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Relational adjectives as properties of kinds*

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1 Introduction

This paper fits in the context of a current movement in formal semantics to reanalyze as INTERSECTIVE most or all adjectives that have been treated as predicate modifiers in the tradition of formal semantics. The specific goal of the paper is to provide an intersective analysis of so-called RELATIONAL adjectives such as Catalan *tècnic* ('technical') in (1). (1a) entails that Martí is an architect ((1b)) but not that he is technical ((1c)) – indeed, *tècnic* sounds rather anomalous when applied to *Martí*:[1]

(1) a. El Martí és arquitecte tècnic.
'Martí is a technical architect.'
b. |= El Martí és arquitecte.
c. #El Martí és tècnic.

In this respect, *tècnic* does not behave like a prototypical intersective adjective such as *male*, which, in the context *NP is Adj N* licenses not only the entailment that *NP is N* but also that *NP is Adj*, as shown in (2). The term 'intersective' refers to the fact that the semantic composition of the adjective and noun can be characterized in terms of the intersection of their extensions, as represented in the translation in (2d):

(2) a. Martí is a male architect.
b. |= Martí is an architect.
c. |= Martí is male.
d. T(*male architect*) = λx [**male**(x) $\wedge$ **architect**(x)]

Rather, *tècnic* and other relational adjectives appear to be SUBSECTIVE: in the context *NP is Adj N* they license only the entailment that *NP is N*.

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[1] Throughout this paper we use the symbol '#' to mark expressions which are, on our analysis, semantically anomalous, and '??' to mark expressions which sound unacceptable to us without our making any a priori commitment to the reason for their unacceptability.

Since the failure to entail *NP is Adj* could not readily be explained on an intersective analysis, Siegel (1976) and others after her have analyzed subsectively interpreted adjectives as predicate modifiers, that is, as properties of properties, rather than properties of individuals, as represented in (3).

(3) $T(\textit{arquitecte tècnic}) = \lambda x[(\textbf{technical}(\textbf{architect}))(x)]$

The predicate modifier analysis, also used for adjectives such as *former*, does not entail that the set of individuals described by the noun phrase has the adjectival property, since that property is not directly ascribed to those individuals.

Despite its ability to account for the entailment facts, there are at least two problems with the predicate modifier analysis when applied to certain classes of adjectives. First, as Larson (1998) observes, the analysis postulates an ambiguity for many adjectives which is difficult to justify. While a sentence like (4) might be ambiguous between a reading that entails that Olga as an individual is beautiful and one that does not, that ambiguity intuitively involves more what *beautiful* is modifying – Olga herself or her dancing – than anything in the lexical semantics of the adjective itself.

(4) Olga is a beautiful dancer.

In this respect, it seems a mistake to account for what we might call the event-related reading of (4) by treating the adjective as ambiguous between a property of individuals and a predicate modifier.

Second, and perhaps more importantly, the predicate modifier analysis makes it difficult to explain why the putatively nonintersective reading is sometimes available even when the adjective appears to be predicated of something of type *e*. For example, *beautiful* in (5) is most naturally understood as describing Olga's dancing, even though it does not modify any noun, and following the standard semantics of copular constructions, should be predicated directly of *Olga*.

(5) Look at Olga dance – she's beautiful!

Unless some kind of ellipsis is postulated, the predicate modifier analysis cannot explain why sentences such as (5) are grammatical and mean what they do. Yet ellipsis is difficult to justify: there is no direct antecedent for a hypothetically elided noun *dancer*, and we would also have to explain why the indefinite article *a*, which would be necessary to form a grammatical postcopular NP, is also elided.

Partee (2001) makes similar observations for what she calls PRIVATIVE adjectives, such as *fake*. If *Adj* is privative, then *NP is Adj N* entails *NP is not N*, as in (6a). Nonetheless, privative adjectives, though ostensibly nonintersective, also appear as simple complements to copular predicates, as shown in (6b):

(6) a. That is fake fur |= That is not fur.
b. That fur is fake.

These syntactic distribution facts and other observations have led Larson and Partee to find a way to treat event-related readings and privative adjectives intersectively.[2] Our proposal fits into this line of research: We will argue that relational adjectives denote properties of KINDS, where kinds are modeled as entities, following Carlson (1977). This proposal allows for an intersective semantics for these

[2] As Olivier Bonami observes (p.c.), Partee (2001) says that privative adjectives are subsective; however, her semantic analysis is intersective insofar as she treats them as simple properties, once the domain of objects is extended to include fake objects.

adjectives and at the same time explains some of the data which are problematic for the predicate modifier analysis.

The structure of the paper is as follows: in Section 2, we provide some background on relational adjectives; Section 3 offers some empirical arguments for their intersectivity, based on Catalan data; Section 4 contains the analysis, a further argument for it, and a discussion of some additional predictions it makes; and Section 5 presents our conclusions.

2 Relational adjectives

We take the term 'relational adjective' from the French descriptive grammar tradition, specifically from work by Bally (1944:96-97), the first linguist we know of to have studied this kind of adjective. Bally was interested in noun-adjective pairs such as *chaleur solaire*, 'solar heat' (his example), and characterized relational adjectives (*adjectifs de relation*) such as *solaire* by the four properties that follow.

