Morphology and Semantics

MMM9 On-line Proceedings

Edited by:
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Table of contents

Foreword

Following the tradition of the MMM meetings, the present volume compiles a selection of papers presented at MMM9, which took place in Dubrovnik (September 15 - 18, 2013).

The Mediterranean Morphology Meetings (MMM) have been jointly organized since 1997 by Prof. Geert Booij (Leiden University), Prof. Angela Ralli (University of Patras), and Prof. Sergio Scalise (University of Bologna). Since 2013, the Permanent Scientific Committee has been expanded with three new members: Jenny Audring (University of Leiden), Nikos Koutsoukos (University of Patras) and Francesca Masini (University of Bologna). For each meeting the Permanent Scientific Committee cooperates with a Local Organizing Committee. At MMM9, the local committee was chaired by Ida Raffaelli (University of Zagreb).

The aim of MMM is to provide an informal setting for linguists working on morphology to present and discuss their work. The setup without parallel sessions guarantees maximal interaction between researchers, and gives young linguists the chance to present their work at a conference of moderate size, where fruitful contacts with senior linguists can be established. The first nine meetings – in 1997 (Mytilene, Greece), 1999 (Lija, Malta), 2001 (Barcelona, Spain), 2003 (Catania, Sicily), 2005 (Fréjus, France), 2007 (Ithaca, Greece), 2009 (Nicosia, Cyprus), 2011 (Cagliari, Sardinia) and 2013 (Dubrovnik, Croatia) – have proven the success of this formula. Many good abstracts were submitted, the attendance was high, and a number of leading morphologists participated.

Each MMM has two sessions, one with a special topic and another with a free topic. The special topic of the Dubrovnik meeting was ‘Morphology and Semantics’. The present volume includes papers from both sessions.

Jenny Audring
Geert Booij
Nikos Koutsoukos
Francesca Masini
Ida Raffaelli
Angela Ralli
Sergio Scalise

Abstracts

In the paper *Paradigmatic word-formation, metonymy and compound verbs in English and Bulgarian* **Alexandra Bagasheva** argues that compound verbs constitute a genuine word-formation category and that it is possible to achieve uniformity in their analysis despite the notorious heterogeneity of their formation. It is suggested that by adopting paradigmatic word-formation analysis and accepting metonymy as the basic meaning computation mechanism behind compound verbs, analytical parsimony and uniformity can be attained. Embracing a product view morphotactically, but a process view morphosemantically, the paper offers uniform analysis of compound verbs in English and Bulgarian.

In the paper *Morphosemantic features of the third verb type (jeti verbs) in Croatian* **Tomislava Bošnjak Botica and Ivana Oraić Rabušić** discuss which morphosemantic relations can be established within the third verb type (*jeti* verbs), or more specifically, which verb meanings can be realized using the pattern **-je-+ti (+se)** in Croatian. The third verb type is hierarchically organized around its prototypical meaning TO BECOME or TO BE. Verbs that belong to the third type can be divided into two groups or subtypes – (1) verbs with an adjectival root, and (2) verbs with a non-adjectival root. Only the deadjectival subtype is open and productive (although this productivity is very low). *Jeti* verbs were classified into eight semantic fields: appearance, colour, condition, sensation, emotions, position / motion, sound, meteorology. The paper demonstrates how morphological devices, i.e. inflection, can change the verb from unaccusative into causative form and *vice versa* by choosing a certain thematic suffix (*-je-* or *-i-*). In other words, this thematic suffix has a morphosyntactic value.

In the computational framework of Temporal Self-Organising Maps (TSOMs) **Marcello Ferro, Claudia Marzi** and **Vito Pirrelli** analyse in their paper *Lexical parsability and morphological structure* the emergence of morphological structure in lexical acquisition to provide an explanatory basis for both psycholinguistic and linguistic accounts of lexical parsability. Simulations of the incremental acquisition of German verb paradigms in different training conditions show the correlation between frequency of word forms and perception (or lack of perception) of their structure, suggesting that it is not possible to decouple representations from the processing operations defined over representations.

In her paper, **Aurore Koehl** (*Deadjectival nominalizations: suffix rivalry and synonymy*) focuses on French nominalizations that originate from the same adjective through the addition of different suffixes: the semantic relationship among these formations is analyzed, and the conclusion is reached that the suffixes involved in the nominalization of adjectives are not in rivalry, nor in distribution but in alternation.

