no longer accessible. (44b), then, constitutes a case of vacuous quantification.

(44) a. [AP eight miles [AP high]].
b. *[AP two inches [AP eight miles [AP high]]].

If we assume, as a starting point of the discussion, that class-1 and class-2 items both perform an operation of existential quantification, the ungrammaticality of the examples in (45) can be explained along similar lines: *eight miles high* denotes a property rather than a set of properties, and therefore quantification by *very* and *more* will be vacuous.

- (45) a. $*[_{DegP} very [_{AP} eight miles [_{AP} high]]].$
 - b. $*[_{AP} \text{ more } [_{AP} \text{ eight miles } [_{AP} \text{ high}]]].$

Under this assumption, the ungrammaticality of (43c,d) need not surprise us. Both *very* and *more* derive a property from a set of properties, and consequently the outermost degree expression ends up uninterpretable at LF.

At this point one may conclude that class-1 and class-2 expressions belong to the same semantic group, something which would tie in with the main line of argumentation in this paper: the existence of c-selection can only be motivated if elements with the same semantics fall into different syntactic categories. Although correct in our opinion, this conclusion is not yet underpinned by a sufficiently detailed semantic analysis. Those in favour of a radical reduction of c-selection to s-selection may argue that degree expressions contain a restriction that dictates which operations must be applied to the ordered set before quantification takes place, and that class-1 and class-2 items can be distinguished in terms of the restrictions they impose. In what follows we will consider the restrictions of degree expressions more carefully. We will show that it is hard, if not impossible, to make such a distinction.

Let us first consider what the expression *more famous* in (43b) means. Intuitively it is clear that the restriction of *more* imposes two operations on the ordered set expressed by *famous*: (i) a contextually defined *reference point* is introduced which is used to split the set, and (ii) of the two subsets thus created the one containing stronger properties is selected. When existential quantification takes place, it chooses a property from the selected set. Since in the case of *more* the set containing weaker properties is discarded,

we will refer to *more* as *upward oriented*. The semantics of *more famous* can be represented by the formula below. In this formula the restriction imposed by *more* take the form of a function \mathcal{U}_{p} which takes as its arguments the reference point p_{ref} and the set of properties expressed by the adjective *famous*. This function has as its output a set from which the existential quantifier selects a particular property.

(46) $\exists p [p \in \mathcal{U}_{p(p_{ref}, FAMOUS)}]$

We assume that p_{ref} is itself given by a function δ :

(47) reference point $\delta(FAMOUS) = p_{ref}$

This function takes a set as its input and returns p_{ref} , a point removed from the bottom of the scale by a distance which may be contextually determined or spelled out by a satellite. An example of the latter is *John F. is more famous than Marilyn*. In this example, the degree of fame is directly compared to the degree of fame expressed by the satellite, here the fame of Marilyn. If this line of reasoning is correct, the following contrast indicates that *less*, *too*, *as* and *enough* pattern with *more* in having a reference point, whereas such a point is absent in *very* and *how*. This contrast will be shown to have further consequences later on.

- (48) a. John F. was $[_{AP} less [_{AP} famous]]$ than Marilyn.
 - b. John F. was $[_{DegP}$ too $[_{AP}$ famous]] to have any privacy.
 - c. John F. was [DegP as [AP famous]] as Marilyn.
 - d. John F. was $[_{AP} [_{AP} famous]$ enough] to have bodyguards.
- (49) a. *John F. was $[_{DegP}$ very $[_{AP}$ famous]] to have any privacy.
 - b. *John F. was $[_{DegP}$ very $[_{AP}$ famous]] than Marilyn.
 - c. $*[_{DegP} how [_{AP} famous]]$ John F is *t* to have any privacy.
 - d. $*[_{\text{DegP}} \text{ how } [_{\text{AP}} \text{ famous}]]$ John F is *t* than Marilyn.

Although the degree expressions in (48) do all have a reference point, the ones in (48c,d) diverge in not having an orientation in the sense discussed earlier. That is to say, *as* and *enough* do not use their reference point to split the ordered set provided by the adjective. They rather require that the property selected be identical to the reference point.

Of course we realize that it is sometimes appropriate to use expressions like *as famous* and *famous enough* in contexts in where the selected property is stronger than the reference point. This, however, is a phenomenon that can be observed more generally in expressions that specify a particular quantity or strength. For instance, the sentence *John has three pounds* can felicitously be used if John in fact has four pounds (cf. Grice 1989 and many others). Therefore, the crucial distinction between phrases with and without an orientation is that only in the latter can the point selected be equal to the reference point. So *John is more famous than Bill* can never be used in a context in which John and Bill are equally famous.

This phenomenon is a result of the logical implication that if one has a particular property to a certain degree, one also has it to a lesser degree. Hence, *as famous as Bill* means by implication 'at least as famous as Bill', just as *to have three pounds* means 'to have at least three pounds'. This explains an observation brought to our attention by Annabel Cormack (p.c.), namely that *not as famous as Bill* does not mean 'either more or less famous than Bill' but only 'less famous than Bill'. Given that *as famous as Bill* by logical implication means 'at least as famous as famous as Bill', *not as famous as Bill* must means 'less famous than Bill'. Note than the same happens in *John has three pounds*. *John does not have three pounds* does not mean that he has either more or less than three pounds, but only that he has less.

In fact, there is a test by which we can determine whether a degree expression has an orientation in addition to a reference point. Only in that case is it possible to add a modifier which fixes the distance between the reference point and the property selected. What we have in mind is the following contrast, where the relevant modifier is *considerably*:

- (50) a. John F. was $[_{AP}$ [considerably more] $[_{AP}$ famous]] than Marilyn.
 - b. John F. was [AP [considerably less] [AP famous]] than Marilyn.
 - c. John F. was [_{DegP} considerably [too [_{AP} famous]]] to have any privacy.
- (51) a. *John F. was $[_{DegP}$ considerably as $[_{AP}$ famous]] as Marilyn.
 - b. *John F. was [AP [AP famous] [considerably enough]] to have bodyguards.

