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Editorial

Modification at the interfaces: An introduction

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Abstract

While we can name examples of modifiers (e.g. adjectives, adverbs, PPs, relative clauses), it is not uncontroversial to what extent ''modifier'' is a syntactic term and how we should represent modification as part of a semantic model. This being true, modification is not only interesting because it challenges a simple composition system that proceeds through application of functions to arguments. In this introduction we present four papers that show that research on modification proves to be relevant for current investigations on the syntax–semantics interface as well as the language–cognition interface.
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1. Foreword

This paper is intended as a companion to this Special Issue [SI] on ''Modification at the Interfaces'', which consists of the following four papers: ''Saturating Syntax: Linkers and Modification in Tagalog'' by Gregory Scontras and Andreea Nicolae; ''Restrictive vs. non-restrictive modification and evaluative predicates'' by Fabienne Martin, ''Interpretation as Optimization: Constitutive Material Adjectives'' by Michael Oliver, and ''Similarity demonstratives'' by Carla Umbach and Helmar Gust.

In this introduction, we identify the theoretical problems that the research on modification has raised (section 2) and, in doing so, we contextualize the aforementioned papers as each contributing to or exemplifying these debates; in particular, we focus on the syntax of modifiers (section 2.1), the modes of composition (section 2.2), intersection (section 2.3), and restrictive vs. non-restrictive modification (section 2.4). Moreover, we discuss how the papers relate to each other thematically and what their spot is in a SI that focuses on how modification has a say in the research on the language interfaces (syntax–semantics as well as language–cognition) (section 3). This introduction also comments on potential connections with other topics that are currently being discussed in works on modification (section 4).

We thus hope that the reader will find in this introduction the answer as to why modification is a topic worth studying and why the following papers make a real theoretical contribution as well as raise new challenging and relevant questions.

2. What is modification?

Unlike technical words such as *argument*, *head*, *function*, *projection* or *complement*, even linguists use *modification* or *modifier* in a loose, intuitive way. This is because, on the one hand, in every-day talk, to modify amounts to change, and

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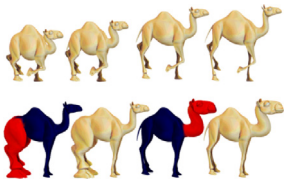
change is a rather broad term. On the other hand, as will become clear shortly, there is no technical definition that identifies the syntactic or semantic behavior of modifiers and which covers the varied set of expressions that could be called *modifiers*.

To modify something means to *alter* the values of some of its parameters but not enough as to change what it is. It also means to *add* something to the modifiee that is not necessary for it to be what it is. Googling for *modifier* pictures, we obtain, for instance, (1).

(1)



In the series of (pictures of) camels shown in (1), two of them have been modified (with a picture enhancer software) so now they look slightly different; they still are camels, but have different properties, namely their color has changed.

This core meaning is recast in linguistic talk to refer to those categories that fall out of the Aristotelian dichotomy between categories that are subjects of a predication, and categories that are the predicate of a proposition. These include adjectives, adverbials, prepositional phrases and relative clauses, as illustrated in (2). (2-a) is an instance of adjectival modification; then there is a series of adverbs modifying different categories: a verb ((2-b)), an adjective ((2-c)) or an entire sentence ((2-d), (2-e)); (2-f) exemplifies a PP that modifies a VP, and in (2-g) the adnominal modifier is a relative clause.

(2) a. *blue* sky
b. *rapidly* sink
c. *extremely* hot
d. She will *probably* be late.
e. *Frankly*, I don't give a damn.
f. Peter had dinner *at midnight*.
g. the man *who was drinking a glass of wine*

According to Frege, our ontology includes either saturated or unsaturated expressions. He further claims that composition proceeds through application of functions to their arguments (cf. Frege et al., 1951). Prototypical unsaturated expressions are verbs. In the case of intransitive verbs, they apply to an individual, which is a prototypical saturated expression (along with propositions), as in (3).

(3) John smokes.

In formal semantics, *John* denotes the actual individual by the name of John, which is of type $\langle e \rangle$, and *smokes* refers to the characteristic function of the set of individuals that smoke, i.e. it denotes in $\langle e, t \rangle$. Composition proceeds via Functional Application so the function is applied to its argument and the result is a truth value. In syntax, this derivation involves merging a DP and a VP into a CP, modulo some additional operations to ensure that certain principles are satisfied.

By contrast, the relation between an adjective (the modifier) and a noun (its modifiee), or an adverb (the modifier) and a verb (its modifiee) cannot be accounted for in the same terms. Modifiers do not saturate their modifiees; not only this, characteristically, modifiers cannot change the type of their modifiee.

As argued for extensively in Morzycki (to appear), it seems only safe to give a negative definition of what it is to be a modifier (i.e. it is a category that does not fit in the conceptual box that includes arguments and predicates); it is harder to provide a positive formal characterization of modification able to capture the diverse phenomena it covers. McNally (to appear) concludes with the following definition of *modifier*:

(4) Modifier: an expression which combines with another expression to produce a result with the same semantic type.

Morzycki (to appear) is skeptical about whether we can attribute a stronger notional content to the concept of modification beyond McNally's phrasing in (4). He points out that two aspects have to be taken into consideration when defining what a

modifier is: if we study a modifier in an external sense, like a subject or a purpose clause, we would be concerned with how it relates to other constituents and with its sentential function (i.e. its distribution); in an internal sense, a modifier, like a noun, may have its own internal properties (i.e. its lexical semantic characteristics). Morzycki mentions the relation that modifiers such as adjectives and adverbs have with gradability, in particular.

In this SI on Modification at the Interfaces we will not further deal with the difficulties of defining modification, so we address the interested reader to McNally (to appear) and the conclusions of Morzycki (to appear). Instead, we will be concerned with the external characterization of modifiers, and more specifically, with aspects that concern the interfaces between syntax and semantics, and between language and cognition.[1] Let us start with modification in syntax.