First, these adjectives never appear prenominally in Romance languages such as French or Catalan (*#solaire chaleur*), whereas other adjectives can occur both pre- and postnominally (*forte croissance* vs. *croissance forte*, 'important growth'). Second, according to Bally, they are not able to appear as predicates in copular sentences: *#Cette chaleur est solaire*. Third, they are not gradable (*#chaleur très solaire*); this is usually related to their 'classificatory' or 'taxonomic' meaning. Finally, they are often identified as denominal and semantically similar to nouns; as Bally (1944: 97) observed, a relational adjective "transpose des substantifs sans rien changer à leur valeur de substantifs" ('substitutes nouns without changing any aspect of their value as nouns'). This is related in his and much subsequent work to an intuition that relational adjectives are 'covert nouns' which, among other characteristics, saturate argument positions of the nouns they modify.

A closer look at these characteristics raises some puzzling questions about relational adjectives, and in particular, about the predicate modifier analysis of them, at least for Catalan. First, the restriction to postnominal position is very surprising if these adjectives are predicate modifiers. As can be seen in (7), those adjectives which are arguably the best candidates for a predicate modifier analysis, such as *presumpte*, 'alleged', never follow the head noun:

(7) a. un presumpte assassí
'an alleged murderer'

b. #un assassí presumpte

On the other hand, this postnominal position is the usual one for intersective adjectives, as can be seen in (8a). (8b) shows that the position of relational adjectives with respect to the head noun corresponds to that of an intersective adjective.

(8) a. un escriptor jove
a writer young
'a young writer'

b. una malaltia pulmonar
a disease pulmonary
'a pulmonary disease'

Second, if relational adjectives were intersective, we would also expect them to be able to appear as a predicate in copular sentences, and yet according to Bally and others (Levi 1978, Fradin and Kerleroux 2003) they cannot. Failure to appear in postcopular position is one of the clearest distributional characteristics of predicate modifier-type adjectives such as *presumpte*:

(9) #L'assassí era presumpte.

If Bally's observation were correct, the distribution of relational adjectives would be contradictory indeed.

It turns out, however, that this second claim by Bally is *not* correct: Postcopular predicative uses *are* in fact possible for relational adjectives, as has been previously noted by various researchers (Demonte 1999, Picallo 2002),[3] and as illustrated in (10):

(10) a. El domini del Tortosa va ser només territorial.
'The dominance of the Tortosa [soccer team] was only territorial.'

b. Aquest congrés és internacional.
'This conference is international.'

c. El conflicte és polític.
'The conflict is political.'

The fact that relational adjectives share the syntactic distribution of other intersective adjectives, and are distributionally unlike adjectives requiring a predicate modifier analysis, is a fundamental piece of data to be accounted for.

The other two characteristics that Bally mentioned seem less crucially correlated with the semantic type of the adjective, or at any rate do not constitute convincing reasons for holding on to the

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[3] Examples also appear in Levi (1978: 254; her examples (7.5a-c)):

(i) The process by which compounds are formed is transformational.

(ii) Her infection turned out to be bacterial, not viral.

(iii) His razor is electric.

However, Levi maintained that these cases necessarily involved ellipsis of a noun following the adjective, and thus were not true cases of predicative uses. Although she does not develop a full analysis, she lists the steps that a derivational analysis like the one she suggests would imply. For e.g. (iii), these steps are the following (reproducing (7.6b), p. 255):

(iv) His razor is a razor using electricity.

(v) His razor is an electricity-using razor.

(vi) His razor is an electric razor.

(vii) His razor is electric.

Such an analysis is necessary to maintain the fundamental distinction that Levi makes between ordinary predicative adjectives (true predicates) and relational ones (nominals acting as adjectives), which seems to be a development of the intuition mentioned above that relational adjectives are "nouns in disguise." Our analysis considers them to be true predicates in Levi's sense, as will be further developed in Section 4.

predicate modifier analysis in the face of the two pieces of data just mentioned. On the one hand, while it may be the case that all predicate modifier-type adjectives are nongradable, nongradability is not a sufficient condition for denoting a property of properties: there are nongradable adjectives which are unquestionably intersective, like *solter*, 'single'.

On the other hand, denominal adjectives are not a homogeneous class. Some denominal adjectives are clearly intersective, such as *vergonyós*, 'shy', derived from *vergonya*, 'shyness'; others, like *ocasional*, 'occasional', fall into the category that has been reanalyzed as intersective by Larson (1998). At the same time, there are relational adjectives that are not synchronically denominal, such as *bèlic*, 'bellic', or *botànic*, 'botanical'. Thus being denominal is neither a necessary nor sufficient condition for being relational.

Readers familiar with the French descriptive grammatical tradition and its characterization of relational adjectives may object at this last remark, since this denominal character was a fundamental element in the original characterization of relational adjectives – indeed, it was the source of the term 'relational', since the adjective's meaning involves relating the denotation of the head noun to another individual identifiable via the adjective. For example, in the NP *chaleur solaire*, the adjective relates the heat denoted by *chaleur* to the sun, recoverable from the semantics of the adjective. We do not dispute at all the interest of this aspect of the semantics of relational adjectives, and it is something we intend to account for within our analysis. However, we maintain (at the moment, without further argument, though see the Conclusion for some comments) that a predicate modifier analysis is not essential to capturing this characteristic, and thus that it should not prevent us from pursuing an intersective semantics, as long as we foresee a means of accounting for the facts via that semantics.

Summarizing, we are, to some extent, calling into question the assumption that what have traditionally been called relational adjectives constitute a single, well-defined class. In the remainder of this article, we will take the syntactic distribution criteria as a starting point and will argue for the viability of an intersective analysis for an important subset of those adjectives which have been previously claimed not to permit such an analysis.