Note, incidentally, that the impossibility of adding *considerably* to *as famous* and *famous enough* shows that the use of such expressions in contexts in where the selected property is stronger than the reference point must be due to a logical implication and not to

something inherent in their semantics proper. Otherwise measuring a distance from the reference point should be possible.

The preceding discussion is summarized in the following table. Notice that one of the cells in this table is vacant. We believe that this is not a coincidence, as a degree expression that would fill this position would lack a restriction and would therefore function in exactly the same way as the universally available operation of (existential) closure. Its inclusion in the lexicon is hence redundant.

(52)

	Orientation	No orientation
Reference point	more less too (much)	as (much) enough
No reference point	very (much) how (much)	

In line with what we have seen so far, the semantics of expressions whose restriction contains a reference point and an orientation can be formalized as follows (where the function 2own selects the subset of FAMOUS below p_{ref}):

(53) a. less famous $\exists p \ [p \in \text{Down}(p_{ref}, FAMOUS)]$ b. too famous $\exists p \ [p \in \text{Up}(p_{ref}, FAMOUS)]$

We propose that if an expression introduces a reference point but does not have an orientation,

its restriction specifies that the property selected by the existential quantifier is equal to the reference point. This corresponds to the following representations (where the function At selects from FAMOUS the, obviously one-membered, set of points identical to p_{ref}):

- (54) a. as famous $\exists p \ [p \in \mathcal{A}t(p_{ref}, FAMOUS)]$
 - b. *famous enough* $\exists p \ [p \in At(p_{ref}, FAMOUS)]$

Finally, consider expressions that have an (upward) orientation but no reference point. In these cases the existential quantifier selects a point that must be located in the higher region of the scale. This can be accounted for as follows. As we have already seen, orientation is expressed by a two-place predicate which takes p_{ref} as its first argument. In the absence of an explicit reference point, this argument receives a default interpretation. The fact that expressions such as *very* and *how* do not license satellites, as was shown in (49), could be seen as the result

of the lack of an explicit first argument of the predicate up. Quite generally, it is not possible to link a pronominal expression to the implicit argument of verbs such as to smoke or to eat, as is illustrated by the ungrammaticality of **John smokes but it is bad quality* and **Fred is eating but it is badly prepared*. The use of satellites seems to be subject to a similar requirement: the argument to which it is linked must be explicit. In case the first argument is implicit, as in the

the formulae below, the use of a satellite is not possible.

- (55) a. very famous $\exists p [p \in \mathcal{U}_{p}(\text{DEFAULT, FAMOUS})]$ b. how famous (exclamative how)
 - $\exists p \ [p \in \mathcal{U}_{p}(\text{DEFAULT, FAMOUS})]$

To summarize the proceeding discussion, we can think of degree expressions as performing three primitive operations. They can introduce a reference point in the set they are applied to. Using the reference point, this set is narrowed down as a result of the orientation of the degree item. Finally, existential quantification applies.

With this in mind, let us return to the main issue addressed in this paper: can c-selection be reduced to s-selection? The semantics as developed above strongly suggests that this question should be answered negatively. The distinction between class-1 and class-2 items cannot be equated with the distinction between oriented and non-oriented degree expressions. As is apparent from the table in (52), the class-1 items *too* and *as* differ with respect to whether they are oriented, as do the class-2 items *more* and *enough*. Similarly, the class-1 items *too* and *very* differ with respect to whether they introduce a reference point. So far we have not encountered a class-2 expression without a reference point, but given the further distribution of semantic properties, this cannot be used to characterize the opposition between class-1 and class-2 items in semantic terms.

There is a further set of data which substantiates this conclusion in a very straightforward fashion. Recall that class-2 expressions can be derived from class-1

expressions by combining them with the dummy adjective *much*. Since *much* is a dummy, this operation does not affect the semantics of the resulting expression. *As* and *as much*, for example, differ in their syntactic class:

- (56) a. He is $[_{DegP}$ as $[_{AP}$ famous]] as Bill.

 - c. *He is $[_{DegP}$ as $[_{PP}$ on drugs]] as Bill.
 - d. He is $[_{PP}$ as much $[_{PP}$ on drugs]] as Bill.

However, the semantics of *as much on drugs* is completely parallel to that of *as famous*. The latter has already been given in (54a); the latter can be represented as in (57):¹⁰

(57) as much on drugs $\exists p \ [p \in \mathcal{A}(p_{ref}, \text{ON DRUGS})]$

Given that the same semantics can be instantiated by either class of degree expressions, it is not possible to reduce the syntactic bifurcation to a semantic one. The overall picture that emerges is that c-selection must be maintained as an independent syntactic phenomenon. The argument is summarized by the table in (58), which shows how the two syntactic classes distribute over the three semantic ones.¹¹

¹⁰It is unclear how much of the semantics of *much* is still present in its usage as a dummy. However, there can be no doubt that the semantics of *as much on drugs* runs parallel to that of *as famous*, which is the crucial point here.

¹¹Note that the functions contained in the restrictions of degree expressions take an ordered set as their second argument, but they do not refer in any way to the notion of degree (in the sense used throughout this paper). Therefore, a natural extension suggests itself: the degree items could as well be applied to other types of ordered sets. Of course, this possibility is only available for class-2 expressions, as only these may be attached to other categories than AP. As has been extensively argued in the semantic literature (see Link 1983, Bach 1986 and Krifka 1986 amongst others), both NPs and VPs may introduce sets ordered with respect to cardinality or amount. Of course these sets are partially ordered as two subsets with the same cardinality/amount remain unordered with respect to each other. It should be easy to see, however, that these partially ordered sets, or lattices, are richer in information than the ordered sets provided by APs: the one-dimensional set on which degree expressions operate can be obtained from a lattice by a simple operation of abstraction from individuals, individual events, portions of matter, or whatever constitutes the second dimension of a lattice. The prediction, then, is that class-2 degree expressions should be able to specify cardinality or amount when attached to NPs and VPs of the type just described. This is indeed the case (see Doetjes 1997 for further discussion):

Degr**2**5

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	Orientation		No orientation	
Reference point	more less too too much	class 2 class 2 class 1 class 2	as as much enough	class 1 class 2 class 2
No reference point	very very much how how much	class 1 class 2 class 1 class 2		

The case for c-selection is based on a particular syntactic and a particular semantic analysis of degree expressions. Although the syntactic distinction between class-1 and class-2 items has been given a sound empirical underpinning, alternative approaches to the semantics of degree expressions can still be imagined. In particular, one would like to see additional support for the essential distinction between the ordered set of properties expressed by the adjective and the selected property expressed by the extended adjectival projection. Some data pertaining to this issue will be presented in the remainder of this section.