In *Typing time as an index of morphological and semantic effects during English compound processing*, **Christina Gagné** and **Thomas Spalding** discuss how processing is affected by morphological structure and semantic transparency. In a written language production task, they found elevated typing times at morpheme boundaries and priming effects for compounds with transparent heads, but also that the processing style changed adaptively across trials.

Marin Lasserre and **Fabio Montermini**'s work (*Neoclassical compounds as relational adjectives*) deals with newly formed neoclassical compounds in French ending in *-logique*. These are proposed to be analyzed as pure relational adjectives that are formed by a single constructional strategy, and their meaning is investigated from a distributional semantic perspective.

João Paulo Lazzarini Cyrino, **Paula Roberta Gabbai Armelin** and **Rafael Dias Minussi** (*On the encyclopedic knowledge of gender*) give an analysis of gender in Brazilian Portuguese within the framework of Distributed Morphology. They propose that gender is situated in the Encyclopedia and cite evidence from cases of gender mismatch and structural coercion.

In her paper, **Francesca Masini** (*Idiomatic verb-clitic constructions: from lexicalization to productivity*) proposes a constructionist analysis of verb-clitic combinations in Italian that are characterized by non-compositional semantics and structural fixedness. Although most of these formations are the result of lexicalization, she shows that one verb-clitic combination has developed into an independent semi-specified and semi-productive construction with emphatic meaning.

Akiko Nagano and **Masaharu Shimada**'s paper (*Relational Adjectives (RA) in English and Japanese and the RA vs. PP debate*) proposes that the distribution of so-called relational adjectives can be fruitfully captured by analyzing them as word-forms for direct modification. This type of adjectives is prevalent in English but totally absent in Japanese. They show that this cross-linguistic difference stems from the difference of the ways these languages choose to spell out the adjunct-introducing P; and the choice depends on the morphological properties of canonical adjectives in each language.

Alexandra Soares Rodrigues' paper (*Semantic rivalry between affixes: the case of Portuguese nominalisers*) argues that affixes have semantic features which are semantically compatible or not with each one of the aspect features of the verb. The semantic feature of the affix will coindex with the semantic feature of the verb that is most compatible with itself. This explains the fact that a verb may end up with different event deverbal nouns. Each one has semantic nuances that result from the specific features used in coindexation.

Pavel Štichauer's paper (*The meaning of Italian VN compounds in a diachronic perspective: the development of a word-formation rule and its semantic instruction*) proposes a diachronic analysis of Italian VN compounds which sheds light on the emergence of this construction and the various meanings usually associated with it.

Paradigmatic word-formation, metonymy and compound verbs in English and Bulgarian

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1. Introduction

Compounds have been widely discussed in the morphological literature. The most hotly debated issues encompass the morphology-syntax interface in the constitution of compounds, mechanisms of meaning computation of the whole, the establishment of reliable criteria for distinguishing a phrase from a compound and models explaining the assignment of stress in compounds. The discussions usually concern nominal compounds (most frequently of the [N N] type) and comments on compound verbs are rare. Admittedly, compound verbs are relatively fewer in comparison to nominal and adjectival compounds in the most widely studied languages. They are frequently considered parasitic, being back-derived or converted from nominal or adjectival compounds (in English). Moreover, their morphotactics usually violates canonical syntactic patterns of combining verbs with various complements and adjuncts (at least in terms of word order). However, it is argued in the current paper that compound verbs constitute a genuine word-formation category and that it is possible to achieve uniformity in their analysis despite the notorious heterogeneity of their formation. It is suggested that by adopting paradigmatic word-formation analysis and accepting metonymy as the basic meaning computation mechanism behind compound verbs, analytical parsimony and uniformity can be attained. Embracing a product view morphotactically, but a process view morphosemantically, in the paper we offer uniform analysis of compound verbs in English and Bulgarian. The paper is structured as follows: in part two the role of paradigms as linguistic entities in word-formation and their utility as an analytical tool are discussed, part three is devoted to a background discussion of metonymy and its relevance to word-formation; part four covers the central characteristics of compound verbs in English and Bulgarian, unifying the role of metonymy and word-formation paradigms in the meaning generation of compound verbs and part five outlines the naturally arising conclusions and suggestions for further research.

2. Word-formation paradigms

2.1 Word-formation between syntagmatic and paradigmatic relations

According to Saussure (1968: 296), the meaning of simple and complex words is assigned in different ways. The meaning of simple words is conventionally assigned by arbitrary mappings between form and content and speakers have to learn these mappings one by one. The meaning of complex words, on the other hand, is motivated and potentially computable. It is based on the meanings associated with the parts and hypotheses about the nature of the relationship that holds them together in a composite whole[1], and partly on the various associative (paradigmatic) relations among linguistic units. The first type of motivating

[1] Under composite whole is understood any derived, non-simplex word no matter whether it has been created by affixation, conversion, compounding or any other among the generally recognized major or minor word-formation patterns.

factors is associated with syntagmatic relations among linguistic elements, while the second type derives from paradigmatic ones.

