

Modification at the interfaces: An introduction

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.

Keywords: composition, intersection, adjectives, adverbials, syntax-semantics interface, language-cognition interface

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 (§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 (§2.1), the modes of composition (§2.2), intersection (§2.3), and restrictive vs. non-restrictive modification (§2.4). Moreover, we discuss how these 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) (§3). This introduction also comments on po-

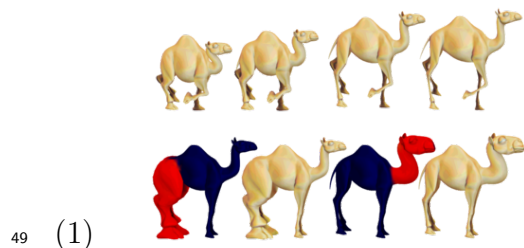
31 tential connections with other topics that are currently being discussed in
32 works on modification (§4).

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

37 2. What is modification?

38 Unlike technical words such as *argument*, *head*, *function*, *projection* or
39 *complement*, even linguists use *modification* or *modifier* in a loose, intuitive
40 way. This is because, on the one hand, in every-day talk, to modify amounts
41 to change, and change is a rather broad term. On the other hand, as will
42 become clear shortly, there is no technical definition that identifies the syn-
43 tactic or semantic behavior of modifiers and which covers the varied set of
44 expressions that could be called *modifiers*.

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



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

54 This core meaning is recast in linguistic talk to refer to those categories
55 that fall out of the Aristotelian dichotomy between saturated and unsatu-
56 rated expressions. These include adjectives, adverbials, prepositional phrases
57 and relative clauses, as illustrated in (2). (2-a) is an instance of adjectival
58 modification; then there is a series of adverbs modifying different categories:
59 a verb ((2-b)), an adjective ((2-c)) or an entire sentence ((2-d), (2-e)); (2-f)

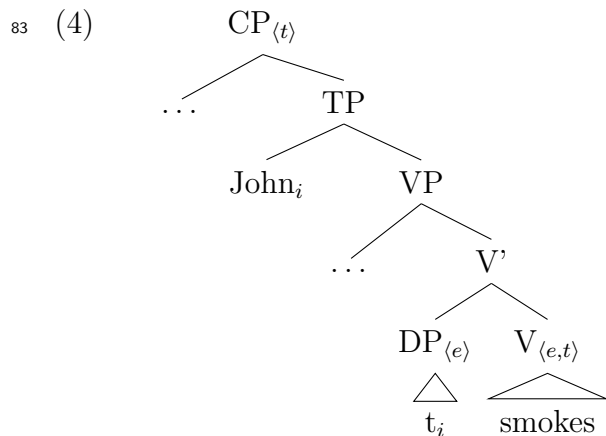
60 exemplifies a PP that modifies a VP, and in (2-g) the adnominal modifier is
 61 a relative clause.

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

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

- 75 (3) John smokes.

76 In formal semantics, *John* denotes the actual individual by the name of John,
 77 which is of type $\langle e \rangle$, and *smokes* refers to the characteristic function of the
 78 set of individuals that smoke, i.e. it denotes in $\langle e, t \rangle$. Composition proceeds
 79 via Functional Application so the function is applied to its argument and the
 80 result is a truth value. In syntax, this derivation involves merging a DP and
 81 a VP into a CP, modulo some additional operations to ensure that certain
 82 principles are satisfied. This is schematically represented in (4).



84 By contrast, the relation between an adjective (the modifier) and a noun (its
85 modifiee), or an adverb (the modifier) and a verb (its modifiee) cannot be ac-
86 counted for in the same terms. Modifiers do not saturate their modifiees; not
87 only this, characteristically, they cannot change the type of their modifiee.

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

94 (5) Modifier: an expression which combines with another expression to
95 produce a result with the same semantic valence.

96 Morzycki (to appear) is skeptical about whether we can attribute a stronger
97 notional content to the concept of modification beyond McNally's phrasing in
98 (5). He points out that two aspects have to be taken into consideration when
99 defining what a modifier is: if we study a modifier in an external sense, like
100 a subject or a purpose clause, we would be concerned with how it relates to
101 other constituents and with its sentential function (i.e. its distribution); in an
102 internal sense, a modifier, like a noun, may have its own internal properties
103 (i.e. its lexical semantic characteristics). Morzycki mentions the relation that
104 modifiers such as adjectives and adverbs have with gradability, in particular.

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

¹This SI is thus also not concerned with studies on degree and event modifiers (for this matter, cf. Ernst 2002; É. 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; Gehrke and Castroviejo, to appear, among others).

112 2.1. *Modifiers and modification in syntax*

113 In syntactic theory, adjectives, adverbs, PPs or relative clauses have been
114 analyzed in different ways depending on whether or not they are subcate-
115 gorized by the corresponding head. Leaving aside for the moment the car-
116 tographic approach, which analyzes them as specifiers, these categories are
117 treated as adjuncts if not subcategorized, but as sisters of the head (and
118 thus complements) if subcategorized. These two options should be able to
119 explain the contrast shown in the Catalan examples in (6). While in (6-a)
120 the PP headed by *de* ‘of’ is necessary for the well-formedness of the sentence
121 – and hence an argument – *lingüística* ‘linguistics’ in (6-b) can stand alone
122 without the PP, so the PP should be analyzed as an adjunct (and hence it is
123 a modifier). Thus, the syntactic category PP can be both an argument and
124 a modifier.