4.2 Extraction

As we have seen in section 2, Dutch has a rule of PP-shift by which complements of adjectives may be left-adjoined at various levels in the extended adjectival projection (cf. (21), (22a,b), (23)). The question we would now like to raise is how this movement affects the possibility of extraction from the PP-complement. We will show that

- b. There was less coffee in the can than I had hoped for.
- c. John goes to the cinema more than any of his friends.
- d. Mary studied enough to pass for the exam.

(58)

⁽i) a. More students attended the lecture than expected.

The advantage of this approach is that these data can be captured without assuming that class-2 degree expressions are systematically multiply ambiguous.

extraction is largely governed by existential quantification, the operation that turns an ordered set of properties into a property.

It is generally assumed that extraction is possible from phrases contained within the mcommand domain of a lexical head, where m-command is defined in (59) (cf. Chomsky 1986).

(59) *M-Command* α m-commands β iff the first maximal projection that category-dominates α also category-dominates β .

The definitions of category domination and category are given below. Following common practice, we will refer to the nodes that make up a category as segments.

- (60) Category Domination α category-dominates β iff every segment of α dominates β .
- (61) *Category*

A category is an ordered set of identical nodes such that each immediately dominates the next.

Consider first the simplest case, where the PP surfaces in complement position. In order to remain neutral about the X'-theoretical status of the nodes on the adjectival projection line, we label these with consecutive numbers. According to any theory extraction from the PP in (62) should be possible as A_1 and A_2 cannot be construed as a single category. A_1 and A_2 differ in two properties. First, A_1 assigns a θ -role to the PP and this θ -role is therefore saturated in A_2 . Second, on the analysis assumed here, closure must apply to A_2 in order to derive a property from the set of properties expressed by A_1 . If A_1 and A_2 do not form a single category, the PP is contained in the m-command domain of the adjective and should therefore allow subextraction.



As expected, extraction is possible in this case:

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- (63) a. Hij is [A2 afhankelijk [PP van zijn vader's goedkeuring]]. he is dependent on his father's approval
 - b. Waar is hij [A2 afhankelijk [PP van t]]? where is he dependent on

Since A_1 and A_2 differ in two properties in (62) the possibility of extraction can be accounted for independently of the proposed operation of closure. The same is true of structures in which the PP is shifted to the left of a class-1 degree expression. In that case the landing site of the PP is clearly outside the adjective's m-command domain:



Indeed subextraction is blocked in structures like (64):

- (65) a. Hij is $[_{Deg3} [_{PP} van zijn vader's goedkeuring] [_{Deg2} te [_{A2} afhankelijk t]]] om een eigen zaak te beginnen.$ *he is on his father's approval too dependent for a own business to start*
 - b. *Waar is hij $[_{Deg3} [_{PP} van t] [_{Deg2} te [_{A2} afhankelijk t]]] om een eigen zaak te beginnen?$ where is he on too dependent for a own business to start

Although the operation of closure is not instrumental in explaining the contrast between (63b) and (65b), there are structures whose (un)grammaticality can only be understood in terms of this operation. Consider what happens if the PP attaches to the highest node of the adjectival projection in the absence of a degree modifier:



In a theory without closure, A_2 and A_3 can only be construed as segments of the same category. The reason for this is that, the θ -role of the adjective having already been assigned, no semantic distinction can be made between A_2 and A_3 . In a theory with closure, however, there is a way in which A_2 and A_3 can be construed as different categories. If this operation applies to A_3 , A_2 and A_3 must be interpreted as separate categories: A_2 expresses an ordered set of properties, whereas A_3 expresses the property selected out of the set. Consequently, the two theories make different predictions with respect to the status of the PP. Only in theories with closure is the PP in the m-command domain of the adjective. Hence, only such theories allow subextraction as in (67b):

- (67) a. Hij is $[_{A3} [_{PP} \text{ van zijn vader's goedkeuring}] [_{A2} afhankelijk t]].$ *he is on his father's approval dependent*
 - b. Waar is hij [A3 [PP van t] [A2 afhankelijk t]]? where is he on dependent

In (67) the property expressed is selected by the operation of closure. We have already argued that this operation is lexically encoded in degree expressions such as *more*, so that we can further test the effects of the proposed semantics on extraction from shifted PPs. It is predicted by this theory that if a PP is shifted to a position between a class-2 item and the adjectival head extraction is allowed. That this should be so follows from the fact that the class-2 modifier, like other degree expressions, takes an ordered set as its input and selects from this a particular property. Hence, the node it attaches to, A_3 in (68), and the node it is dominated by, A_4 , must be distinguished on semantic grounds and consequently be construed as separate categories. This implies that the PP appears within the adjective's m-command domain.

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Extraction from the PP is indeed possible:

(69) a. Hij is $[_{A4} \text{ meer } [_{A3} [_{PP} \text{ van zijn vader's goedkeuring}] [_{A2} \text{ afhankelijk } t]]] dan je dacht.$

he is more of his father's approval dependent than you thought

b. Waar is hij [A4 meer [A3 [PP van t] [A2 afhankelijk t]]] dan je dacht? where is he more of dependent than you thought

However, a different situation obtains when the PP is shifted to the left of a class-2 degree expression. Since these items lexically encode existential quantification, there is no way to construe A_4 and A_3 in the tree below as independent categories. The only operation that could license such a construal is closure, but this operation cannot be applied given that A_3 already expresses a property. If A_3 and A_4 are not independent categories but segments of the same category, then A_1 does not m-command the PP and subextraction is predicted to be ungrammatical.