3 Further evidence for an intersective analysis

We will now offer three more empirical arguments against considering relational adjectives to be predicate modifiers. The aim of these data is to show that relational adjectives behave like intersective adjectives and unlike the core cases of predicate modifiers with respect to syntax and some aspects of semantics. We conclude that an intersective reanalysis such as the one we will propose should be taken seriously.

First, consider the distribution of the partitive pronoun *en* in Catalan. Roughly, *en* plays the role of a nominal within an indefinite NP:

(11) a. Buscàvem llibres, però no en vam trobar.
We-looked-for books, but not EN did find
'We looked for books, but we didn't find any.'

b. Buscàvem llibres; només en vam trobar un.
We-looked-for books; only EN did find one
'We looked for books; we only found one.'

When *en* is used, some of the material in the related NP can be stranded or dislocated, provided it is preceded by the preposition *de* 'of':

(12) a. No en vam trobar, de fotografies maques.
Not EN did-find, of pictures beautiful
'Beautiful pictures, we didn't find any.'

b. No en vam trobar, de maques.
Not EN did-find, of beautiful (talking e.g. about pictures)
'Beautiful, we didn't find any.'

As can be seen, among other possibilities, the stranded material can be the head noun plus one or more modifying adjectives (12a), or simply the adjective, where the reference of *en* has to be recovered from discourse or context (12b).

However, not just any adjective can be dislocated; crucially, those adjectives which constitute the prototypical examples of predicate modifiers cannot:

(13) a. No en vam veure, de presumptes assassins.
'We did not see any, alleged murderers.'

b. *No en vam veure, de presumptes.

The key to understanding why only intersective adjectives and not predicate modifiers can appear in this construction probably lies in the presence of the preposition *de*. As mentioned above, this preposition is obligatory with dislocated nominals anaphorically related to the pronoun *en*, so that (14) is not acceptable:

(14) *No en vam trobar, fotografies maques.

Interestingly, the preposition cannot be used when the stranded or dislocated NP-related material is a determiner (15), while it is compulsory when the material left behind is an adjective (16):[4]

(15) a. En vam trobar una.
'We found one.'

b. *En vam trobar d'una.

(16) a. *En vam trobar maques.

b. En vam trobar de maques.
'We found beautiful ones.'

While a complete analysis of this construction is beyond the scope of this paper, we posit that the preposition *de* when linked to the pronoun *en* must be followed by a property-type constituent (for the sake of convenience, represented extensionally here as of type $\langle e,t \rangle$). This explains why nominals and intersective adjectives cooccur with the preposition, while determiners cannot. Similarly, if adjectives

[4] In fact, Quixal, et al. 2003 used this property as a diagnostic for determining whether a lexical item is an adjective or a determiner in Catalan.

such as *presumpte* do not denote in type <*e*,*t*> but rather only in type <<*e*,*t*>,<*e*,*t*>> (or its intensional counterpart), the unacceptability of (13b) follows directly.

Now if relational adjectives were of the same type as predicate modifiers like *presumpte*, we would expect them not to be able to appear in the *en* construction. However, they can and do appear in this construction, as shown in (17).

(17) En aquella època, de malalties, n'hi havia de pulmonars.
'At that time, diseases, there were pulmonary ones.'

Given what we have said here about the conditions on the appearance of adjectives in this construction, the acceptability of (17) is strong evidence that relational adjectives are of type <*e*,*t*>.

Another consequence of the difference in semantic type between adjectives like *presumpte* and those like *jove*, and the source of our second argument for the intersectivity of relational adjectives, appears in (18). Catalan, like other Romance languages (though unlike English, as a rule), allows surface NPs which lack an overt noun, as in (18a). However, this *Det AP* (Adjective Phrase) configuration is not possible when the AP is a predicate modifier, as (18b) shows.

(18) a. Els joves van venir.
'The young ones came.'

b. *Els presumptes van venir.
'The alleged ones came.'

Although, once again, a full analysis of this construction is not possible here, a simple explanation of these facts would be that Catalan, unlike English, regularly allows for determiners to combine with adjectives, as long as the adjective is of the appropriate semantic type. Given that the determiner, under most assumptions, combines only with constituents of type <*e*,*t*>, we can readily explain the contrast in (18).

As was the case with the *en* construction, if relational adjectives were of the same semantic type as predicate modifiers, we would predict them not to occur in 'headless' NPs. Crucially, however, this prediction is incorrect, as seen in (19):

(19) Les pulmonars són les pitjors.
'The pulmonary ones are the worst.'

A third piece of evidence that relational adjectives denote properties of individuals comes from their failure to exhibit interesting scope effects in combination with other adjectives. If a noun combines with more than one adjective, all of which are intersective, the order in which the adjectives combine with the noun will not affect the denotation of the resulting noun phrase.[5] Thus, the nominals in (20) denote exactly the same set of objects: shoes that are new and white.

(20) a. sabates noves blanques
shoes new white
'new white shoes'

[5] Saying this does not exclude the possibility that there might be preferences for certain adjective orderings over others. See example (23) below for one such case.

b. sabates blanques noves
shoes white new
'new white shoes'

The failure of adjective order to affect the denotation of the nominal is due to the semantic rule for composing the adjective and noun denotations. When *Adj* is intersective, we assume, following many linguists before us, a rule such as the following:

(21) For all *N* (or *N'*) α and *A* (or *AP*) β, $[[\alpha\ \beta]] = [[\alpha]] \cap [[\beta]]$

Given that intersection is commutative and associative, the result of intersecting the denotation of *sabates* with that of *noves*, and then intersecting the denotation of the result with the denotation of *blanques*, will be the same as the result of intersecting the denotation of *sabates* first with that of *blanques* and then intersecting the result with that of *noves*.