- 125 (6) a. La Maria està enamorada del germà *(de la Sònia).
the Mary is in love of the brother of the Sonia
126 ‘Mary is in love with *(Sonia’s) brother.’
127 b. La Maria està enamorada de la lingüística (de corpus).
the Mary is in love of the linguistics of corpus
128 ‘Mary loves (corpus) linguistics.’

129 That is, although modifiers are described as being optional, some categories
130 that are usually modifiers can occur in contexts where they are selected
131 components. In (6), the head is the relational noun *germà* ‘brother’, so the
132 PP *de la Sònia* (Sonia’s) is obligatory and, thus, a complement instead of an
133 adjunct.

134 While modifiers can be of all kinds of categories (NP, AP, PP or even
135 heads), *modifier* itself is not a syntactic category, unlike *determiner*, *tense*
136 or *preposition*. *Modification* is also not a syntactic operation. In generative
137 grammar (Chomsky, 1993, 2004), two operations – which amount to only
138 one – are in charge of deriving well-formed linguistic strings, namely (exter-
139 nal) merge and move (or internal merge). Strictly speaking, this concerns
140 subcategorized expressions, since the kind of merger that puts together non-
141 subcategorized expressions with the constituents they adjoin to has different
142 properties. The core idea under the Chomskyan view adopted from Hoek-
143 sema (1984) (to be compared to the cartographic view) is that adjunction
144 is an operation that returns a phrase of the same type as the host (i.e. the
145 target of the adjunction operation). This is represented in (7).

146 (7) $[_{XP} [_{XP} [_{XP} \dots X^0 \dots] \text{ADJUNCT}] \text{ADJUNCT}]$

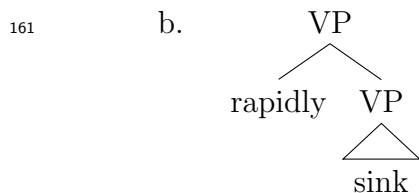
147 Note that the adjunct combines with an XP and the result of the merger is
 148 still an XP. Adjuncts retain bar-level information of the target (here, a maxi-
 149 mal projection XP remains a maximal projection after adjunction), category
 150 information (the result of the operation is of category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

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

156 (8) $[_{XP} \dots X^0 \dots [_{YP} \dots Y \dots]]$

157 The schema in (7) fares well to represent VP modification by adverbials in
 158 cases such as (2-b), repeated below as (9-a); (9-b) shows that the modifier
 159 *rapidly* does not change the label of the projection, which stays a VP.

160 (9) a. rapidly sink



162 However, as noted by Cinque (1999) and further proponents of a cartographic
 163 approach to syntactic analysis, the Chomskyan conception to adjuncts can-
 164 not straightforwardly explain the hierarchy found among classes of adverbials
 165 cross-linguistically. In his account, adverbials are classified according to se-
 166 mantic features (speech act Adv > evaluative Adv > evidential Adv >
 167 epistemic Adv > ...) and are specifiers of designated functional projections.

²In 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 $\langle x, y \rangle$ 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.

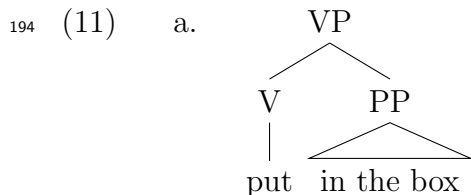
168 Hence, in the cartographic approach, modifiers are mapped to specifiers,
169 which establish a Spec-Head relation consisting in checking semantically-
170 flavored features.

171 Note that we have been considering the analysis of the adverb in (9-b) as a
172 representative instance of modifiers. But we have not discussed the analyses
173 of adjectives, PPs or relative clauses. Different classes of adjectives receive
174 a cartographic treatment in works such as Cinque (1994, 2010). Specifi-
175 cally, intersective adjectives are analyzed as reduced relative clauses and are
176 merged above the DP frame as so-called *indirect modifiers*; by contrast, *di-*
177 *rect modifiers*, which include non-intersective and non-predicative adjectives,
178 are merged directly in dedicated positions within the extended NP projection
179 (see also Bolinger 1967 and Sproat and Shih 1988 for more detail about this
180 distinction). From other perspectives, APs are also analyzed as predicates of
181 small clauses (Kayne, 1994) or adjuncts to different categories depending on
182 their syntactic-semantic properties (cf. e.g. Abney 1987; Bernstein 1993 for
183 proposals within this option, and see Demonte 2003 for a general overview).
184 Finally, research on the distinction between thematic and functional layers of
185 syntactic projections has yielded the proposal that AP is the complement of
186 Deg⁰, the head of a Deg(ree)P (Abney, 1987; Corver, 1991; Kennedy, 1999,
187 a.o.).