(70)



This prediction is correct:

(71) a. Hij is $[_{A4} [_{PP} \text{ van zijn vader's goedkeuring}] [_{A3} \text{ meer } [_{A2} \text{ afhankelijk } t]]]$ dan je dacht.

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he is of his father's approval more dependent than you thought
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b. *Waar is hij $[_{A4} [_{PP} van t] [_{A3} meer [_{A2} afhankelijk t]]]$ dan je dacht? where is he of more dependent than you thought

A further prediction, brought to our attention by Jonathan White (p.c.), concerns extraction from class-2 modifiers rather than from shifted PPs. In the representation in (72) the class-2 modifier is located within the m-command domain of the adjective, because A_1 and A_2 can only be construed as separate categories. As explained before, degree expressions take an ordered set of properties as their input and derive a property through existential quantification. Hence A_1 and A_2 must be distinguished on semantic grounds.

(72)



Indeed extraction from complex class-2 modifiers is possible, not only in Dutch but also in English. This is shown by the data in (73). To be sure we have not argued yet that the APs in (73a,b) have a left-branching structure — we will do so below.

- (73) a. Hij is [A2 [drie IQ punten minder] [A1 intelligent]] dan Jan. *he is three IQ points less intelligent than John*
 - b. [Hoeveel IQ punten] is hij [_{A2} [t minder] [_{A1} intelligent]] dan Jan? *how many IQ points is he less intelligent than John*

(74) a. He is $[_{A2}$ [three IQ points less] $[_{A1}$ intelligent]] than John.

b. [How many IQ points] is he $[_{A2} [t \text{ less}] [_{A1} \text{ intelligent}]]$ than John?

In a theory that does not rely on closure it is not immediately obvious how the set of data presented above can be accounted for. Both class-2 modifiers and preposed prepositional complements would occupy positions outside the adjective's m-command domain, as

there is no semantic notion that can be used to distinguish the category they attach to and the category by which they are dominated. At this point the best one could do is to state a descriptive generalisation to the effect that extraction is possible from the lowest adjunct only. Such a generalisation would predict that, if a PP is fronted in Dutch, its landing site affects the possibility of extraction from the class-2 modifier. In particular, extraction should be blocked if the PP follows the modifier, as in the structure in (68), but it should be allowed if it precedes it, as in (70). The fact of the matter is, however, that the position of the PP is immaterial:

(75) a. Hij is $[_{A4}$ [aanzienlijk minder] $[_{A3}$ $[_{PP}$ van zijn vader] $[_{A2}$ afhankelijk t]]] dan je dacht.

he is considerably less of his father dependent than you thought

b. Hoeveel is hij [A4 [t minder] [A3 [PP van zijn vader] [A2 afhankelijk t]]] dan je dacht?

how much is he less of his father dependent than you thought

c. Hij is $[_{A4} [_{PP} van zijn vader] [_{A3} [aanzienlijk minder] [_{A2} afhankelijk t]]] dan je dacht.$

he is of his father considerably less dependent than you thought

d. Hoeveel is hij [A4 [PP van zijn vader] [A3 [t minder] [A2 afhankelijk t]]] dan je dacht?
 how much is he of his father less dependent than you thought

These facts fall out immediately from a theory employing existential quantification. In both (68) and (70) the class-2 item is m-commanded by the adjective, as its lexically encoded properties determine that the node it is attached to and the node it is dominated by may not form a single category.

A final prediction concerns a set of data we have not discussed yet, namely those involving morphological degree expressions. The best-known of these are morphological comparatives (formed with the suffix *-er*), but there is a second type of example. In Dutch, N-A compound formation can be used to force selection of a property high on the scale provided by the adjective:

- 32 Doetjes, Neeleman & van De Koot
- (76) a. Jan is verliefder op Marie dan Piet. John is in-love-er on Mary than Pete
 - b. Jan is straalverliefd op Marie.
 John is beam-in-love on Mary
 'John is very much in love with Mary'

The semantics of the complex adjectives in (76) can be represented on a par with that of *more* and *very*:

(77) a. *verliefder* $\exists p \ [p \in \mathcal{U}_{p}(p_{ref}, VERLIEFD)]$ b. *straalverliefd*

 $\exists p \ [p \in \mathcal{U}_p(\text{DEFAULT, VERLIEFD})]$

This semantics is corroborated by the impossibility of further degree modification (but see section 5 for discussion):

- (78) a. *Jan is erg verliefder op Marie dan Piet. John is very in-love-er on Mary than Pete
 - b. *Jan is meer straalverliefd op Marie dan Piet. John is more beam-in-love on Mary than Pete

Given the semantics in (77), a contrast is to be expected with respect to PPs in complement position and shifted PPs, if the head contains a morphological degree expression. If the PP occurs on the right, in its base position, it is m-commanded by the adjective: in the structure in (79) A_1 and A_2 must constitute different categories, as A_1 has a θ -role which is absent in A_2 . It should therefore allow extraction.



Consider, however, what happens if the PP is shifted leftward and adjoined to the adjectival projection. Nodes A_2 and A_3 in the representation below must be construed as segments of the same category, because there is no feature that can distinguish between

them. In particular, it is not the case that they can be distinguished by closure, since the morphological degree expression in the head has already performed existential quantification (see section 5 for further discussion).



The data are as expected:

(81)	a.	(De vrouw) waar Jan [$_{A2}$ verliefder [$_{PP}$ op t]] is dan Piet. (the woman) which John in-love-er on is than Pete
	b.	(De vrouw) waar Jan [$_{A2}$ straalverliefd [$_{PP}$ op t]] is.
		(the woman) which John beam-in-love on is
(82)	a.	*(De vrouw) waar Jan $[_{A3} [_{PP} \text{ op } t] [_{A2} \text{ verliefder } t]]$ is dan Piet. (<i>the woman</i>) which John on in-love-er is than Pete
	b.	*(De vrouw) waar Jan [$_{A3}$ [$_{PP}$ op t] [$_{A2}$ straalverliefd t]] is. (the woman) which John on beam-in-love is

We can conclude that the quite complex pattern of possible and impossible extraction sites follows under the assumption that degree expressions of both class-1 and class-2 function as existential quantifiers. As we have seen the extraction pattern extends to morphological degree expressions.