2.1. Modifiers and modification in syntax

In syntactic theory, adjectives, adverbs, PPs or relative clauses have been analyzed in different ways depending on whether or not they are subcategorized by the corresponding head. Leaving aside for the moment the cartographic approach, which analyzes them as specifiers, these categories are treated as adjuncts if not subcategorized, but as sisters of the head (and thus complements) if subcategorized. These two options should be able to explain the contrast shown in the Catalan examples in (5). While in (5-a) the PP headed by *de* 'of' is necessary for the well-formedness of the sentence – and hence an argument – *lingüística* 'linguistics' in (5-b) can stand alone without the PP, so the PP should be analyzed as an adjunct (and hence it is a modifier). Thus, the syntactic category PP can be both an argument and a modifier.

(5) a. La Maria està enamorada del germà *(de la Sònia).
the Mary is in love of the brother of the Sonia
'Mary is in love with *(Sonia's) brother.'

b. La Maria està enamorada de la lingüística (de corpus).
the Mary is in love of the linguistics of corpus
'Mary loves (corpus) linguistics.'

That is, although modifiers are described as being optional, some categories that are usually modifiers can occur in contexts where they are selected components. In (5), the head is the relational noun *germà* 'brother', so the PP *de la Sònia* (Sonia's) is obligatory and, thus, a complement instead of an adjunct.

While modifiers can be of all kinds of categories (NP, AP, PP or even heads), *modifier* itself is not a syntactic category, unlike *determiner*, *tense* or *preposition*. *Modification* is also not a syntactic operation. In generative grammar (Chomsky, 1993, 2004), two operations – which amount to only one – are in charge of deriving well-formed linguistic strings, namely (external) merge and move (or internal merge). Strictly speaking, this concerns subcategorized expressions, since the kind of merger that puts together non-subcategorized expressions with the constituents they adjoin to has different properties. The core idea under the Chomskyan view adopted from Hoeksema (1984) (to be compared to the cartographic view) is that adjunction is an operation that returns a phrase of the same type as the host (i.e. the target of the adjunction operation). This is represented in (6).

(6) $[_{XP}\ [_{XP}\ [_{XP}\ \ldots X^0\ \ldots]\ \text{ADJUNCT}\ ]\ \text{ADJUNCT}\ ]$

Note that the adjunct combines with an XP and the result of the merger is still an XP. Adjuncts retain bar-level information of the target (here, a maximal projection XP remains a maximal projection after adjunction), category information (the result of the operation is of category X) and headedness (the head of the phrase is the same before and after adjunction), and this operation can recursively apply *ad infinitum*.[2]

(6) is to be contrasted with the head-complement relation illustrated in (7), in which the complement (here YP) combines with the head (X^0) to form a constituent corresponding to the maximal projection of the head (XP).

(7) $[_{XP}\ \ldots X^0\ \ldots [_{YP}\ \ldots Y\ \ldots]\ ]$

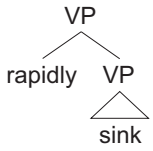
[1] This SI is thus also not concerned with studies on degree and event modifiers (for this matter, cf. Ernst, 2002; Kiss, 2009; Lang et al., 2003; Piñón, 2008; Kennedy and McNally, 2005; Rett, 2014; Nouwen, 2011, a.o.); and it also does not reflect on the notions of degree and manner, and the way certain modifiers seem to be tests for a unified treatment of the two phenomena (for this matter, cf. Landman and Morzycki, 2003; Schwager, 2009; Castroviejo and Gehrke, to appear, among others).

[2] In bare phrase structure (Chomsky, 1995), the technical details have evolved to account for a wider range of properties. For instance, when an adjunct, say of label y, adjoins to a host with label x, the final projection has the ordered pair $\langle x, x \rangle$ as its label, to indicate that the relation established by them is asymmetrical. In further developments (e.g. Hornstein, 2009), the result of the adjunction operation has no label. Since none of this is essential for our purposes here, we address the interested reader to the cited references and references therein.

The schema in (6) fares well to represent VP modification by adverbials in cases such as (2-b), repeated below as (8-a); (8-b) shows that the modifier *rapidly* does not change the label of the projection, which stays a VP.

(8) a. *rapidly* sink

b.



However, as noted by Cinque (1999) and further proponents of a cartographic approach to syntactic analysis, the Chomskyan conception to adjuncts cannot straightforwardly explain the hierarchy found among classes of adverbials cross-linguistically. In his account, adverbials are classified according to semantic features (speech act Advs > evaluative Advs > evidential Advs > epistemic Advs > . . .) and are specifiers of designated functional projections. Hence, in the cartographic approach, modifiers are mapped to specifiers, which establish a Spec-Head relation consisting in checking semantically-flavored features.

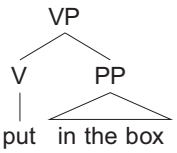
Note that we have been considering the analysis of the adverb in (8-a) as a representative instance of modifiers. But we have not discussed the analyses of adjectives, PPs or relative clauses. Different classes of adjectives receive a cartographic treatment in works such as Cinque (1994, 2010). Specifically, intersective adjectives are analyzed as reduced relative clauses and are merged above the DP frame as so-called *indirect modifiers*; by contrast, *direct modifiers*, which include non-intersective and non-predicative adjectives, are merged directly in dedicated positions within the extended NP projection (see also Bolinger, 1967; Sproat and Shih, 1988 for more detail about this distinction). From other perspectives, APs are also analyzed as predicates of small clauses (Kayne, 1994) or adjuncts to different categories depending on their syntactic-semantic properties (cf. e.g. Abney, 1987; Bernstein, 1993 for proposals within this option, and see Demonte, 2003 for a general overview). Finally, research on the distinction between thematic and functional layers of syntactic projections has yielded the proposal that AP is the complement of Deg^0, the head of a Deg(ree)P (Abney, 1987; Corver, 1991; Kennedy, 1999, a.o.).

PPs also receive different analyses in examples such as (9-a) (subcategorized) and (9-b) (not subcategorized).

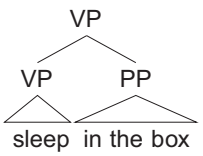
(9) a. put in the box
b. sleep in the box

In (9-a), the PP *in the box* is the complement of V, as in (10-a), whereas in (9-b), the PP is adjoined to the right of the VP, as in (10-b).

(10) a.



b.