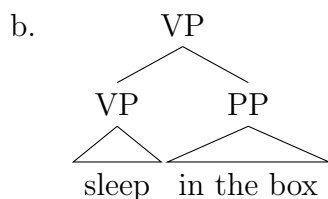
188 PPs also receive different analyses in examples such as (10-a) (subcate-
189 gorized) and (10-b) (not subcategorized).

- 190 (10) a. put in the box
191 b. sleep in the box

192 In (10-a), the PP *in the box* is the complement of V, as in (11-a), whereas in
193 (10-b), the PP is adjoined to the right of the VP, as in (11-b).



195



196 Finally, two kinds of analyses have been proposed for relative clauses; the
 197 raising analysis (Schachter, 1973; Vergnaud, 1974; Kayne, 1994), exemplified
 198 in (12-a), and the matching analysis (Chomsky, 1965; Lees, 1966; Sauerland,
 199 2003), exemplified in (12-b).

200 (12) the book which John likes

201 a. the book_j [_{CP} [Op/which *t_j*]_i John likes *t_i*]

202 b. the book [_{CP} [Op/which (book)]_i John likes *t_i*]

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

205 In sum, there is no agreement as to whether or not modifiers have a
 206 one-to-one correspondence with a syntactic category or as to whether modi-
 207 fication is a syntactic operation. The term *modifier* is then sometimes used
 208 in syntax to refer to a set of grammatical categories with a specific seman-
 209 tic behavior, which, however, do not receive a unitary treatment in modern
 210 syntactic theory.

211 2.2. Modes of composition

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

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

233 Take intersective adjectives first, which can be straightforwardly treated
 234 as properties ($\langle s, \langle e, t \rangle$ or $\langle e, t \rangle$). Assuming that a noun N denotes the set
 235 of individuals that are N (in the case of *mammal*, the set of individuals that
 236 are mammals), composition with adjectives like *carnivorous* proceeds as in
 237 (13).

- 238 (13) From Kamp and Partee (1995, 137)
- 239 a. $\llbracket \text{carnivorous} \rrbracket = \{x \mid \text{carnivorous}(x)\}$
 - 240 b. $\llbracket \text{mammal} \rrbracket = \{x \mid \text{mammal}(x)\}$
 - 241 c. $\llbracket \text{carnivorous mammal} \rrbracket = \{x \mid \text{carnivorous}(x) \ \& \ \text{mammal}(x)\}$
 - 242 $\quad = \llbracket \text{carnivorous} \rrbracket \cap \llbracket \text{mammal} \rrbracket$

243 This leads to the entailment pattern in (14): If Mary is a carnivorous mammal
 244 and she is a violinist, then it must be true that she is also a carnivorous
 245 violinist.

- 246 (14) a. Mary is a carnivorous mammal. [A-N]
 247 b. Mary is a violinist. [N]
 248 c. \therefore Mary is a carnivorous violinist.

249 A further class of adjectives are the so-called subsective ones, for which the
 250 set denoted by A-N is a subset of the set denoted by N. For these adjectives,
 251 the entailment pattern illustrated in (14) does not hold (Clark, 1970; Parsons,
 252 1970): If Mary is a skillful surgeon (i.e. skillful as a surgeon) and she is also
 253 a violinist, this does not entail that she is a skillful violinist (i.e. skillful as a
 254 violinist) (15).

- 255 (15) a. Mary is a skillful surgeon. [A-N]
 256 b. Mary is a violinist. [N]
 257 c. $\not\therefore$ Mary is a skillful violinist.

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

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

280 Additional differences in adjective classes regard the fact that most inter-
 281 sectives and subsectives (unlike some non-subsectives) can also be predicates,
 282 as shown in (16).

- 283 (16) a. Mary is carnivorous / skillful.
 284 b. *Mary is former.

285 If *carnivorous* and *skillful* have to be able to apply to an individual (of type
 286 $\langle e \rangle$), then, they must be of type $\langle e, t \rangle$ ($\langle \langle s, \langle e, t \rangle \rangle$) when they are predicates,
 287 while of type $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$ ($\langle \langle \langle s, \langle e, t \rangle \rangle, \langle s, \langle e, t \rangle \rangle \rangle$) when they are modifiers.

288 Montague’s (1973) strategy of “generalizing to the hardest case” treats
 289 all adjectives – even intersective ones – as functions from predicates to predi-
 290 cates, so even the simplest class of adjectives are given an analysis that works
 291 for adjectives that involve further complications. What matters for the pur-
 292 poses of explaining modification is that, in all cases, modifiers are functions
 293 that do not change the type of the predicate they take as input, which neatly

294 correlates with the Chomskyan definition of adjunct in the syntax and is also
295 reflected in McNally’s (to appear) definition in (5).

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

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

309 Moving on with Scontras and Nicolae’s (this issue) classification, the
310 COMPOSITIONAL approach is best known for the proposal in Heim and Kratzer
311 (1998) that besides Functional Application, we should consider an additional
312 composition rule called *Predicate Modification* [PM], which is spelled out in
313 (17).⁴

314 (17) Predicate Modification (From Heim and Kratzer 1998, 65)
315 If α is a branching node, $\{\beta, \gamma\}$ is the set of α ’s daughters, and $\llbracket\beta\rrbracket$
316 and $\llbracket\gamma\rrbracket$ are both in $D_{\langle e,t \rangle}$, then
317 $\llbracket\alpha\rrbracket = \lambda x \in D_{\langle e \rangle}. \llbracket\beta\rrbracket(x) = \llbracket\gamma\rrbracket(x) = 1$.