Let us summarize the discussion so far. At the end of section 2 we were faced with the problem of how to account for the complementary distribution of class-1 and class-2 degree expression, given that these elements do not compete for the same syntactic position. We have proposed a particular semantics of degree which accounts for this by describing the operation performed by degree expressions as one of existential

quantification over an ordered set. This had as an immediate consequence that attaching more than one degree expression results in vacuous quantification.

This brings us back to our main line of argumentation. If degree expressions uniformly introduce existential quantifiers, we cannot reduce the syntactic distinction between class-1 and class-2 items to a semantic split. To put it differently, c-selection can, in this case, not be reduced to s-selection. We have seen that this conclusion is confirmed by a more detailed investigation of the semantics of degree expressions (involving the independently motivated notions of reference point and orientation). Furthermore, we considered two classes of syntactic data, involving extraction and modifiers of degree items, which support the set-point distinction in APs, and thus the reality of existential quantification in the present domain.

5 Specification at the LF interface

5.1 The interpretation of specifier-head agreement

The coexistence of c-selection and s-selection as independent phenomena supports the existence of an autonomous syntax, that is, a rule system that exists independently of phonology and semantics. Consider the following issue that arises on a minimalist view of the grammar. According to standard assumptions, there is a computational system that relates the PF and LF interfaces using a vocabulary that is neither phonological nor semantic in nature. In principle, a further simplification is possible: the computational system could use a purely semantic vocabulary, thereby eliminating the need for a syntactic interlingua. The phenomenon of c-selection shows that this conception of the linguistic system cannot be correct.

Clearly, c-selectional statements are stored in the lexicon as idiosyncratic properties of heads. Hence, c-selection does not directly provide evidence for a non-semantic computational system. It does provide indirect evidence to this effect, however, since c-selection statements must be seen as instructions to the computational system – they impose restrictions on the merger of terms. If the computational system employed a purely semantic vocabulary, no c-selectional statements could made. The existence of irreducible c-selectional properties, then, implies that the vocabulary of the computational system is at least in part non-semantic in nature.

The autonomy of the computational system does not imply that the relation between syntax and semantics is in general arbitrary. In the literature a number of cases have been established in which c-selection can successfully be reduced to s-selection. Such generalizations are not in conflict with the conclusion arrived at in this paper. After all, sentences must be interpreted and consequently the c-selectional properties of a head must be compatible with its semantics.

Generalizations relating syntactic structure to semantic representations provide, perhaps surprisingly, further motivation for an autonomous syntax. Typically, these generalizations take the form of mapping rules which say that a specific syntactic configuration must receive a particular interpretation. If the relevant configuration has irreducible syntactic properties, the existence of such rules confirms the autonomous status of the computational system. Note that the structure of the argument is entirely parallel to the one based on c-selection. In both cases, a system external to syntax crucially refers to properties of syntactic representations, thereby providing support for their reality.

We will now explore an example of this type in the area of degree expressions. More specifically, we will argue that the syntactic relation of specifier-head agreement is interpreted in such a way as to allow a small set of exceptions to the complementary distribution of class-1 and class-2 degree items. The essence of specifier-head agreement is the sharing of a feature between an X^0 and a maximal projection. This would lead one to expect that the shared feature, even though it is realized twice, may be mapped onto a single semantic entity. To put it differently, in the translation from syntax to semantics the feature on the head may be deleted under identity with the feature in the specifier. This is the intuition behind analyses of verbal concordance in terms of specifier-head agreement, but an operation along these lines is also necessary in order to account for the interpretation of embedded WH questions.

In embedded WH questions, the WH operator moves to the specifier of a subordinating head. The nature of this head cannot be inspected in many languages, because it remains unpronounced at PF under pressure of the doubly-filled-COMP filter (or an equivalent constraint). However, there are several languages, including several variants of Dutch, which allow phonological realization of the relevant head. As it turns out, this head typically has WH properties (if used in the absence of a WH operator in its specifier, it introduces a yes/no question). For most speakers, the following judgements obtain:

- (83) a. Ik vraag me af [$_{CP}$ wie [$_{C'}$ of [Peter op z'n verjaardagsfeestje uitgenodigd heeft]]].
 - I wonder me PRT who if Peter on his birthday party invited has
 - b. *Ik vraag me af [_{CP} wie [_{C'} dat [Peter op z'n verjaardagsfeestje uitgenodigd heeft]]]. *I wonder me* PRT *who that Peter on his birthday party invited has*

From a lexical perspective, both *wie* and *of* contain a WH feature. From a semantic perspective, however, there is only one WH feature, as the sentence in (83a) is a simple WH question. This implies that the two WH features have been mapped onto a single semantic operator. In the implementation suggested earlier, the feature in the head has been deleted at LF under identity with the feature in the specifier.

Given that the interpretive procedures treat specifier-head configurations in this way, a prediction follows with respect to the co-occurrence of degree expressions. We have ascribed the largely complementary distribution of degree items to the fact that they each introduce an existential quantifier. Hence, combining two degree expressions is generally ruled out as a case of vacuous quantification. However, if operator properties shared by a head and its specifier can be mapped onto a single semantic entity, the possibility presents itself that a degree expression takes another degree expression as its specifier. In such a structure, mapping rules at the interface can delete the existential quantification. This situation obtains in two configurations.

5.2 Specifiers of class-1 degree items

First of all, a class-1 item can take a class-2 expression as its specifier in a structure like (84). The existential quantifiers of the two degree expressions are mapped onto a single semantic entity, due to the way in which specifier-head relationships are treated at LF.



In fact, we have already come across an example of this type. As we have seen in (17), a class-2 degree expression can be attached external to a class-1 head. So far we have assumed that the modifier is adjoined to DegP, but in view of the present discussion we are led to the conclusion that it is in the specifier of the degree head. The example, minus the context that primes it pragmatically, is repeated below.