Finally, two kinds of analyses have been proposed for relative clauses; the raising analysis (Schachter, 1973; Vergnaud, 1974; Kayne, 1994), exemplified in (11-a), and the matching analysis (Chomsky, 1965; Lees, 1966; Sauerland, 2003), exemplified in (11-b).

(11) the book which John likes
a. the book$_j$ [$_{CP}$ [Op/which t_j]$_i$ John likes t_i]
b. the book [$_{CP}$ [Op/which (book)]$_i$ John likes t_i]

Note that despite the syntactic differences regarding the base generation and movement of N, the relative clause is analyzed as a CP complement of N.

In sum, there is no agreement as to whether or not modifiers have a one-to-one correspondence with a syntactic category or as to whether modification is a syntactic operation. The term *modifier* is then sometimes used in syntax to refer to a set of grammatical categories with a specific semantic behavior, which, however, do not receive a unitary treatment in modern syntactic theory.

2.2. Modes of composition

Turning now to the semantics, and just concentrating on Adjective-Noun [A-N] composition, modification poses a problem not only for the Fregean view of unsaturated and saturated expressions, but may also suppose a challenge for his conjecture that all composition is saturating, i.e. Functional Application [FA] (cf. Frege et al., 1951). To be more precise, if we want to keep composition as simple as possible, i.e. restrict it to FA only, then we have to either complicate the lexical type of the modifier or the phrase structure where the modifier merges. Alternatively, we can add further compositional rules, in addition to FA, and keep the types and the structure simple and uniform. Scontras and Nicolae (2014) propose to classify these different options as LEXICAL, COMPOSITIONAL or STRUCTURAL, depending on where the burden of modification falls.

The LEXICAL approach is the strategy taken by Parsons (1970) and Montague (1973), who analyze adverbs such as *slowly* in *drives slowly* as being properties of properties, i.e. of type $\langle\langle s, \langle e, t\rangle\rangle, \langle s, \langle e, t\rangle\rangle\rangle$ or type $\langle\langle e, t\rangle, \langle e, t\rangle\rangle$ in an extensional system. Applied to adjectives, this cannot be the whole story. For one, adjectives come in different classes, and a uniform type for all of them requires additional explanations for the differences between them. Second, some of them have predicative uses, which, under the most straightforward account, call for a simpler type ($\langle s, \langle e, t\rangle\rangle$ or $\langle e, t\rangle$). Let us go into a bit of detail.

Take intersective adjectives first, which can be straightforwardly treated as properties ($\langle s, \langle e, t\rangle\rangle$ or $\langle e, t\rangle$). Assuming that a noun N denotes the set of individuals that are N (in the case of *mammal*, the set of individuals that are mammals), composition with adjectives like *carnivorous* proceeds as in (12).

(12) From Kamp and Partee (1995:137)

a. $[\![\text{carnivorous}]\!] = \{x|\ \text{carnivorous}\ (x)\}$

b. $[\![\text{mammal}]\!] = \{x|\ \text{mammal}\ (x)\}$

c. $[\![\text{carnivorous mammal}]\!] = \{x|\ \text{carnivorous}\ (x)\ \&\ \text{mammal}\ (x)\} = [\![\text{carnivorous}]\!] \cap [\![\text{mammal}]\!]$

This leads to the entailment pattern in (13): If Mary is a carnivorous mammal and she is a violinist, then it must be true that she is also a carnivorous violinist.

(13) a. Mary is a carnivorous mammal. [A-N]

b. Mary is a violinist. [N]

c. ∴ Mary is a carnivorous violinist.

A further class of adjectives are the so-called subsective ones, for which the set denoted by A-N is a subset of the set denoted by N. For these adjectives, the entailment pattern illustrated in (13) does not hold (Clark, 1970; Parsons, 1970): If Mary is a skillful surgeon (i.e. skillful as a surgeon) and she is also a violinist, this does not entail that she is a skillful violinist (i.e. skillful as a violinist) (14).

(14) a. Mary is a skillful surgeon. [A-N]

b. Mary is a violinist. [N]

c. ∴ Mary is a skillful violinist.

Then, there are non-subsective adjectives, such as *former, alleged, counterfeit*, where neither the intersection nor the subset relation holds between A-N and N. *Former senator* is not the intersection of former individuals and senators, and it is not a subset of the senators, either. Within the non-subsectives, Kamp and Partee (1995) name *privative* adjectives those which, like *counterfeit* and *fake*, involve the following relation: A-N implies ¬N. So, for instance, a fake gun is (arguably) not a gun. In fact, in more recent work, Partee (2010) suggests that we can dispose of the category of privative adjectives altogether; instead, they should be analyzed as subsective adjectives that trigger coercion of the modified noun.

Oliver (2014) takes up on this suggestion for privative adjectives, and develops an optimality account of constitutive material adjectives such as *wooden* in *wooden lion*, whereby composition and coercion are applied non-monotonically. Essentially, Oliver puts into play Kamp and Partee's (1995) *Non-vacuity principle*, which exhorts speakers to interpret predicates as having non-empty positive and negative extensions. In an attempt to simplify and correct previous approaches to the data, he presents a derivation of *wooden lion* that yields the expected output, by assuming the following: first, composition proceeds as usual, but if the result is a null extension – ⟦wooden lion⟧ does not designate a set of regular lions, so in its literal sense, it should denote the empty set – then coercion applies in such a way that the extension of the noun is expanded so as to include less prototypical lions.

Additional differences in adjective classes regard the fact that most intersectives and subsectives (unlike some non-subsectives) can also be predicates, as shown in (15).

(15) a. Mary is carnivorous/skillful.
b. *Mary is former.

If *carnivorous* and *skillful* have to be able to apply to an individual (of type $\langle e \rangle$), then, they must be of type $\langle e, t \rangle$ ($\langle s, \langle e, t \rangle \rangle$) when they are predicates, while of type $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$ ($\langle \langle s, \langle e, t \rangle \rangle, \langle s, \langle e, t \rangle \rangle \rangle$) when they are modifiers.

Montague's (1973) strategy of ''generalizing to the hardest case'' treats all adjectives – even intersective ones – as functions from predicates to predicates, so even the simplest class of adjectives are given an analysis that works for adjectives that involve further complications. What matters for the purposes of explaining modification is that, in all cases, modifiers are functions that do not change the type of the predicate they take as input, which neatly correlates with the Chomskyan definition of adjunct in the syntax and is also reflected in McNally's (to appear) definition in (4).