318 Note how this rule brings intersection into the mode of composition rather
319 than the lexical semantics of (intersective) modifiers. The advantage of as-
320 suming PM is that it captures the dual behavior of intersective modifiers,
321 both as predicates and modifiers, (18).

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

324 In both cases, *carnivorous* is of type $\langle e, t \rangle$. While in (18-a) it composes

³Incidentally, this divide also correlates with the intersective vs. subsective interpreta-
tion of adjectives.

⁴See also Larson (1983, 1995) for an earlier predicate modification analysis.

325 with \llbracket this mammal \rrbracket , of type $\langle e \rangle$, through FA, in (18-b), it composes with
326 \llbracket mammals \rrbracket , of type $\langle e, t \rangle$, through PM.

327 On the downside, PM works nicely for intersective modifiers, but it is less
328 straightforward for subsective (*skillful*) and non-subsective (*former*) modi-
329 fiers, for which one might have to assume a different semantic type, which
330 would go against a unitary treatment of modifiers as a concept.⁵ Moreover,
331 the COMPOSITIONAL approach departs from the simplicity of and the corre-
332 spondence with the computational system, whose only composition operation
333 is *merge*, which corresponds to FA (cf. §2.1).

334 Another proposal within this approach is Chung and Ladusaw’s (2004)
335 composition rule called *Restrict*. Rather than to account for A-N composi-
336 tion, Restrict is proposed in an attempt to account for linguistic contexts in
337 Austronesian (Maori and Chamorro) that involve composition of predicates
338 that do not change the degree of saturation. Imagine (19) is a well-formed
339 sentence in Austronesian, and *fed* and *dog* have the standard denotations
340 spelled out in (19-a) and (19-b), respectively. The result of appealing to
341 Restrict in this example is shown in (20).

342 (19) John fed dog.

343 a. \llbracket feed $\rrbracket = \lambda y \lambda x. \mathbf{feed}(y)(x)$

344 b. \llbracket dog $\rrbracket = \lambda y. \mathbf{dog}(y)$

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

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

354 Even if Restrict is not conceived to account for A-N composition, it does
355 involve an operation of composition of two predicates which does not yield
356 saturation. In subsequent work (Chung and Ladusaw, 2006), the same au-

⁵However, 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.

357 thors propose a rule they call *Modify* in order to account for the way in-
 358 tersective modifiers compose with NPs in Chamorro, a language which has
 359 so-called *linkers*, just like Tagalog (discussed in Scontras and Nicolae, this
 360 issue). *Modify* consists in taking two properties P and Q and returning their
 361 intersection, as in (21).

$$362 \quad (21) \quad \text{Modify}(\lambda x[\mathbf{cat}(x)], \mathbf{black}) = \lambda x[\mathbf{cat}(x) \wedge \mathbf{black}(x)] \quad (\text{From Chung} \\ 363 \quad \text{and Ladusaw 2006, 337})$$

364 Along with PM, assuming *Restrict* or *Modify* implies complicating the set of
 365 available modes of composition, while keeping the semantic types of modi-
 366 fiers simple. Unlike PM, though, which is a general semantic rule, *Restrict*
 367 is viewed as a specific instruction on a morpheme, which informs the com-
 368 putational system regarding the mode of composition.

369 The third strategy pointed out by Scontras and Nicolae (this issue), and
 370 the one they endorse to account for the Tagalog data they discuss, is the
 371 STRUCTURAL approach. In line with Rubin (1994, 1996, 2003), they argue
 372 that modification requires a specific syntactic projection whose head Mod^0
 373 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
 374 type, FA is the default compositional operation, and the burden of the mod-
 375 ification process lies on phrase structure (i.e. the *Mod* head, which is absent
 376 in the other two approaches). Their main argument comes from the so-called
 377 *linker* in Tagalog (the allomorphs NA/-NG), which (almost) always occur in
 378 contexts of non-saturating semantic composition and, thus, modification.

379 2.3. Intersection

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

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

- 390 (22) a. Lobsters are large crustaceans (McNally’s to appear ex. (14))
 391 b. Lobsters are animals.

- 392 c. $\not\sim$ Lobsters are large animals.
 393 (23) a. A big ant may not be a big individual.
 394 b. A small elephant may not be a small individual.
 395 c. A big ant may be smaller than a small elephant.

396 However, once it became clear that gradable adjectives had to be relativized
 397 to comparison classes of individuals (Bartsch and Vennemann, 1972; Cress-
 398 well, 1977; Klein, 1980; von Stechow, 1984; Fulst, 2006; van Rooij, 2010)
 399 — i.e. *big for an ant*, *small for an elephant* — the intersective analysis of
 400 gradable adjectives was possible.