(85) John is $[_{DegP}$ less $[_{Deg'}$ too $[_{AP}$ tall for this sweater]]] than Bill.

The semantics of this example is straightforward. Once the existential quantifier of *too* is omitted, the function 2 ourn, which is introduced by *less*, can apply to the outcome of the function 2 o, which is introduced by the degree head.

(86) less too tall $\exists p \ [p \in \textit{Down}(p_{ref-2}, \textit{Up}(p_{ref-1}, TALL))]$

The overall semantics of *less too tall*, then, can be described as follows. *Tall* provides an ordered set from which the function \mathcal{U}_{p} selects a subset. This subset is located above a reference point p_{ref-1} , which is given by the function δ on the basis of the set TALL. *Down* selects a subset from the set delivered by \mathcal{U}_{p} , using a second reference point, p_{ref-2} , which is again generated by δ (note that p_{ref-2} is taken from \mathcal{U}_{p} 's output rather than from TALL). Finally, existential quantification selects a property from the set produced by *Down*. In the example at hand, the point selected lies between two contextually determined reference points, namely the degree of tallness above which one is too tall for the sweater in question and Bill's degree of tallness.

There is a further example that can be analyzed in terms of specifier-head agreement. Recall that certain modifying expressions also select a point from an ordered set, but in a way that differs from class-1 and class-2 expressions. An example is *eight miles* in *eight miles high*. At first sight, it may seem that *eight miles* directly selects a point, but this cannot be maintained in view of examples like *several miles high*. In this expression existential quantification must select a point from a (non-singleton) set. The difference with degree expressions lies in the type of restriction imposed by *several miles*. The set provided by the adjective is narrowed down by a function Δ which selects all points with the value specified by the modifier.

(87) several miles high $\exists p [p \in \Delta(\text{SEVERAL MILES, HIGH})]$

Note that Δ resembles δ in that it measures the value of points with respect to the bottom of a given set. However, whereas δ produces a point, Δ produces a set. This set can be a singleton in case the value provided by the modifier is sufficiently specific, as in the case of *eight miles high*.

Given that expressions like *several miles* are maximal projections, it should be possible to insert them in the specifier of a degree head, on a par with class-2 modifiers. This is indeed the case:

(88) The projected flight path is $[_{DegP}$ several miles $[_{Deg'}$ too $[_{AP}$ high]]].

Given the special interpretation of specifier-head relationships, the existential quantifier of *too* can again be omitted, after which the function Δ may apply to the output of \mathcal{U}_{p} . In other words, *several miles* measures a distance from the bottom of the scale derived by *too*.

(89) several miles too high $\exists p \ [p \in \Delta(\text{SEVERAL MILES}, \mathcal{U}_{p}(p_{ref}, \text{TALL}))]$

Although specifier-head agreement makes it possible to combine two degree expressions, it is perhaps worth pointing out that not every such structure will be well-formed, since the restrictions of the degree expressions may not be compatible. First, some degree items have a restriction that reduces the ordered set provided by the adjective to a point, thereby blocking further attachments of modifiers that require a set. An example is *as*, whose restriction involves the function *At*. Given that *At* derives a singleton set, further modification with *several miles*, which measures a distance from the bottom of the scale, is impossible:

(90) *The projected flight path is $[_{DegP}$ several miles $[_{Deg}$, as $[_{AP}$ high]]] as originally planned.

In a similar vein, degree expressions involving a reference point cannot be combined with degree expressions whose restriction involves an operation that relies on a default value. Recall that defaults as used by the functions \mathcal{U}_{p} and \mathcal{D}_{ourn} cannot be referred to. In this sense they are like implicit arguments of optionally transitive verbs (cf. **John smokes but it is bad quality*). This means that once the set is split by means of a default value, it is not possible to refer to the lower boundary of the newly derived ordered set. Consequently, no function that must refer to this boundary can be applied. This excludes expressions and the autonomy of syntax

further attachment of any expression that introduces a reference point. After all, reference points are derived by the function δ , which measures a particular distance from the lower boundary of a given set. The ungrammaticality of (91) is thus accounted for.

(91) *The projected flight path is $[_{DegP} less [_{Deg}, very [_{AP} high]]]$.

5.3 Specifiers of class-2 degree items

There is a second configuration that allows the combination of two degree expressions, namely one in which a class-2 modifier occupies the specifier position of another class-2 modifier, as in the left-branching structure below:



This structure must be contrasted with the right-branching one in (93). In the latter, the two degree expressions are not in a specifier-head configuration, and therefore the two existential quantifiers must be interpreted separately, with the – by now familiar – result of vacuous quantification.

(93) * AP XP [∃x ...] AP (Class-2) XP [∃x ...] AP (Class-2) The prediction, then, is that two class-2 modifiers can be combined, but in a leftbranching structure only. In fact, sequences of the relevant type are easily constructed. (94) is an example.¹²

(94) John is very much more dependent on his father than on his mother.

The question to be addressed, however, is whether the extended adjectival projection in (94) has a left- or right-branching structure. Two tests that could decide the issue come to mind: extraction and substitution. The example in (95a) shows that a degree expression and a modifier of the relevant sort *can* behave like a constituent in question formation; (95b) illustrates that the same possibility exists in Dutch. This is a first step towards establishing the structure in (92).

- (95) a. [How much more] is John $[_{AP} t [_{AP} dependent on his father]]$ than on his mother?
 - b. [Hoeveel meer] is Jan [AP t [AP afhankelijk van zijn vader]] dan van zijn moeder?
 how much more is John dependent on his father than on his mother

It remains to be shown that the structure in (93) is inadmissible. For this we turn to substitution data. As is well known, substitution by *so* respects constituent boundaries: it cannot substitute for non-constituents. In this light, consider the contrast in (96). If *very much more intelligent than Bill* could be assigned a right-branching structure, it should be possible for *so* to substitute for the sequence *more intelligent (than Bill)*. As the facts show, however, *so* can only replace *intelligent*.

¹²Alongside (94) the example below is grammatical:

⁽i) John is much more intelligent than Bill.