In contrast, when a noun is modified by both a predicate modifier such as *presumpte* and another adjective of whatever kind, as in (22), the order in which the adjectives combine with the noun does crucially affect the denotation of the resulting NP. For example, (22a) entails that the referent of the NP is young, while (22b) does not.

(22) a. jove presumpte assassí
'young alleged murderer'

b. presumpte jove assassí
'alleged young murderer'

As a first approximation, we can attribute this difference to the nonintersectivity of the semantic contribution of *presumpte*. If *presumpte* is not intersective, there will be no guarantee that combining it with a given noun and then combining the result with some other adjective will return the same result as combining it with that noun previously modified by the same adjective.

Once again, the data demonstrate that relational adjectives behave like intersective ones and contrast with predicate modifiers: the order in which relational adjectives appear with respect to other (intersective) adjectives does not affect the interpretation of the noun phrase. The nominals in (23) have exactly the same denotation:[6]

(23) a. producció mundial pesquera
production worldwide fishing
'worldwide fishing production'

b. producció pesquera mundial
production fishing worldwide
'worldwide fishing production'

[6] Some speakers do not accept the ordering in (23a) for reasons which are unclear to us. However, what is crucial is that all of those speakers who accept both orders assign the same interpretation to both nominals. In fact, these examples are taken from a Catalan corpus (Rafel 1994), where both nominals appear in the same text and the author is clearly referring to the same thing in both cases.

Summarizing, we now have five pieces of data which argue for an intersective analysis of relational adjectives: position with respect to the head noun, predicative uses, distribution within the *en* construction, uses in 'headless' NPs and lack of scope effects when combined with other adjectives. We now turn to developing such an analysis.

4 Analysis

4.1 Previous formal treatments

Relational adjectives as a separate class within the subsectives have received very little attention from formal semanticists.[7] The most concrete proposal for a semantic analysis we have found is that in Fradin and Kerleroux 2003 (hereafter F&K). F&K take seriously the intuition that relational adjectives are deeply related to nouns, and their analysis builds on the observation that such adjectives often modify nouns with more than one argument. On their semantics, the relational adjective predicates the nominal property embedded in the adjective meaning of one of the arguments in the noun being modified. For example, the function of *cérébral*, 'cerebral', in the nominal *lobe cérébral*, 'cerebral lobe', is to predicate the property "brainhood" of the second argument of *lobe*, as in (24):

(24) $T(\textit{lobe cérébral}) = \lambda x \lambda y\ [\mathbf{lobe}(x,y) \wedge \mathbf{brain}(y)]$

Abstracting and generalizing, the schema for the type they propose for relational adjectives is that represented in (25), where the adjective is of type $<<e,t>,<e,t>>$ – in this sense, a predicate modifier – but effectively intersective in the sense that it introduces a first-order property which is predicated of one of the modified noun's arguments.[8]

(25) $\lambda P \lambda x/y\ [P(x, ..., y) \wedge \mathbf{N}(x/y)]$, where **N** is the noun from which the adjective is derived.

F&K's analysis, though technically a predicate modifier analysis, is intersective in spirit, and is similar to ours in that the first order property introduced by the relational adjective does not (generally) modify the referent of the modified nominal. However, the similarities end there: F&K's central concern is to account for the apparent argument-saturating effect of the relational adjective, while, as will become clear below, this is not our first priority. We will leave additional comments on the differences between our analysis and F&K's until the final section of the paper.

4.2 A Larsonian intersective semantics

As noted above, our proposal is inspired in Larson's analysis of event-related adjectives (Larson 1998). Larson proposed that certain adjectives (in fact, many) denote properties of events rather than, or in

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[7] The most extensive analysis of relational adjectives (though not under that name) in the generative linguistics tradition is probably Levi's (Levi 1978). Levi's transformational syntactic account treated relational adjectives as nouns at Deep Structure, which were converted to adjectives in the course of deriving Surface Structure. Although she does not offer any explicit semantic type assignment for these adjectives, her analysis of predicative uses of them, sketched briefly in footnote 3, strongly suggests that her conception of relational adjectives was very close to a predicate modifier analysis. See also Bolinger 1967 for extensive informal discussion of these adjectives, which suggests an analysis similar to that proposed by Levi.

[8] F&K allow for the possibility that the adjective might modify any of the noun's arguments, hence the "*x*/*y*" notation; however, this aspect of their analysis is not crucial for our purposes and we will not comment on it further here.

addition to, denoting properties of ordinary individuals; thus, an adjective like *bona*, 'good', could be translated as in (26a).[9] In addition, he posited that nouns quite generally have an event argument in addition to their other, more familiar arguments, as illustrated with *violinista* in (26b). On the event related reading of the adjective, the adjective modifies the event argument of the noun, as in (26c):

(26) a. $T(bona) = \lambda e.\mathbf{good}(e)$
b. $T(violinista) = \lambda x \lambda e.\mathbf{violinist}(x,e)$
c. $T(bona\ violinista) = \lambda x \lambda e.\mathbf{good}(e) \wedge \mathbf{violinist}(x,e)$

In this representation, *bona* denotes a first order property and restricts the denotation of *violinista*, but does so without being ascribed to the individual argument of *violinista*. The fact that *bona* denotes in type $<e,t>$ accounts for its acceptability in predicative positions; the fact that it modifies the noun's event argument and not its individual argument accounts for its apparent nonintersectivity.