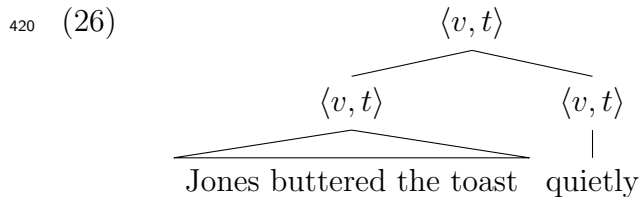
401 Later on, Larson (1998) provided an intersective analysis of *beautiful* in
 402 *beautiful dancer*. The case is illustrated in (24).

- 403 (24) a. Olga is a beautiful dancer.
 404 b. Olga is beautiful.
 405 c. Olga dances beautifully.

406 (24-a) is ambiguous between the intersective interpretation in (24-b) and the
 407 subsecutive interpretation in (24-c). Larson (1998) shows that we need not
 408 intersect just individuals (entities of type $\langle e \rangle$), but also events (of type $\langle v \rangle$).
 409 If we assume that (at least certain) nouns have an event variable as part
 410 of their denotation, then we can maintain the idea that both readings in
 411 (24) can be obtained through intersection. If (24-a) is to be translated as
 412 (25), then we are intersecting a set of dancing events by Olga with a set of
 413 beautiful events.

- 414 (25) $\exists e$ [**dancing**(Olga, e) & **beautiful**(e)]

415 In fact, in the (Neo-)Davidsonian tradition (Davidson 1967 for PPs and Par-
 416 sons 1990 for VP modifiers more generally) many kinds of adverbials can also
 417 receive an intersective analysis once events are taken into consideration. For
 418 instance, in (26) (Morzycki's to appear ex. (26)), intersection is carried out
 419 between events of Jones buttering the toast and quiet events.



421 In a similar line of work, McNally and Boleda (2004) argue that an intersec-
 422 tive analysis for relational adjectives like *technical* can be provided as long
 423 as they are treated as properties of kinds and (at least certain) nouns denote
 424 relations between kinds and their realizations, as in (27).

$$425 \quad (27) \quad \llbracket \text{architect} \rrbracket = \lambda x_k \lambda y_o [R(y_o, x_k) \wedge \mathbf{architect}(x_k)]$$

426 *Technical* in *technical architect* is thus analyzed as in (28), and an intersective
 427 analysis is maintained, where the intersection is between those kinds that are
 428 architects and technical.

$$429 \quad (28) \quad \llbracket \text{technical} \rrbracket = \lambda x_k . \mathbf{technical}(x_k)$$

430 The analyses of Larson (1998) and McNally and Boleda (2004) not only have
 431 the advantage of enabling an intersective analysis of a set of adjectives that
 432 otherwise would need to be treated as members of a different category; they
 433 also predict that such modifiers can have predicative uses, even if the meaning
 434 is always one where the token individual is the one targeted.

435 Kind modification is also at stake in Umbach and Gust’s (this issue) paper
 436 on similarity as modification. Specifically, it addresses the question of how
 437 German *so* can be both a demonstrative and (the anaphor of) a modifier.
 438 Take for instance, (29) (their (1b)).

439 (29) [speaker pointing to a car in the street]
 440 So ein Auto hat Anna (auch).
 so a car has Anna too
 441 ‘Anna has such a car / a car like this, (too).’

442 In this example, we have to separate out the target of the demonstration
 443 – here, an individual, they argue – and the referent of the NP *so ein Auto*
 444 ‘such a car’. Umbach and Gust propose that the denotation of the NP has
 445 to be similar (i.e. not identical) to the target of the demonstration. Being
 446 similar is not a semantic primitive, though. The way they put it, a class of
 447 individuals is generated that is the intersection of cars and individuals that
 448 are indistinguishable from the target of demonstration, i.e. the actual car.
 449 To be more specific, in their account, using similarity demonstratives creates
 450 a so-called *ad hoc* kind (that is, we need not use *so* to refer to well-established
 451 kinds, cf. Carlson 1980; Anderson and Morzycki to appear) corresponding
 452 to the class of individuals that are similar to the target NP. The assumption

453 is that we cannot point at kinds but rather at either individuals or events.
454 So these demonstratives behave like modifiers to the extent that they yield
455 a restriction of the denotation of the head N through intersection, not of the
456 denotation of two linguistic expressions, but rather one linguistic expression
457 and the information we recast from the target of demonstration.

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

471 2.4. Restrictive vs. non-restrictive modification

472 A phenomenon that cross-cuts intersective modification is that of the re-
473 strictive [R] vs. non-restrictive [NR] interpretation of modifiers, as illustrated
474 below for Spanish adjectives.^{6,7}

475 (30) From Demonte (2008, 71)

⁶The term *restrictive* is not used here in the sense of Keenan (1983), which is treated as a synonym of *subjective*, 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).

⁷The 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 subjective adjective *pobre* does not have a NR interpretation when it appears pre-nominally (see Masià 2013 for recent discussion).

- 476 a. Encontré las llaves *viejas*.
 I.found the keys old
 477 ‘I found the old keys (i.e. the subset of keys which are old).’
 478 b. Encontré las *viejas* llaves.
 I.found the old keys
 479 ‘I found the old keys (i.e. I found certain keys and they are old).’