This shows that *more* and other class-2 degree items accept semantically charged *much* as a modifier. This is in line with a generalisation that seems to govern the distribution of *much*: semantically charged *much* seems to attach to those expressions X that do not mean *much* X. Whereas *tall* in *he is tall* is interpreted as "tall to a high degree", a similar interpretation cannot be assigned to *different* in *they are different*. Hence, **much tall* is ungrammatical as opposed to *much different*. Since *more intelligent* does not mean 'to a high degree more intelligent', attachment of *much* is allowed. This makes it impossible to decide whether *much* is a dummy in (94) or not. Note, however, that this does affect the argument made in the main text.

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- (96) a. John is more *intelligent than Bill*. In fact he is very much more *so*.
 - b. *John is *more intelligent than Bill*. In fact he is very much *so*.

The same contrast obtains in the Dutch examples in (97). As in English, the pro form *dat* cannot substitute for *more dependent on his parents*, but only for *dependent*.

- (97) a. Jan is meer afhankelijk van zijn ouders dan ik dacht. Hij is dat zelfs heel veel meer. John is more dependent on his parents than I thought. He is that even very much more
 b. *Jan is meer afhankelijk van zijn ouders dan ik dacht. Hij is dat zelfs heel
 - b. *Jan is meer afhankelijk van zijn ouders dan ik dacht. Hij is dat zelfs heel veel.
 John is more dependent on his parents than I thought. He is that even very much

In the left-branching structure now established, *very much* functions as a specifier of *more* and hence the existential quantifier of the latter may be omitted, with the semantic representation in (98) as a result. Note that the default value used by \mathcal{U}_{p} in its second application is not the default for *intelligent* but that for *more intelligent* (that is, it is the default in a set whose lower limit is determined on the basis of p_{ref}).

(98) *very much more intelligent* $\exists p [p \in \mathcal{U}_p(\text{DEFAULT}, \mathcal{U}_p(p_{\text{ref}}, \text{INTELLIGENT}))]$

A structure that closely resembles that in (92), in which a class-2 item occupies the specifier of another class-2 item, is provided by examples like *several IQ points more intelligent*. Recall that *several IQ points*, like degree expressions, has an existential quantifier. Its restriction uses the function Δ , which was introduced in the previous section. Therefore, like *very much more intelligent, several IQ points more intelligent* must have a left-branching structure:

(99) [AP [several IQ points more] [AP intelligent]]

In such a structure, the semantics of the example is straightforward. The existential quantifier of *more* can be omitted under specifier-head agreement, after which the function Δ applies to the output of \mathcal{U}_{p} :

(100) several IQ points more intelligent $\exists p \ [p \in \Delta(\text{SEVERAL IQ POINTS}, \mathcal{U}_{p}(p_{\text{ref}}, \text{INTELLIGENT}))]$

Notice, incidentally, that examples involving modifiers of this type reveal that the function \mathcal{D}_{ourn} is in fact a composite function. It is derived from \mathcal{U}_{p} by the application of a second function, *Reverse*, which changes the polarity of the scale provided by the adjective (so that the top of the scale will now be used as the bottom in any further functions that are applied). In order to see why, consider the example in (101).

(101) [AP [several IQ points less] [AP intelligent]]

If Δown were a simplex function, the semantics of (101) would be as in (102a), but according to this formula Δ measures from the lowest degree of intelligence, while it should measure (downwards) from the highest degree. The definition of Δ does not need to be complicated once Δown is seen as U_p plus *Reverse*, as in (102b).

(102) several IQ points less intelligent

- a. $\exists p \ [p \in \Delta(\text{SEVERAL IQ POINTS}, \text{Down}(p_{\text{ref}}, \text{INTELLIGENT}))]$
- b. $\exists p \ [p \in \Delta(\text{SEVERAL IQ POINTS}, \mathcal{U}_{p(p_{ref}}, \textit{Reverse}(\text{INTELLIGENT})))]$

Let us now return to the main line of argumentation in this section. The same tests that motivate a left-branching structure for *very much more intelligent* corroborate the proposed analysis of *several IQ points more intelligent*. To give one example, *so*-substitution cannot strand *several IQ points*:

(103) a. John is more *intelligent than Bill*. In fact he is several IQ points more *so*.b. *John is *more intelligent than Bill*. In fact he is several IQ points *so*.

Note that, as expected, the pattern in (96) and (103) is in sharp contrast with what one finds if *so* is to replace a class-1 degree head, stranding its specifier. Since in the relevant constructions we are dealing with a right-branching structure (cf. 84), *so*-substitution can apply:

- (104) a. John is too tall for this sweater but he is less so than Bill.
 - b. The projected flight path is too high. In fact, it is several miles so.

In sum, more than one degree expression can occur in the extended adjectival projection as long as each occupies the specifier position of the next. The examples given so far involved two degree expressions (or a degree expression and a modifier containing the function Δ), but nothing excludes further recursion:^{13,14}

(105) The projected flight path was too high, but it was eight miles less too high than originally calculated.

5.4 Impossible combinations

Since LF procedures limit recursion to specifier-head relationships, degree expressions are otherwise in complementary distribution. As already demonstrated, two class-2 modifiers cannot be combined in a right-branching structure (cf. (93)). A similar point holds of class-1 degree expressions. Such expressions are heads selecting an adjectival complement. Consequently, the syntax dictates that they can only be combined in a structure like (106), but here unification of their existential quantifiers under specifier-head agreement is impossible. This leads to vacuous quantification, and hence ungrammaticality.



¹³The predicted semantics of *eight miles less too high* is as in (i).

- (i) a. *John was $[_{PP}$ [less very much] $[_{PP}$ into syntax]] than Fred.
 - b. *John was $[_{AP}$ [less enough] $[_{AP}$ dependent on drugs]] to be eligible for treatment.