To account for the predicative uses, one possible assumption is that further type-shifting operations apply that turn a modifier into a predicate (Partee and Rooth, 1983; Partee, 1987, 1995). Another option is to assume flexible types, i.e. types that are underspecified enough to account for both uses. Similarly, Siegel (1976) proposes her ''doublets'' theory to account for the behavior of long and short forms of Russian adjectives. According to this analysis, we need to have two sets of lexical entries, one for each type of use.[3]

Summing up, adopting the LEXICAL approach involves placing the burden of the modification process onto the semantic type of the modifier. Partee's (and colleagues') work within the framework of Montague semantics and its ''generalize to the hardest case'' strategy is a representative example of this kind of analysis, along with flexible types, type shifting and doublets strategies.

Moving on with Scontras and Nicolae's (2014) classification, the COMPOSITIONAL approach is best known for the proposal in Heim and Kratzer (1998) that besides Functional Application, we should consider an additional composition rule called *Predicate Modification* [PM], which is spelled out in (16).[4]

(16) Predicate Modification (From Heim and Kratzer, 1998:65)
If α is a branching node, $\{\beta, \gamma\}$ is the set of α's daughters, and $[\![\beta]\!]$ and $[\![\gamma]\!]$ are both in $D_{\langle e,t \rangle}$, then $[\![\alpha]\!] = \lambda x \in D_{\langle e \rangle}. [\![\beta]\!](x) = [\![\gamma]\!](x) = 1$.

Note how this rule brings intersection into the mode of composition rather than the lexical semantics of (intersective) modifiers. The advantage of assuming PM is that it captures the dual behavior of intersective modifiers, both as predicates and modifiers, (17).

(17) a. This mammal is *carnivorous*. [predicate]
b. Lions are *carnivorous* mammals. [modifier]

In both cases, *carnivorous* is of type $\langle e, t \rangle$. While in (17-a) it composes with ⟦this mammal⟧, of type $\langle e \rangle$, through FA, in (17-b), it composes with ⟦mammals⟧, of type $\langle e, t \rangle$, through PM.

On the downside, PM works nicely for intersective modifiers, but it is less straightforward for subsective (*skillful*) and non-subsective (*former*) modifiers, for which one might have to assume a different semantic type, which would go against

[3] Incidentally, this divide also correlates with the intersective vs. subsective interpretation of adjectives.
[4] See also Larson (1983, 1995) for an earlier predicate modification analysis.

a unitary treatment of modifiers as a concept.[5] Moreover, the COMPOSITIONAL approach departs from the simplicity of and the correspondence with the computational system, whose only composition operation is *merge*, which corresponds to FA (cf. section 2.1).

Another proposal within this approach is Chung and Ladusaw's (2004) composition rule called *Restrict*. Rather than to account for A-N composition, Restrict is proposed in an attempt to account for linguistic contexts in Austronesian (Maori and Chamorro) that involve composition of predicates that do not change the degree of saturation. Imagine (18) is a well-formed sentence in Austronesian, and *fed* and *dog* have the standard denotations spelled out in (18-a) and (18-b), respectively. The result of appealing to Restrict in this example is shown in (19).

(18) John fed dog.
a. $[\![\text{feed}]\!] = \lambda y \lambda x \, . \, \mathbf{feed}(y)(x)$
b. $[\![\text{dog}]\!] = \lambda y \, . \, \mathbf{dog}(y)$

(19) $\text{Restrict}(\lambda y \lambda x \, . \, \mathbf{feed}(y)(x), \mathbf{dog}) = \lambda y \lambda x \, . \, \mathbf{feed}(y)(x) \wedge \mathbf{dog}(y)$

Crucially, there is no saturation of the function **feed** in spite of its combining with **dog**. Interestingly, this compositional issue raised by Austronesian does not arise in languages such as English, where *feed* and *dog* do not compose with one another but through the presence of a determiner. But a similar problem arises in pseudo-incorporation in Hindi (cf. Dayal, 2011) and Hungarian (cf. Farkas and de Swart, 2003) or light verb + bare noun constructions in Romance (which are also analyzed as the result of pseudo-incorporation in Espinal and McNally, 2011).

Even if Restrict is not conceived to account for A-N composition, it does involve an operation of composition of two predicates which does not yield saturation. In subsequent work (Chung and Ladusaw, 2006), the same authors propose a rule they call *Modify* in order to account for the way intersective modifiers compose with NPs in Chamorro, a language which has so-called *linkers*, just like Tagalog (discussed in Scontras and Nicolae, 2014). Modify consists in taking two properties P and Q and returning their intersection, as in (20).

(20) $\text{Modify}(\lambda x[\mathbf{cat}(x)], \mathbf{black}) = \lambda x[\mathbf{cat}(x) \wedge \mathbf{black}(x)]$ (From Chung and Ladusaw, 2006:337)

Along with PM, assuming Restrict or Modify implies complicating the set of available modes of composition, while keeping the semantic types of modifiers simple. Unlike PM, though, which is a general semantic rule, Restrict is viewed as a specific instruction on a morpheme, which informs the computational system regarding the mode of composition.

The third strategy pointed out by Scontras and Nicolae (2014), and the one they endorse to account for the Tagalog data they discuss, is the STRUCTURAL approach. In line with Rubin (1994, 1996, 2003), they argue that modification requires a specific syntactic projection whose head Mod^0 is a function of type $\langle\langle e, t\rangle, \langle\langle e, t\rangle, \langle e, t\rangle\rangle\rangle$. Hence, the modifier has a simple type, FA is the default compositional operation, and the burden of the modification process lies on phrase structure (i.e. the Mod head, which is absent in the other two approaches). Their main argument comes from the so-called *linker* in Tagalog (the allomorphs NA/-NG), which (almost) always occur in contexts of non-saturating semantic composition and, thus, modification.

2.3. Intersection

We sketched in section 2.2 that modifiers can be classified according to whether they are intersective (*carnivorous*), subsective (*skillful*) or non-intersective and non-subsective (*former*). It could well be that intersection is one of the core ingredients of the semantics of modification; observe that even the subsective–intersective distinction has been challenged in the past few years. Hence, there is a general effort to reduce all kinds of modification to intersective modification.