480 Roughly, as shown in the paraphrases above, the difference between R and
 481 NR amounts to whether or not the total amount of individuals in the ex-
 482 tension of the head, here keys, equals the total amount of individuals in the
 483 extension of the modified head, here, old keys. Interestingly, at first sight,
 484 Romance establishes a one-to-one correspondence between word order (pre-
 485 vs. post-nominal) and interpretation (R vs. NR).⁸

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

495 The pattern exemplified for Spanish partially extends to French, as out-
 496 lined by Martin (this issue), who takes a step further by focusing on evalua-
 497 tive adjectives such as *affreux* ‘horrible’. She raises the question of whether
 498 the aforementioned syntax-semantics mapping is true and, if so, why these
 499 adjectives have a preference for the pre-nominal position. More specifically,
 500 Martin debates how to reconcile the preference of evaluative adjectives in
 501 French for having a NR interpretation (the Nonrestrictive Bias Hypothesis)
 502 and the tendency of pre-nominal modifiers to have a NR interpretation vs.
 503 post-nominal modifiers to have a R interpretation (the Complementarity Hy-
 504 pothesis). She dismisses the at-issue vs. non-at-issue approach and claims

⁸The 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 subjective adjectives (e.g. *buen amigo* ‘good friend \equiv good *qua* friend’) and modal adjectives (e.g. *posible dimisión* ‘possible resignation’).

505 that the term *restrictive* is used in the literature in two different ways. In par-
506 ticular, there are cases where the R vs. NR interpretation is blurred, namely
507 when the extension of the set of individuals that are both in the extension of
508 the modifier and the head equals the extension of the head. Her proposal is
509 that a modifier can restrict the denotation of its head in a purely extensive
510 way when the modifier is a definite DP, and / or it can further invoke other
511 accessible situations when the modifier appears in indefinite DPs or when it
512 is an adverbial. This would be the case in (31).

- 513 (31) From Martin (this issue, 12)
- 514 a. Pierre m'a offert d'horribles fleurs.
Pierre me.has offered some.horrible flowers
515 'Pierre offered me horrible flowers.'
- 516 b. Pierre m'a offert des fleurs horribles.
Pierre me.has offered some flowers horrible
517 'Pierre offered me horrible flowers.'

518 In (31), we have an indefinite DP, unlike in (30). Note that in both cases,
519 the extension of flowers equals the extension of horrible flowers. Hence, by
520 definition, the adjective should be nonrestrictive, so this characterization does
521 not capture the difference in meaning of the sentences in (31). According to
522 Martin, such cases deserve a modal account. In particular, being restrictive
523 in the modal sense consists in considering another accessible situation in
524 which a different individual is in the extension of the head but not of the
525 modifier. That is, in (31-b), the restrictive case, we state that there are
526 some individuals that are flowers and horrible, and we invoke a situation s'
527 accessible from the evaluation situation s such that some other individuals
528 are flowers but not horrible. By contrast, in the modal nonrestrictive sense
529 of (31-a), in all accessible situations s' from s , flowers are horrible. Note that
530 both in the modal and non-modal characterizations, there is a core sense in
531 which being restrictive is contrastive, because it involves entertaining the idea
532 that there are individuals that are not in the extension of the modifier, while
533 being nonrestrictive is emphatic, because all possible alternative individuals
534 are both in the denotation of the head and the modifier.

535 3. Interface issues

536 In this SI on Modification at the Interfaces, we also aim to learn a few
537 lessons about the syntax-semantics interface (Scontras and Nicolae, this is-

538 sue; Martin, this issue) and even the language-cognition interface (Oliver,
539 this issue; Umbach and Gust, this issue) through four case studies on modi-
540 fication. Specifically, this SI addresses the following interface questions:

541 1. Syntax-semantics interface

- 542 • Can we provide empirical evidence in favor of one of the three
543 hypotheses of modes of composition sketched in §2.2?
- 544 • Under which conditions can we establish a one-to-one correspon-
545 dence between syntactic position and semantic interpretation?

546 2. Language-cognition interface

- 547 • How does our parser work when composing a modifier and a head
548 whose intersection is the empty set?
- 549 • Can we reconcile the findings of artificial intelligence and the for-
550 mal analyses in truth-conditional semantics?

551 Scontras and Nicolae contribute an empirical argument in favor of treat-
552 ing modification as an operation that concerns phrase structure rather than
553 the mode of composition or the lexical semantics of modifiers. As part of this
554 inquiry, Scontras and Nicolae put under semantic scrutiny the bidirectional
555 claim in (32) to conclude that while it is the case in Tagalog that when-
556 ever there is an instance of modification, we find the NA/-NG, the reverse
557 implication does not always hold.

558 (32) Modifier \Leftrightarrow Linker

559 Specifically, they consider contexts that are not typically analyzed as in-
560 stances of modification that also contain the linker, e.g. clausal complements
561 or the restriction of a quantifier. If Scontras and Nicolae are right in analyz-
562 ing NA/-NG as a “modification morpheme”, these data are valuable for the
563 study of the syntax-semantics interface in that they may induce a reconsid-
564 eration of constructions in other languages that do not include overt markers
565 of modification.