The analysis we propose is analogous to Larson's analysis for event-related adjectives, with the difference that we make use of kinds rather than events. First, we posit that all common nouns have an implicit kind argument,[10] which is related to the individual-sort argument typically associated with nouns via the Carlsonian realization relation *R* (Carlson 1977). We represent the general translation for nouns, closely following Krifka, et al. 1995, as in (27), where the subscript *k* indicates a kind-level entity and the subscript *o*, an object-level entity. Put informally, this analysis states that objects realize the kinds of things that nouns describe:

(27) For all common nouns *N*, $T(N) = \lambda x_k\, \lambda y_o[R(y_o,x_k) \wedge \mathbf{N}(x_k)]$

Thus, a noun such as *arquitecte*, 'architect', would receive the translation in (28):

(28) $T(arquitecte) = \lambda x_k\, \lambda y_o[R(y_o,x_k) \wedge \mathbf{architect}(x_k)]$

Second, we posit that those adjectives traditionally described as relational denote properties of kinds. That is, they fall into the same sortal class as adjectives such as *widespread* or *extinct* in English.[11] Thus, an adjective such as *tècnic* will have the translation in (29); it can be truthfully applied to any number of kinds – the kind *architect*, *solution*, *translation*, etc.:

(29) $T(tècnic) = \lambda x_k[\mathbf{technical}(x_k)]$

As under this analysis *tècnic* denotes a property of a kind, and not of an individual, we need a special noun-adjective (or more precisely, noun-adjective phrase) composition rule to combine the adjective with the noun, as in (30):

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[9] Of course, treated this way, this adjective would have to have other translations as well, corresponding to properties of the other sorts of individuals it can describe. No doubt a better analysis would assign a single translation to the adjective, on which it denoted a property of the most general sort of entity, a sort encompassing both entities and events. However, for the sake of illustrating Larson's analysis, we will use more specific translations like that found in the text.

[10] This assumption neither excludes nor presupposes the presence of an event argument; however, we will leave any possible event arguments out of the representations that follow to keep things simple.

[11] The intuition is also expressed in Bosque and Picallo 1996, and more indirectly in Bolinger 1967, though neither of these works develop it into a specific semantic proposal.

(30) If noun *N* translates as $\lambda x_k\, \lambda y_o[R(y_o, x_k) \wedge \mathbf{N}(x_k)]$ and adjective phrase *AP* translates as $\lambda x_k[\mathbf{A}(x_k)]$, then [*N AP*] translates as $\lambda x_k\, \lambda y_o[R(y_o,x_k) \wedge \mathbf{N}(x_k) \wedge \mathbf{A}(x_k)]$

The effect of this rule is to restrict the kind described by the modified noun to one of its subkinds.

After the adjective phrase and the noun have composed, the resulting phrase still needs to be saturated with two arguments – one corresponding to a kind, and the other corresponding to the object-level individual described by the noun. We propose that the kind argument gets saturated by a contextually-determined kind. This seems plausible because in most or perhaps all cases, this kind will be uniquely identifiable in the context (indeed, this is the assumption behind Carlson's claim that kind terms are like proper names). Thus, the noun phrase *arquitecte tècnic* translates as in (31), where we use an indexed free variable (analogous to a free pronoun) to saturate the kind argument:

(31) $\lambda x_k\, \lambda y_o[R(y_o,x_k) \wedge \mathbf{architect}(x_k) \wedge \mathbf{technical}(x_k)](k_j) = \lambda y_o[R(y_o,k_j) \wedge \mathbf{architect}(k_j) \wedge \mathbf{technical}(k_j)]$

This property of individuals can then be applied to an argument such as *Martí*:

(32) a. El Martí és arquitecte tècnic.
'Martí is a technical architect.'

b. $\lambda y_o[R(y_o,k_j) \wedge \mathbf{architect}(k_j) \wedge \mathbf{technical}(k_j)](\mathbf{m}) = [R(\mathbf{m}, k_j) \wedge \mathbf{architect}(k_j) \wedge \mathbf{technical}(k_j)]$

This analysis has the advantage that it does not directly ascribe "technicalness" to Martí, while still entailing that a technical architect is an architect. It also predicts the unacceptability of *#El Martí és tècnic* mentioned above; that is, it predicts the apparent nonintersective behavior of the adjective. The key here is that if the argument of the adjective does not denote a kind, the adjective cannot be predicatively used: the sort of the adjective and its argument will conflict, and this sortal mismatch will make the predication infelicitous.

In contrast, if the subject of a copular sentence containing a relational adjective *does* plausibly denote a kind, the predication will be acceptable, as in (33):

(33) La tuberculosi pot ser pulmonar.
'Tuberculosis can be pulmonary.'

Thus, the analysis both predicts that relational adjectives can be used predicatively and accounts for the conditions under which this use is possible.