 $⁽i) \quad \exists p \; [p \in \Delta(\text{EIGHT MILES}, \, \textit{Up}(p_{\text{ref-2}}, \, \textit{Reverse}(\textit{Up}(p_{\text{ref-1}}, \, \text{HIGH}))))]$

¹⁴As before, a combination of two degree expressions in a specifier-head relationship is blocked if the restriction of the head is incompatible with further modification. Hence, if the head introduces the operation At or a function which uses a default value, further extension of the structure is impossible:

Indeed, a sequence of two class-1 degree items is always excluded. Consider as an example (107a). The ungrammaticality of this construction is all the more striking in view of the fact that the expression in (107b), which has the interpretation targeted by its ungrammatical counterpart, is fully acceptable. (107b), however, instantiates the structure in (84).¹⁵

- (107) a. *This colour seems $[_{DegP} very [_{DegP} too [_{AP} red]]]$ for the hallway.
 - b. This colour seems $[_{DegP}$ very much $[_{Deg}$, too $[_{AP}$ red]]] for the hallway.

Another structure that is categorically excluded is one in which a class-1 degree expression is attached after attachment of a class-2 modifier. Clearly, the degree head and the modifier are not in a specifier-head relationship, so that it is not possible to delete one of them under identity with the other. As before, the result is vacuous quantification:



Structures of this type are indeed not attested, as confirmed by the ungrammaticality of (109a). Note that the semantics targeted by (109a) is realized by the example in (109b), but the latter does involve specifier-head agreement relationship between the two degree expressions. Like (99), (109b) instantiates the structure in (92).

a. *John is [_{DegP} very [_{AP} less [_{AP} dependent on his father]]] than on his mother.
b. John is [_{AP} [[very much] less] [_{AP} dependent on his father]] than on his mother.

In conclusion, we have argued that the mapping principles which derive semantic representations are sensitive to the essentially syntactic relation between a specifier and

¹⁵In line with Grimshaw (1991) we assume that DegPs are adjectival in nature and can hence, in principle, satisfy the selectional properties of Deg heads. Deg-recursion is excluded in practice, however, given the semantics of degree expressions.

its head. Only if two degree expressions entertain such a syntactic relation can one of the existential quantifiers be deleted under identity with the other. Hence, it is only possible to combine two degree expressions in the extended adjectival expressions if this syntactic relation obtains. The fact that the principles of interpretation refer to specifier-head relationships corroborates the main thesis of this paper, namely that the computational system is autonomous. Otherwise, reference to syntactic relationships by the aforementioned mapping principles should be impossible.

The proposed interpretation of specifier-head relationships helps us solve an otherwise recalcitrant problem. As is well-known, certain comparatives are derived through affixation, yielding forms like *higher*. Interestingly, these forms allow further modification in a way similar to syntactic comparatives. Thus, on a par with *three IQ points more intelligent* and *very much more dependent* we find the following examples:

- (110) a. The flight path is eight miles higher than originally planned.
 - b. The flight path is very much higher than originally planned.

If specifier-head agreement did not play a crucial role in interpretation, examples of the type in (110) would constitute a bracketing paradox. Consider why. We have already seen that modified syntactic comparatives have a left-branching structure. In *three IQ points more intelligent, three IQ points* is combined with *more* before the thus derived complex expression is combined with *intelligent*. Recall that both substitution and movement tests diagnosed the resulting left-branching structure in (92). In any theory this must presumably follow from the semantics of the comparative expression and the modifier that precedes it. After all, the syntax does not prevent subsequent attachment of two XPs to an adjectival phrase. If this is the case, one would also expect the examples in (110) to have a structure in which the comparative morpheme combines with the modifier before the resulting expression is combined with the adjective. However, it is clear that this is not compatible with the morphological properties of the comparative affix *-er*: those require a right-branching structure.

As one may expect, substitution by *so* confirms that the examples under discussion indeed have a right-branching structure. We illustrate this with the English examples in (111), but similar data obtain in Dutch. Note again the contrast with the data in (96) and (103), which involve class-2 modification.

- (111) a. The flight path is *higher* than originally planned. In fact, it is eight miles *so*.
 - a'. *The flight path is *high*er than originally planned. In fact, it is eight miles more *so*.
 - b. The flight path is *higher* than originally planned. In fact, it is very much so.
 - b'. *The flight path is *high*er than originally planned. In fact, it is very much more *so*.

It is unclear how these observations can be accommodated in a theory that does not rely on specifier-head agreement. However, on the view of the syntax-semantics mapping proposed here, no bracketing paradox arises. The left-branching structure of modified syntactic comparatives is forced by the fact that only in such a structure can the modifier be analyzed as a specifier of the comparative morpheme. In this configuration the existential quantifiers of the modifier and the comparative morpheme can be interpreted as a single semantic entity, thus avoiding vacuous quantification. To put it differently, modified morphological comparatives allow a right-branching structure precisely because the comparative morpheme is an affix and can therefore form a head with the adjective:

(112) AP XP [∃x ...] A [∃x ...] (Class-2) A

Thus, although modified syntactic and morphological comparatives are different syntactically, they are interpreted on a par due to the effects of specifier-head agreement:

-er

(113) *eight miles higher* $\exists p \ [p \in \Delta(\text{EIGHT MILES}, \mathcal{U}_{p(p_{ref}, \text{HIGH}))]$

In conclusion, the sensitivity of the system relating syntax and semantics to specifierhead agreement provides a further argument for the autonomy of syntax. As in the case of c-selection, a system external to syntax crucially refers to a relation that cannot be reformulated in terms of that system. This relation, then, seems to be irreducibly syntactic. This ties in with the main conclusion of this paper. The literature on degree expressions contains proposals according to which degree expressions are modifiers (cf. Bresnan 1973 and Jackendoff 1977) and proposals according to which they are heads (cf. Abney 1987, Zwarts 1992 and Corver 1997a,b). We have argued that both positions are correct, but for different classes of degree expressions. Class-2 degree expressions are modifiers, but class-1 degree expressions are heads. The question then arises what distinguishes one class from the other. We have shown that an attempt to reduce this bifurcation to a semantic distinction must fail. Instead, the defining property of class-1 expressions is that they are functional heads which consequently c-select a complement of a specific category, whereas class-2 expressions, being modifiers, lack such selectional requirements.

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