566 Martin attempts a definition of non-restrictive modification that is able to
567 capture a broader set of data than had been considered before regarding the
568 position of the adjective with respect to the head noun, and the interpretive
569 effects of this syntactic position. In Martin’s account, the data and previ-
570 ous hypotheses are refined in such a way that the correspondence between

571 form and function relative to the pre-head position of modifiers and their re-
572 strictive interpretation (and vice-versa for the post-head and nonrestrictive
573 interpretation) only holds for those adjectives that can occupy both positions
574 in purely extensional contexts and in indefinite DPs. (Non)restrictivity in
575 indefinite DPs and in adverbials requires a modal definition that takes into
576 consideration an accessibility relation between situations. Hence, word or-
577 der (and thus syntax) triggers interpretive (and thus semantic) effects. She
578 further argues that the frequent inability of evaluative adjectives to appear
579 in post-head position only applies to so-called *wonderful* predicates (in con-
580 trast to *beautiful* predicates), and this has to do with a rule that affects their
581 *use*. Observe how the *function* of certain modifiers (here, the fact that they
582 can only be employed if their content “matters”, cf. Martin, this issue, §3.3)
583 becomes a relevant factor for the syntax.

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

598 Umbach and Gust consider how certain demonstratives (in this case, Ger-
599 man *so*) can function as modifiers. In this research, Umbach and Gust reflect
600 on the notion of similarity. More specifically, they assume that similarity is
601 not a semantic primitive, so they look into cognitive science to find the cog-
602 nitive grounds of this concept that is in turn compatible with truth-conditional
603 semantics. The proposal they make is to calculate similarity through extend-
604 ing the well-known notion of measure function used in the semantics of (grad-
605 able) adjectives (cf. Kennedy, 1999). That is, viewed as measure functions,
606 adjectives apply to individuals and return degrees, i.e. numerical values. For
607 instance, **tall** applied to **Bill** yields Bill’s height. But adjectives such as *tall*
608 are uni-dimensional, unlike nouns. To establish a similarity relation between

609 a target of a demonstration and the reference of an NP, Umbach and Gust
610 propose that nouns are *generalized measure functions* because they are multi-
611 dimensional. To be more precise, their different dimensions (e.g. in a car, its
612 speed rate, model, color, etc.) obtain a value that can be compared with the
613 values of other similar objects. To represent this complexity, Umbach and
614 Gust argue, following assumptions in artificial intelligence, that generalized
615 measure functions map individuals to points or regions in multi-dimensional
616 spaces. In this model, similarity is defined as indistinguishability with respect
617 to a series of relevant dimensions.

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

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

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

641 Moving on to Martin's take on *wonderful* predicates, which she argues
642 cannot be used for pure referential uses, it may well be the case that the
643 explanation for the contrast in (33) could also extend to examples such as (34)

644 from Spanish, which do not contain *wonderful* predicates, but an adjective
645 that is modified by an intensifier.

646 (33) a. #J'ai vu **le** voisin affreux ce matin.
I have seen the neighbor horrible this morning
647 (From Martin this issue, 1)

648 b. J'ai vu **un** voisin affreux ce matin.
I have seen a neighbor horrible this morning
649 'I have seen a horrible neighbor this morning.'

650 (34) From Pastor (2011, 325)

651 a. #He leído **el** libro { muy/ bastante/ demasiado/ ... }
Have.I read the book very quite too
652 interesante de Cela.
interesting by Cela

653 'I have read the {very/quite/too/ ... } interesting book by Cela.'

654 b. Todos mis alumnos leerán **un** libro { muy/ bastante/
all my students read.will a book very quite
655 demasiado/ ... } interesante de Cela.
too interesting of Cela
656 'All my students will read a {very/quite/too/ ... } interesting
657 book by Cela.'

658 In Martin's account, (33-a), a post-nominal *wonderful* predicate in an anaphor-
659 ical definite is odd, because the uniqueness condition on definites yields a con-
660 text where only one neighbor is (salient) in the context; hence, *affreux* 'hor-
661 rible' should be NR. However, since the predicate occurs post-nominally, it
662 must be interpreted restrictively (i.e. we should be able to contrast this neigh-
663 bor with another neighbor present in the context). A contradiction arises and,
664 thus, the ill-formedness of (33-a). By contrast, the *wonderful* predicate in an
665 indefinite, (33-b), does not run into this problem, because nothing forces the
666 NR interpretation.

667 To explain the particular behavior of *wonderful* predicates, Martin as-
668 sumes Umbach's (2012a; 2012b) reflections on the distinction between sub-
669 jective and universal evaluative judgments. Crucially, according to Martin,
670 *affreux* 'horrible' belongs to the category of subjective evaluative judgments,
671 which characteristically do not rely on shared norms but are purely indi-
672 vidual discourse commitments. As such, *affreux* 'horrible' does not target
673 the Common Ground but the speaker's commitments, and it always licenses

674 faultless disagreement.⁹ On the other side, universal evaluative judgments
 675 such as *Mary is beautiful* can be treated as empirical judgments like *John is*
 676 *2 meters tall* or *The earth is flat* in that they can be normative, in which case
 677 they would target the Common Ground and be debatable. To the extent that
 678 the degree expressions *muy / bastante / demasiado interesante* ‘very / quite
 679 / too interesting’ in (34) have the same distribution as *wonderful* predicate
 680 *affreux*, we could raise the question of whether the former make subjective
 681 or universal evaluative judgments.