4.3 A further argument for the analysis

Our analysis makes yet another correct prediction, which amounts to an additional argument in its favor. This prediction involves adjective order. It has been noted (e.g. by Demonte 1999, Picallo 2002) that relational adjectives always appear closer to the head noun than do other intersective adjectives, illustrated in the following contrast:

(34) a. inflamació pulmonar greu
b. #inflamació greu pulmonar
'serious pulmonary inflammation'

Our analysis predicts precisely this pattern of word order possibilities.[12] We first show how it predicts the unacceptability of (34b). We assume the following translations for *inflamació*, *pulmonar*, and *greu*:

(35) a. $T(\textit{inflamació}) = \lambda x_k \lambda y_o[R(y_o,x_k) \wedge \textbf{inflammation}(x_k)]$
b. $T(\textit{pulmonar}) = \lambda x_k[\textbf{pulmonary}(x_k)]$
c. $T(\textit{greu}) = \lambda x_o[\textbf{serious}(x_o)]$

Let us assume that adjective ordering reflects order of composition, and that if *greu* appears closest to the head noun, it must combine with it first. In order for this combination to take place, we must first saturate the noun's kind argument; only then will it denote a property of individuals that can be intersected with the denotation of *greu*. That is, the translation of *inflamació greu* will be as follows:

(36) $T(\textit{inflamació greu}) = \lambda y_o[R(y_o,k_j) \wedge \textbf{inflammation}(k_j) \wedge \textbf{serious}(y_o)]$

But this resulting translation is not of the right sort to combine with *pulmonar*: the latter can only be combined with something whose translation contains a lambda-bound kind argument. Thus, the phrase *inflamació greu pulmonar* is ruled out.

This problem does not arise if we combine *inflamació* with *pulmonar* first and then with *greu*:

(37) a. $T(\textit{inflamació pulmonar}) = \lambda y_o[R(y_o,k_j) \wedge \textbf{inflammation}(k_j) \wedge \textbf{pulmonar}(k_j)]$
b. $T(\textit{inflamació pulmonar greu}) = \lambda y_o[R(y_o,k_j) \wedge \textbf{inflammation}(k_j) \wedge \textbf{pulmonary}(k_j) \wedge \textbf{serious}(y_o)]$

After the relational adjective combines with the noun, we can saturate the kind argument and the result will denote a property of the same sort as that denoted by *greu*. Note that this prediction is not contradictory with examples such as those in (23) above (*producció mundial pesquera* vs. *producció pesquera mundial*), as in these latter cases both adjectives are relational. As discussed in Section 3, our analysis correctly predicts that both orders should be possible and lead to no difference in denotation.

4.4 Some complications in the data

4.4.1 Relational adjectives predicated of nonkinds

As noted in Section 4.2, our analysis predicts that relational adjectives should only take as arguments in a predicative construction NPs that denote kinds (as opposed to ordinary individuals), and this prediction appears to be largely borne out by facts such as (33) and (1c), repeated below for convenience:

(38) a. La tuberculosi pot ser pulmonar. (=33)
b. #El Martí és tècnic. (=1c)

However, we have also found ostensible counterexamples to this prediction, in which a relational adjective is predicated of a NP that arguably does not denote a kind in the context. (39) presents an example.

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[12] Our analysis does not make any specific predictions concerning the ordering of relational adjectives with respect to each other. In principle it permits variation in the ordering of relational adjectives (see the discussion of (23) above), but of course other factors independent of semantic type *per se* may limit the ordering possibilities. However, we must leave further exploration of this issue for future research.

(39) Infection with tuberculosis spreads in two ways, by the respiratory route directly from another infected person or by the gastrointestinal route by drinking milk infected with the tubercle bacillus….In infections with *M. tuberculosis*, the tubercle bacilli commonly affect the lungs, in which case the disease is known as pulmonary tuberculosis. By contrast, infections with *M. bovis* often affect the bones and joints. **About 90 percent of all clinically recognized tuberculosis in humans is <u>pulmonary</u>**. (the Britannica Guide to the Nobel Prizes, http://www.britannica.com/nobel/micro/606_50.html)

The sentences in (10) above, repeated here in (40), constitute additional examples:

(40) a. El domini del Tortosa va ser només territorial.
b. Aquest congrés és internacional.
c. El conflicte és polític.

In all of these examples, the property denoted by the adjective is used to classify individual instances of a kind that could typically be described using the adjective. For example, (40b) asserts that a particular conference belongs to the (sub)kind of international conferences.

A thorough study of such examples (including their frequency and distribution in different types of corpora) will have to await future research, but we would like to make a few preliminary observations. Perhaps the most salient fact about such examples is that we have only found them attested with common noun subjects, and the contrast between (38b) and the examples in (39)-(40) is sharp.

One way to explain this contrast is to hypothesize that relational adjectives are susceptible over time to extending the domain over which they denote. Perhaps they originate as properties of kinds and then, as those properties become useful for subclassifying instances of these kinds directly, their extension is expanded to include such instances themselves. Such an explanation would predict that, statistically speaking, it will sound more felicitous to predicate a relational adjective of an individual that is described using a noun denoting a kind for which that adjective is a well-established modifier than it will be to predicate such an adjective of an individual that is described by an expression that does not denote such a kind.[13] While we must evaluate this prediction carefully in future research, the following case study bears it out.

As (40b) sounded very natural to us, we did a simple Google search for the expressions "international conference" and "conference is international". The first search returned about 3,720,000 hits, and the second, 251 hits. While these lists of hits contain irrelevant examples, certainly they returned many, many relevant ones. We then did a search for "international bakery" and "bakery is international". This time, the former returned 1,910 hits (again, not all of which are relevant), and the latter, none. This dramatic difference in hits correlates with our intuition that, even though (41a) is perfectly acceptable (and was in fact attested), (41b) sounds very odd.

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[13] Moreover, this account might well also lead to explanation for the widely noted fact that many relational adjectives also have a nonrelational meaning, as in (49):

(49) a. Aquests pantalons són molt econòmics.
'These trousers are very economical (i.e., cheap)'

If our analysis is correct, cases in which a relational adjective is predicated of an individual for the purposes of subclassification could be a first step in the development of such derived meanings.