Take for starters gradable adjectives, which have been taken as prototypical cases of subsective modifiers (Chierchia and McConnell-Ginet, 2000), as the entailment patterns below certify.

(21) a. Lobsters are large crustaceans (McNally's to appear ex. (13))
b. Lobsters are animals.
c. #Lobsters are large animals.

[5] However, see Larson (1998) for an intersective analysis of adjectives like *skillful*, and see Klein and Sag (1985) for general discussion on the debate between ''rule-to-rule'' vs. type-driven composition.

(22) a. A big ant may not be a big individual.
b. A small elephant may not be a small individual.
c. A big ant may be smaller than a small elephant.

However, once it became clear that gradable adjectives had to be relativized to comparison classes of individuals (Bartsch and Vennemann, 1972; Cresswell, 1977; Klein, 1980; von Stechow, 1984; Fults, 2006; van Rooij, 2010) – i.e. big *for an ant*, small *for an elephant* – the intersective analysis of gradable adjectives was possible.

Later on, Larson (1998) provided an intersective analysis of *beautiful* in *beautiful dancer*. The case is illustrated in (23).

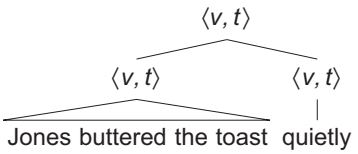
(23) a. Olga is a beautiful dancer.
b. Olga is beautiful.
c. Olga dances beautifully.

(23-a) is ambiguous between the intersective interpretation in (23-b) and the subsective interpretation in (23-c). Larson (1998) shows that we need not intersect just individuals (entities of type $\langle e \rangle$), but also events (of type $\langle v \rangle$). If we assume that (at least certain) nouns have an event variable as part of their denotation, then we can maintain the idea that both readings in (23) can be obtained through intersection. If (23-a) is to be translated as (23-b), then we are intersecting a set of dancing events by Olga with a set of beautiful events.

(24) $\exists e$ [**dancing**(Olga, e) & **beautiful**(e)]

In fact, in the (Neo-)Davidsonian tradition (Davidson, 1967 for PPs and Parsons, 1990 for VP modifiers more generally) many kinds of adverbials can also receive an intersective analysis once events are taken into consideration. For instance, in (25) ((Morzycki's to appear ex. (25)), intersection is carried out between events of Jones buttering the toast and quiet events.

(25)



In a similar line of work, McNally and Boleda (2004) argue that an intersective analysis for relational adjectives like *technical* can be provided as long as they are treated as properties of kinds and (at least certain) nouns denote relations between kinds and their realizations, as in (26).

(26) $[\![\text{architect}]\!] = \lambda x_k \lambda y_o [R(y_o, x_k) \wedge$ **architect**$(x_k)]$

Technical in *technical architect* is thus analyzed as in (27), and an intersective analysis is maintained, where the intersection is between those kinds that are architects and technical.

(27) $[\![\text{technical}]\!] = \lambda x_k.$**technical**$(x_k)$

The analyses of Larson (1998) and McNally and Boleda (2004) not only have the advantage of enabling an intersective analysis of a set of adjectives that otherwise would need to be treated as members of a different category; they also predict that such modifiers can have predicative uses, as long as the subject is of the right type (i.e. if it denotes an event or a kind, respectively).

Kind modification is also at stake in Umbach and Gust's (2014) paper on similarity as modification. Specifically, it addresses the question of how German *so* can be both a demonstrative and (the anaphor of) a modifier. Take for instance, (28) (their (1b)).

(28) [speaker pointing to a car in the street]
So ein Auto hat Anna (auch).
so a car has Anna too
'Anna has such a car/a car like this, (too).'

In this example, we have to separate out the target of the demonstration – here, an individual, they argue – and the referent of the NP *so ein Auto* 'such a car'. Umbach and Gust propose that the denotation of the NP has to be similar (i.e. not identical) to the target of the demonstration. Being similar is not a semantic primitive, though. The way they put it, a class of individuals is generated that is the intersection of cars and individuals that are indistinguishable from the target of demonstration, i.e. the actual car. To be more specific, in their account, using similarity demonstratives creates a so-called *ad hoc* kind (that is, we need not use *so* to refer to well-established kinds, cf. Carlson, 1980; Anderson and Morzycki, to appear) corresponding to the class of individuals that are similar to the target NP. The assumption is that we cannot point at kinds but rather at either individuals or events. So these demonstratives behave like modifiers to the extent that they yield a restriction of the denotation of the head N through intersection, not of the denotation of two linguistic expressions, but rather one linguistic expression and the information we recast from the target of demonstration.

Certainly, intersection is not the whole story for modifiers. First, there are non-subsective adjectives like *former*, which can hardly be reinterpreted as intersective (but see Larson, 1998). Then, as pointed out by Morzycki (to appear), identifying modifiers through intersection would leave out modal adjectives and adverbs (*possible, possibly*), subject-oriented adverbs (*accidentally*) and adverbs of quantification (*always*). However, it is only through the operation of modification that the set-theoretic notion of intersection is realized in natural language. Modification viewed as intersection raises the important issue of what variables modifiers can be predicates of (individuals, events, kinds, . . .cf. Morzycki, to appear) and what descriptions of variables can actually be intersected. Hence, modification proves to be an extremely relevant notion for semantic theory, since it may provide critical information for determining our semantic ontology.

2.4. Restrictive vs. non-restrictive modification

A phenomenon that cross-cuts intersective modification is that of the restrictive [R] vs. non-restrictive [NR] interpretation of modifiers, as illustrated below for Spanish adjectives.[6,7]

(29) From Demonte (2008:71)

a. Encontré las llaves *viejas*.
I.found the keys old
'I found the old keys (i.e. the subset of keys which are old).'

b. Encontré las *viejas* llaves.
I.found the old keys
'I found the old keys (i.e. I found certain keys and they are old).'