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

- 685 (35) a. RED(SHIRT)
 686 b. RED(PEN)

687 As Asher shows, while for a shirt to be red it has to be completely red¹⁰ (un-
 688 like a red apple, which only needs to have red skin), a red pen can be a pen
 689 that has red ink. Hence, the pen does not need to be red (it can have a black
 690 cover), which makes the adjective subjective. In Oliver’s Interpretation as
 691 Optimization approach, the Full Interpretation constraint (Chomsky, 1986),
 692 which requires that each lexical item in a derivation makes a semantic con-
 693 tribution, favors the existence of expressions such as *wooden lion*, in which
 694 Kamp & Partee’s Head Primacy Principle, (36) is violated; in Oliver’s terms,
 695 in this particular case, the modifier stratum outranks the noun stratum, and
 696 not the other way around.

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

702 Thus, the denotation of the noun *lion* is widened to include the notion of
 703 “representation of a lion” to make sense of the expression. The Head Primacy

⁹Faultless 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); Bylina (2013).

¹⁰But see Kennedy and McNally (2010) and McNally (2011) for qualification.

704 Principle is not an issue for intersective adjectives, but it is for subjective
705 ones. In example (36-b), the fact that pens have ink that can also be char-
706 acterized as red (or blue or black) should be a relevant factor in this system.
707 This specific behavior of an otherwise intersective adjective does not rely on
708 whether or not the outcome is an empty extension, so the condition of Full
709 Interpretation appealed to by Oliver is not crucial here. It would be interest-
710 ing to explore whether Interpretation as Optimization is able to cover these
711 cases as well as related modifiers, such as relational adjectives (McNally and
712 Boleda, 2004), where the modifier characterizes one of the variables of the
713 noun (here, the kind argument) instead of the whole category. Probably,
714 assuming a more fine grained type theory in the line of Asher (2011) would
715 allow Interpretation as Optimization to capture a broader set of data.

716 Finally, another question that will come to mind when reading Umbach
717 and Gust’s work is how multi-dimensional adjectives are to be treated in an
718 account that makes use of generalized measure functions, from individuals to
719 multi-dimensional spaces. According to Sassoon (2011) and Sassoon (2013),
720 multi-dimensional adjectives are those whose gradability depends on several
721 criteria. For instance, someone can be *healthy* with respect to blood pres-
722 sure, sugar, cholesterol, etc. Thus, to truthfully state that Peter is healthier
723 than Mary, we should compare the values for the different dimensions. By
724 contrast, to truthfully state that Mary is taller than Peter, we just need to
725 measure their height. It might seem at first sight that multi-dimensional ad-
726 jectives should fall under the same category as nouns, according to Umbach
727 and Gust. However, as pointed out in their footnote 16, while *healthy* is
728 multi-dimensional, when we compare individuals according to “healthiness”,
729 we do so by comparing dimensions one by one (i.e. Peter is healthier than
730 Mary with respect to blood pressure, but Mary is healthier than Peter with
731 respect to sugar). That is, while both nouns and adjectives can have different
732 dimensions, these dimensions are integrated in different ways, which has con-
733 sequences not only for grammar (notably the category distinction between
734 N and A), but also for language processing and acquisition. In fact, Sassoon
735 establishes two cognitive processes responsible for identifying individuals as
736 members of a certain noun or adjective denotation. She argues that, for
737 nouns, we use similarity functions and average over the weight of the val-
738 ues for these dimensions; by contrast, for adjectives, we follow a rule-based

739 strategy and run logical operations on individual dimensions.¹¹

740 Let us point out that while Sassoon applies similarity as a strategy for
741 categorization — which involves degrees of distance with respect to an ideal
742 referent — Umbach and Gust treat similarity as the type of relation estab-
743 lished between a target of demonstration and the denotation of an NP. One
744 follow-up question is whether it would make sense to use generalized mea-
745 sure functions to account for the meaning of multi-dimensional adjectives
746 or, more precisely, whether dimensions for adjectives should show up in the
747 level of (cognitive) representation Umbach and Gust are exploring, alongside
748 nominal dimensions. Another interesting question would be whether *so* es-
749 tablishes with the adjective the same type of relation as with the noun (i.e.
750 similarity), or else a rule-based procedure decides whether or not *so groß* ‘so
751 large’ in (37-b) is the right characterization of Hamburg’s largeness.

- 752 (37) A: Berlin ist mit 3,5 Millionen Einwohnern die größte
Berlin is with 3,5 millions inhabitants the largest
753 Millionenstadt in Deutschland.
megacity in Germany
754 ‘Berlin, with 3.5 million inhabitants, is the largest big city in
755 Germany.’
756 B: So groß ist Hamburg nicht.
so large is Hamburg not
757 ‘Hamburg is not this large.’

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

¹¹McNally (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).

762 **5. Conclusion**

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

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