(41) a. Droubi's Bakery is an international bakery that is currently located only in Houston. http://www.droubisbakery.com
b. ??That bakery is international.

We suggest that while *international* might be plausibly used to describe and subclassify any number of kinds of things (including bakeries), its use as a classifier of bakeries has not become sufficiently established for the adjective to serve as a direct property of individual bakeries.

It could be thought that this contrast is merely due to frequency: more frequent adjective-noun pairs (be they relational adjectives or not) would lead to predicative examples, whereas less frequent ones would not. However, this appears not to be the case: Google searches for "nice mouse" and "pink table" returned a number of hits comparable to the "international bakery" case (2,680 and 1,660, respectively), and their predicative counterparts ("mouse is nice" and "table is pink") returned 183 and 65. This suggests that both the analysis and the explanation for cases like (40) and (41) are on the right track, for it reveals two related facts.

First, for some adjective-noun pairs involving relational adjectives it is not possible to use the adjective predicatively at all ((41b)), or it is only possible under very constrained conditions. Second, even for adjective-noun pairs where we find the adjective predicatively applied to an NP headed by the noun in question, we find that predicative uses involving a given relational adjective and a given noun are proportionally much less frequent than predicative uses of a given nonrelational adjective in combination with a given noun. For example, while the attributive uses of *nice* in NPs headed by *mouse* are approximately 15 times more frequent than the predicative uses of *nice* with NPs headed by *mouse* (based on the figures mentioned above), the attributive uses of *international* in NPs headed by *conference* are 15,000 times more frequent than the predicative uses of the same adjective with NPs headed by *conference*. This may explain why many people have the strong intuition that relational adjectives cannot be used predicatively, even though this is clearly not the case. However, a thorough statistical analysis should be performed in order to test whether these differences in distribution are robust through the different classes of adjectives.

Given this explanation, we would predict relational adjectives to sound anomalous when predicated of proper names because proper names are not classificatory expressions, and the set of individuals described by a proper name, generally being a singleton, will not permit further subclassification by a property such as one described by a relational adjective. We would also not be surprised to find that the use of relational adjectives predicatively to subclassify ordinary individuals is most frequent in specialized discourses, where the adjectives used for subclassification of a given kind of entity are well known and the interest in such subclassification is obvious.

Obviously, this explanation for the facts in (40) runs the risk of weakening our analysis: If we stand by it, we must admit that at least some relational adjectives can denote properties not only of kinds but also of individuals. Nonetheless, we think this weakening is more apparent than real. First, our analysis clearly accounts for the classic subsective behavior of relational adjectives. Second, it forms the basis for a promising explanation of the complex distribution of relational adjectives described in this section.

4.4.2 The use of more familiar kind-level predicates within NP

Because we propose that relational adjectives denote properties of kinds and because nothing in our analysis prevents any kind-level predicate from modifying a noun within an NP, we also expect that we should find examples of the more familiar kind-level predicates such as *extinct* in NPs which are predicated of ordinary individuals. However, as pointed out to us (Satoshi Tomioka and Olivier Bonami, p.c.), sentences such as the following sound extremely odd:

(42) a. ??Dino is an extinct dinosaur.
b. ??Tweety is a widespread bird.

We suspect that the oddness/nonexistence of examples such as (42a), involving *extinct*, is that such sentences can never be true. If Dino is or was a dinosaur, it is entailed that that species of dinosaur exists or existed (whether in reality or fiction) at the relevant time of evaluation, and if the species is or was entailed to exist, it cannot simultaneously be or have been extinct, which is what the semantic rule for combining adjectives and nouns requires. Thus, (42a) may well be odd, and similar examples inexistent, because of their contradictory nature. A similar explanation can be provided for (42b): it is pragmatically odd to assign the property of being a widespread bird to a single individual.

However, if this is true, we should find other, pragmatically plausible instances of kind-level predicates modifying a noun within an NP predicated of ordinary individuals. In order to test this prediction, we performed a series of Google searches for occurences of the adjectives *extinct*, *widespread*, *scarce*, *abundant*, *common* and *rare* in this construction.[14] The searches were of course only approximations, as no linguistic constraints can be set on current web search engines: we searched for exact matches for "is a(n) A", where A was one of the six adjectives just listed. For four of the adjectives (*rare*, *scarce*, *common*, and, perhaps surprisingly, *widespread*), we found relevant examples in the first 20 to 40 matches.[15] These results clearly confirm our prediction. Some of the examples, together with the original URLs, are the following:

(43) a. There are a number of reasons such a clamorous stir has developed with collectors over this find: (1) It Is a truly a vintage piece from the early 1980's. (…) (5) It was not printed in the United States, but is a ***scarce*** overseas piece.
http://www.findarticles.com/cf_0/m0FCM/4_32/112904360/p1/article.jhtml
b. This is a ***scarce*** figure of a railway engineer in fair to good all original condition.(…)This is a ***scarce*** figure in good condition. (…) . This is a ***scarce*** item in good all original condition. (…)This is a ***scarce*** Britains nurse in fair to good all original condition.[16]
http://www.collectorsworld.net/lead.htm

[14] These are the kind-level adjectives listed in Krifka, et al. 1995, one of the standard references on genericity and kinds. We chose to search English examples because this class of adjectives is even smaller in Catalan than it is in English, and the number of web pages in Catalan, much smaller as well.

[15] *Google* returns an approximate total number of matches for the searches, which we report here: *extinct* (7,370), *widespread* (109,000), *abundant* (22,700), *rare* (709,000), *scarce* (22,700), *common* (1,670,000).