Roughly, as shown in the paraphrases above, the difference between R and NR boils down to whether or not the total amount of individuals in the extension of the head, here keys, equals the total amount of individuals in the extension of the modified head, here, old keys. Interestingly, at first sight, Romance establishes a one-to-one correspondence between word order (pre- vs. post-nominal) and interpretation (R vs. NR).[8]

In the seminal work by Sells (1985) on the distinction between R and NR relative clauses, he proposes that while the relation between a head and a R relative clause is syntactically represented, the relation between a head and a NR relative clause belongs to the domain of discourse. Years later, other proposals have characterized NR modifiers as contributing secondary assertions, ancillary commitments or conventional implicatures (among many others Potts, 2005; Bonami and Godard, 2008; Morzycki, 2008; Koev, 2012; Schlenker, 2012), which are nowadays globally referred to as ''not-at-issue meaning'' (Simons et al., 2011, and seq.).

The pattern exemplified for Spanish partially extends to French, as outlined by Martin (2014), who takes a step further by focusing on evaluative adjectives such as *affreux* 'horrible'. She raises the question of whether the aforementioned syntax–semantics mapping is true and, if so, why these adjectives have a preference for the pre-nominal position. More specifically, Martin debates how to reconcile the preference of evaluative adjectives in French for having a

[6] The term *restrictive* is not used here in the sense of Keenan (1983), where it is treated as a synonym of *subsective*, as shown in (i).

(i) A function is restrictive iff f(a) $\leq$ a, for all a $\in$ A. (From Keenan, 1983 as cited in Chung and Ladusaw, 2006:335).

[7] The R vs. NR interpretation only concerns those adjectives with predicative uses and whose syntactic position (i.e. pre- vs- post-nominal) does not trigger a change in the meaning of the adjective. Hence, the pre- vs. post-nominal position of e.g. the Spanish adjective *pobre* 'poor' does not correlate with the R vs. NR distinction, respectively. In the distinction between *el hombre pobre* and *el pobre hombre* 'the poor man', the subsective adjective *pobre* does not have a NR interpretation when it appears pre-nominally (see Masià, 2013 for recent discussion).

[8] The facts are far more complex than that. Incidentally, Demonte (1999) claims that it is generally the case that pre-nominal adjectives in Spanish are non-intersective, while post-nominal adjectives can be either intersective or non-intersective. Pre-nominal non-intersectives are subsective adjectives (e.g. *buen amigo* 'good friend $\equiv$ good *qua* friend') and modal adjectives (e.g. *posible dimisión* 'possible resignation').

NR interpretation (the Nonrestrictive Bias Hypothesis) and the tendency of pre-nominal modifiers to have a NR interpretation vs. post-nominal modifiers to have a R interpretation (the Complementarity Hypothesis). She dismisses the at-issue vs. non-at-issue approach and claims that the term *restrictive* is used in the literature in two different ways. In particular, there are cases where the R vs. NR interpretation is blurred, namely when the extension of the set of individuals that are both in the extension of the modifier and the head equals the extension of the head. Her proposal is that a modifier can restrict the denotation of its head in a purely extensive way when the modifier is a definite DP, and / or it can further invoke other accessible situations when the modifier appears in indefinite DPs or when it is an adverbial. This would be the case in (30).

(30) From Martin (2014)

a. Pierre m'a offert d'horribles fleurs.
Pierre me.has offered some.horrible flowers
'Pierre offered me horrible flowers.'

b. Pierre m'a offert des fleurs horribles.
Pierre me.has offered some flowers horrible
'Pierre offered me horrible flowers.'

In (30), we have an indefinite DP, unlike in (29). Note that in both cases, the extension of flowers equals the extension of horrible flowers. Hence, by definition, the adjective should be nonrestrictive, so this characterization does not capture the difference in meaning of the sentences in (30). According to Martin, such cases deserve a modal account. In particular, being restrictive in the modal sense consists in considering another accessible situation in which a different individual is in the extension of the head but not of the modifier. That is, in (30-b), the restrictive case, we state that there are some individuals that are flowers and horrible, and we invoke a situation s' accessible from the evaluation situation s such that some other individuals are flowers but not horrible. By contrast, in the modal nonrestrictive sense of (30-a), in all accessible situations s' from s, flowers are horrible. Note that both in the modal and non-modal characterizations, there is a core sense in which being restrictive is contrastive, because it involves entertaining the idea that there are individuals that are not in the extension of the modifier, while being nonrestrictive is emphatic, because all possible alternative individuals are both in the denotation of the head and the modifier.

3. Interface issues

In this SI on Modification at the Interfaces, we also aim to learn a few lessons about the syntax–semantics interface (Scontras and Nicolae, 2014; Martin, 2014) and the language–cognition interface (Oliver, 2014; Umbach and Gust, 2014) through four case studies on modification. Specifically, this SI addresses the following interface questions:

1. Syntax–semantics interface
   - Can we provide empirical evidence in favor of one of the three hypotheses of modes of composition sketched in section 2.2?
   - Under which conditions can we establish a one-to-one correspondence between syntactic position and semantic interpretation?
2. Language–cognition interface
   - How does our parser work when composing a modifier and a head whose intersection is the empty set?
   - Can we reconcile the findings of artificial intelligence and the formal analyses in truth-conditional semantics?

Scontras and Nicolae contribute an empirical argument in favor of treating modification as an operation that concerns phrase structure rather than the mode of composition or the lexical semantics of modifiers. As part of this inquiry, Scontras and Nicolae put under semantic scrutiny the bidirectional claim in (31) to conclude that while it is the case in Tagalog that whenever there is an instance of modification, we find the NA/-NG, the reverse implication does not always hold.

(31) Modifier $\Leftrightarrow$ Linker

Specifically, they consider contexts that are not typically analyzed as instances of modification, which also contain the linker, e.g. clausal complements or the restriction of a quantifier. If Scontras and Nicolae are right in analyzing NA/-NG as a

''modification morpheme'', these data are valuable for the study of the syntax–semantics interface in that they may induce a reconsideration of constructions in other languages that do not include overt markers of modification.