[16] It seems that this use of *scarce* is mostly found in collectors' vocabulary.

(44) a. The Ageing Labour Force is a ***Common*** Challenge for Europe
[Title, hence capital letters]
http://presidency.finland.fi/netcomm/news/showarticle279.html
b. "Sweet potato" is a ***common*** nickname for what small musical instrument?
http://www.themusicstand.com/info/trivia/questions/0,1936,t,00.html

(45) Charlie Kaufman is a ***Rare*** Scribe
[Title, hence capital letters]
http://www.scre.com/cgi-bin/news.cgi?v=news&c=Screenwriting_Coverage&id=031820048187

(46) SHIN SPLINTS is a ***widespread*** term for a variety of generalized symptoms for pain in the lower legs.
http://www.doctorsexercise.com/journal/sum01.htm

Note that the example in (46) is parallel to that in (42b), which we suggested was unacceptable for pragmatic reasons. What makes (46) different is that, while its subject does not denote a kind, it does denote an entity which can have distinct realizations at distinct points in time, making it easier to satisfy the truth conditions of the predicate: An individual term such as *shin splints* can qualify as widespread because it is used on many occasions.

To sum up, it seems that kind-level predicates modifying nouns within NPs predicated of individuals are in fact attested; however, it is also clear that they are relatively rare. Our hypothesis is that this is for pragmatic, rather than semantic, reasons: Not many individual-denoting subjects fulfill the restrictions that a kind-level adjective imposes on the predicate. We are currently undertaking a statistical analysis that should shed more light on the facts discussed both in this subsection and in the previous one.

5 Conclusion

In this paper we have shown how an intersective analysis of relational adjectives can be maintained if we assume that they denote properties of kinds. Our analysis accounts for the predicative uses of relational adjectives (and the conditions under which they can occur), their failure to induce scope effects in combination with other adjectives, and the ordering restrictions on them that have been observed. It also captures their "classificatory" flavor, noted by many researchers: If they are properties of kinds, their main function will be to establish subkinds, that is, to further classify entities.

Treating relational adjectives as properties of kinds also has the consequence of substantially expanding the class of kind-level adjectives. The literature on kinds has always given the impression that the number of adjectives that select specifically for kind-type arguments is extremely small (see Krifka, et al. 1995 and Section 4.4.2.). While there is no reason in principle why this class couldn't be so small, it is nonetheless puzzling that there would be only a handful of adjectives specialized for talking about such a cognitively important category as we might consider kinds to be. Though it was not one of our original goals, we consider it a welcome result that our analysis of relational adjectives normalizes the category of kind-level adjectives in this respect.

At this point, our analysis leaves one important issue unaddressed: It says nothing so far about the apparent argument saturation effect of relational adjectives – the sort of facts that Fradin and Kerleroux's analysis, discussed in Section 4.1, was designed to account for. While we must leave the

resolution of this issue for future research, we think the key question to ask is whether this argument saturation effect is real or simply apparent.

Our analysis commits us, in principle, to treating it as a byproduct, insofar as the relational adjective directly restricts only the kind of entity that the modified noun describes, and doesn't have any argument saturating effect. Interestingly, recent work by Mezhevich (2002) argues precisely against allowing relational adjectives to saturate noun argument positions directly, defending instead the view that this "saturation" is in large part a contextual effect (see her paper for details). The analysis she suggests for e.g. *presidential advisor* is the following (her (55a)), where ***R*** stands for a contextually-determined relation:

(47) $\lambda x[\textbf{advisor}(x) \wedge \boldsymbol{R}(x, \textbf{president})]$

If Mezhevich's arguments for the analysis in (47) are sound, then the criticism of our analysis that it fails to account for the argument-saturating effect of relational adjectives will be greatly weakened.

As noted in the introduction, our proposal represents a further step in the project of simplifying and unifying the semantics of adjectives. On top of Larson's (1998) arguments for unification in the direction of a simple property type, Catalan shows perhaps more clearly than English that the strategy adopted by Siegel and others of "generalizing to the worst case" and analyzing subsective adjectives as predicate modifiers is not satisfactory: It sheds no light on the fact that, in a language where a number of distributional phenomena clearly distinguish intersective adjectives from nonintersective ones, relational adjectives (and other subsective adjectives) clearly pattern with the former.

Moreover, there is a methodological advantage to trying to reanalyze subsective adjectives as intersective. It is possible to provide a predicate modifier semantics for these adjectives without having to pay close attention to the differences in the kinds of subsectivity different adjectives exhibit – for example, the fact that *occasional* restricts the denotation of a noun by restricting some aspect of its temporal dimension, while *pulmonary* restricts a class of individuals to those that have something to do with the lungs. In contrast, the intersective analysis proposed by Larson for *occasional* is not remotely plausible for *pulmonary*, thus forcing us to be much more explicit about the differences between the two types of adjectives, while at the same time allowing us to capture something that they have in common.

The move to an intersective semantics for at least some of the subsective adjectives entails providing a much finer-grained semantics for nouns. However, how best to do this is not a trivial question. Larson proposed adding an event argument to the argument structure of nouns. Our extension of his analysis has led us to add a kind argument as well. When one contemplates the possibility of having to add even more arguments in order to account for other kinds of modification, representing the lexical entailments of nouns in a more richly structured fashion like that developed in Pustejovsky (1995) begins to look appealing. We hope that additional work on the varieties of adjectival and adverbial modification will help to answer this question.

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