Martin attempts a definition of non-restrictive modification that is able to capture a broader set of data than had been considered before, regarding the position of the adjective with respect to the head noun, and the interpretive effects of this syntactic position. In Martin's account, the data and previous hypotheses are refined in such a way that the correspondence between form and function relative to the pre-head position of modifiers and their restrictive interpretation (and vice-versa for the post-head and nonrestrictive interpretation) only holds for those adjectives that can occupy both positions in purely extensional contexts and in indefinite DPs. (Non)restrictivity in indefinite DPs and in adverbials requires a modal definition that takes into consideration an accessibility relation between situations. Hence, word order (and thus syntax) triggers interpretive (and thus semantic) effects. She further argues that the frequent inability of evaluative adjectives to appear in post-head position only applies to so-called *wonderful* predicates (in contrast to *beautiful* predicates), and this has to do with a rule that affects their *use*. Observe how the *function* of certain modifiers (here, the fact that they can only be employed if their content ''matters'', cf. Martin, 2014, section 3.3) becomes a relevant factor for the syntax.

Oliver proposes an optimality approach to the interpretation of constitutive material modifiers such as *stone, wooden, plastic* or *velveteen*. Oliver shows that the interpretation of *wooden lion* raises the issue of how our conceptual-intentional system proceeds in order to extend the meaning of *lion* to include not only actual flesh-and-bone lions, but also inert ones. In this paper we see how lexical semantics meets compositional semantics and ultimately cognition. In particular, Oliver assumes that interpretation involves choosing the optimal candidate among a series of other candidates that fail to satisfy highly ranked conditions. He further assumes that interpretation is not a monotonic process, in that it involves *precomposition*, that is, if the first attempt of composition yields a vacuous extension, then coercion is carried out and FA (or else PM) happens again. Interpretation is thus treated as a process of trial and error, which is a cognitive assumption that the optimality approach makes explicit.

Umbach and Gust consider how certain demonstratives (in this case, German *so*) can function as modifiers. In this research, Umbach and Gust reflect on the notion of similarity. More specifically, they assume that similarity is not a semantic primitive, so they look into cognitive science to find the cognitive grounds for this concept that is in turn compatible with truth-conditional semantics. The proposal they make is to calculate similarity through extending the well-known notion of measure function used in the semantics of (gradable) adjectives (cf. Kennedy, 1999). That is, viewed as measure functions, adjectives apply to individuals and return degrees, i.e. numerical values. For instance, **tall** applied to **Bill** yields Bill's height. But adjectives such as *tall* are uni-dimensional, unlike nouns. To establish a similarity relation between a target of a demonstration and the reference of an NP, Umbach and Gust propose that nouns are *generalized measure functions* because they are multi-dimensional. To be more precise, their different dimensions (e.g. in a car, its speed rate, model, color, etc.) obtain a value that can be compared with the values of other similar objects. To represent this complexity, Umbach and Gust argue, following assumptions in artificial intelligence, that generalized measure functions map individuals to points or regions in multi-dimensional spaces. In this model, similarity is defined as indistinguishability with respect to a series of relevant dimensions.

4. How does this SI relate to the ongoing debates on modification?

This SI on Modification at the Interfaces focuses on the very notion of modification and the interface questions that a particular set of data raise for a reliable theory of modification. Other than that, the works we have introduced not only address the relevant issues raised in section 3; they may also contribute interesting approaches to phenomena that have not been studied from the same perspective.

To begin with, the data analyzed by Scontras and Nicolae are reminiscent of so-called *Ezafe* constructions in Farsi, which also consist in the presence of a special morpheme in contexts of modification, but only when the modifier precedes the head. Instead of identifying Ezafe as a marker of modification, Larson and Yamakido (2008) analyze this phenomenon from the perspective of the syntactic structure of the DP (the same goes for the data on linkers analyzed by den Dikken, 2006). In Larson and Yamakido's work, the Ezafe linker, which does not have the exact same distribution as Tagalog NA/-NG, is treated as a case marker, and the Farsi data are viewed as evidence that nominal modifiers base-generate as arguments of D, like relative clauses, and then move to the pre-nominal position. This syntactic account is justified because of the presence of the linker only if the modifier precedes the head. Whatever the approach, the comparison of languages that include linkers may prove to be enlightening in that we may be able to gain a better understanding of the syntactic intricacies of modification (and plausibly further arguments for the STRUCTURAL approach).

Moving on to Martin's take on *wonderful* predicates, which she argues cannot be used for purely referential uses, it may well be the case that the explanation for the contrast in (32) could also extend to cases such as (33) illustrated for Spanish, which do not contain *wonderful* predicates, but an adjective that is modified by an intensifier.

(32) a. # J'ai vu **le** voisin affreux ce matin.
I have seen the neighbor horrible this morning
(From Martin, 2014)
b. J'ai vu **un** voisin affreux ce matin.
I have seen a neighbor horrible this morning
'I have seen a horrible neighbor this morning.'

(33) From Pastor (2011:325)
a. # He leído **el** libro { muy/ bastante/ demasiado/ . . . } interesante de Cela.
Have.I read the book very quite too interesting by Cela
'I have read the {very/quite/too/ . . . } interesting book by Cela.'
b. Todos mis alumnos leerán **un** libro { muy/ bastante/ demasiado/ . . . } interesante de Cela.
all my students read.will a book very quite too interesting of Cela
'All my students will read a {very/quite/too/ . . . } interesting book by Cela.'

In Martin's account, (32-a), a post-nominal *wonderful* predicate in an anaphorical definite is odd, because the uniqueness condition on definites yields a context where only one neighbor is (salient) in the context; hence, *affreux* 'horrible' should be NR. However, since the predicate occurs post-nominally, it must be interpreted restrictively (i.e. we should be able to contrast this neighbor with another neighbor present in the context). A contradiction arises and, thus, the ill-formedness of (32-a). By contrast, the *wonderful* predicate in an indefinite, (32-b), does not run into this problem, because nothing forces the NR interpretation.

To explain the particular behavior of *wonderful* predicates, Martin assumes Umbach's (2012a,b) reflections on the distinction between subjective and universal evaluative judgments. Crucially, according to Martin, *affreux* 'horrible' belongs to the category of subjective evaluative judgments, which characteristically do not rely on shared norms but are purely individual discourse commitments. As such, *affreux* 'horrible' does not target the Common Ground but the speaker's commitments, and it always licenses faultless disagreement.[9] On the other side, universal evaluative judgments such as *Mary is beautiful* can be treated as empirical judgments like *John is 2 meters tall* or *The earth is flat* in that they can be normative, in which case they would target the Common Ground and be debatable. To the extent that the degree expressions *muy/bastante/demasiado interesante* 'very/quite/too interesting' in (33) have the same distribution as the *wonderful* predicate *affreux*, we could raise the question of whether the former make subjective or universal evaluative judgments.

Stemming from Oliver's work, another interesting topic to cover would be that of subsective adjectives like *red* in the following examples mentioned in Asher (2011):

(34) a. RED (SHIRT)
b. RED (PEN)

As Asher shows, while for a shirt to be red it has to be completely red[10] (unlike a red apple, which only needs to have red skin), a red pen can be a pen that has red ink. Hence, the pen does not need to be red (it can have a black cover), which makes the adjective subsective. In Oliver's Interpretation as Optimization approach, the Full Interpretation constraint (Chomsky, 1986), which requires that each lexical item in a derivation makes a semantic contribution, favors the existence of expressions such as *wooden lion*, in which Kamp & Partee's Head Primacy Principle, (35), is violated; in Oliver's terms, in this particular case, the modifier stratum outranks the noun stratum, and not the other way around.

(35) Head Primacy Principle: In a modifier-head structure, the head is interpreted relative to the context of the whole constituent, and the modifier is interpreted relative to the local context created from the former context by the interpretation of the head. (Kamp and Partee, 1995:161)

Thus, the denotation of the noun *lion* is widened to include the notion of ''representation of a lion'' to make sense of the expression. The Head Primacy Principle is not an issue for intersective adjectives, but it is for subsective ones. In example (34-b), the fact that pens have ink that can also be characterized as red (or blue or black) should be a relevant factor in this system. This specific behavior of an otherwise intersective adjective does not rely on whether or not the outcome is an empty extension, so the condition of Full Interpretation appealed to by Oliver is not crucial here. It would be interesting to explore whether Interpretation as Optimization is able to cover these cases as well as related modifiers, such as relational

[9] Faultless disagreement: If speaker A says *This flowers are horrible* and speaker B says *That's not true!*, they can both be right; cf. for completeness Kölbel (2003) and seq., Lasersohn (2005), Stephenson (2007), Stojanovic (2007) and Bylinina (2013).
[10] But see Kennedy and McNally (2010) and McNally (2011) for qualification.

adjectives (McNally and Boleda, 2004), where the modifier characterizes one of the variables of the noun (here, the kind argument) instead of the whole category. Probably, assuming a more fine-grained type theory in the line of Asher (2011) would allow Interpretation as Optimization to capture a broader set of data.

Finally, another question that will come to mind when reading Umbach and Gust's work is how multi-dimensional adjectives are to be treated in an account that makes use of generalized measure functions, from individuals to multi-dimensional spaces. According to Sassoon (2011) and Sassoon (2013), multi-dimensional adjectives are those whose gradability depends on several criteria. For instance, someone can be *healthy* with respect to blood pressure, sugar, cholesterol, etc. Thus, to truthfully state that Peter is healthier than Mary, we should compare the values for the different dimensions. By contrast, to truthfully state that Mary is taller than Peter, we just need to measure their height. It might seem at first sight that multi-dimensional adjectives should fall under the same category as nouns, according to Umbach and Gust. However, as pointed out in their footnote 16, while *healthy* is multi-dimensional, when we compare individuals according to ''healthiness'', we do so by comparing dimensions one by one (i.e. Peter is healthier than Mary with respect to blood pressure, but Mary is healthier than Peter with respect to diabetes). That is, while both nouns and adjectives can have different dimensions, these dimensions are integrated in different ways, which has consequences not only for grammar (notably the category distinction between N and A), but also for language processing and acquisition. In fact, Sassoon establishes two cognitive processes responsible for identifying individuals as members of a certain noun or adjective denotation. She argues that, for nouns, we use similarity functions and average over the weight of the values for these dimensions; by contrast, for adjectives, we follow a rule-based strategy and run logical operations on individual dimensions.[11]

Let us point out that while Sassoon applies similarity as a strategy for categorization – which involves degrees of distance with respect to an ideal referent – Umbach and Gust treat similarity as the type of relation established between a target of demonstration and the denotation of an NP. One follow-up question is whether it would make sense to use generalized measure functions to account for the meaning of multi-dimensional adjectives or, more precisely, whether dimensions for adjectives should show up in the level of (cognitive) representation Umbach and Gust are exploring, alongside nominal dimensions. Another interesting question would be whether *so* establishes with the adjective the same type of relation as with the noun (i.e. similarity), or else a rule-based procedure decides whether or not *so groß* 'so large' in (36b) is the right characterization of Hamburg's largeness.

(36) A: Berlin ist mit 3,5 Millionen Einwohnern die größte Millionenstadt in Deutschland.
Berlin is with 3,5 millions inhabitants the largest megacity in Germany
'Berlin, with 3.5 million inhabitants, is the largest big city in Germany.'
B: So groß ist Hamburg nicht.
so large is Hamburg not
'Hamburg is not this large.'

As suggested by Umbach and Gust, *so* is comparing largeness with respect to inhabitants, but not extension, even if this is one of the dimensions of *groß* 'large'. This is consistent with Sassoon's claim that dimensions in nouns and adjectives are integrated in different ways.

5. Conclusion

We have introduced the four papers that are included in this SI on Modification at the Interfaces by locating them in the current research on the semantics of modification. We hope to have provided good enough reasons to consider modification an interesting object of linguistic research, not only because some fundamental issues in their characterization remain open, but also because their study can yield a better understanding of topics at the syntax–semantics and language–cognition interfaces.

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[11] McNally (2011), following Hahn and Chater (1998), appeals to similarity-based vs. rule-based reasoning to account for the different ways of establishing standards in relative (*tall*) vs. absolute (*full*) adjectives. In a nutshell, to determine if John is tall, we look at specific individuals holding this property to different degrees – a comparison class – and check whether John is more similar to the tall exemplars than to the short ones. By contrast, to determine whether a glass is *full*, we check whether there is an exact match between our specific individual and how fullness is ascribed as an abstract representation (where precisely the standard is set is a convention; for instance, it can rely on the type of container).

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