A logical methodological question, therefore, is whether the choice of one or the other type as a starting point for analysis in word-formation will lead to divergent analytical results. No answer to this question will be provided here, not least because whatever the answer to the methodological quandary, it will not undermine the fact that paradigmaticity is an ontic property of the lexical system of languages (including word-formation).

The interrelatedness and interdependence between syntagmatic and paradigmatic relations between elements in a linguistic system for the establishment of the unique value of a linguistic item within the system has long been acknowledged in linguistics (at least since Saussure's *Course de Linguistique Generale*). Despite this insight, the prevalent view in morphology is that complex words are exclusively derived compositionally from their constituent parts and the operations performed on them, Bach (1989: 46). The operations are mostly considered to involve syntagmatic relations both in terms of form and in terms of meaning. In the influential theory of word-formation developed by Marchand (1969: 3), complex lexical items are considered to be syntagmas based on a determinant/determinatum relationship. However, as Lpika (1981) acknowledges the resulting composite form as a whole is opposed to other simple or complex lexemes[2]. Thus these composite forms contract paradigmatic relations with other lexical items, be them simple or complex. More importantly, Booij (2001) explicitly maintains that the rules for establishing the types of syntagmatic relations between constituents (and all constraints regulating possible combinations thereof, i.e. word-formation rules) are derived on the basis of the paradigmatic relations or associations in form or meaning.

Conceding with Booij (2001: 3), we believe that

> In morphology the paradigmatic and syntagmatic dimension of language structure are strongly interwoven. The starting point is a paradigmatic one: we compare a set of verbs with a set of formally and semantically related nouns. On the basis of this comparison, we can conclude the existence of a syntagmatic operation, a word-formation process.

The recognition of different types of word-formation processes as syntagmatic operations is based on establishing the nature of the differences in the paradigmatic relations that hold sets of words together. In cases in which a syntagmatic process cannot be uniquely and exhaustively formulated or when uniform word-formation products come into being as a result of diverse syntagmatic word-formation processes, relying on paradigmatic relations for the analysis of these word-formation products is not only justified, but also desirable. So in the face of the heterogeneity of derivational processes involved in the appearance of compound verbs (composition, i.e. compounding proper, conversion and back-derivation being the standard ones) a uniform analysis can be achieved by applying the notion of the word-formation paradigm.

2.2 Word-formation paradigms

The concept of the word-formation paradigm remains a contentious issue in lexical morphology. It is traditionally associated with inflectional morphology, see Anderson (1992), Aronoff (1994), Stump (2001), among others. An illustrative example of the prevalent

[2] Nothing of import ensues from the terms lexeme, word and lexical item. For the purposes of the current argument, the three are used interchangeably, with the difference between simplex and complex words deduced from context.

position which sees a sharp boundary between inflectional morphology and word-formation can be found in Stump's comments,

> paradigms play a central role in the definition of a language's inflectional morphology. This centrality is manifested in a variety of ways: for example, the sequence in which inflectional rules apply in the realization of a word's morphosyntactic properties may systematically depend on the cell which that word occupies within its paradigm (Stump 2001: 32).

Yet, the recognition of the primacy of paradigmatic relations in certain word-formation processes has lead to the acknowledgment of the derivational paradigm[3], see Bauer (1997), Becker (1993), Beecher (2004), Bochner (1993), Booij (2001), Booij and Lieber (2004), Pounder (2000), Štekauer (2014), van Marle (1985), as a linguistic fact and as an analytical heuristic in studying derivational morphology; as well as to the recognition of the paradigmatic nature of derivational semantics. Without investing too much theoretical import, we prefer the term *word-formation paradigm* to the more frequently used one *derivational paradigm*. The former name avoids any implications that the concept of paradigm in word-formation is only applicable in affixal processes. More importantly, they differ in terms of schematicity (not unlike the inheritance relations among schemas with different degree of abstractness in a constructionist lexicon, see Booij (2010a: 25-27; 41-43). The derivational paradigm has local scope and well specified, semantic relations. The word-formation paradigm is more comprehensive and captures the fundamental, general relations among words which are implicated in analogical relations of word-formation relevance. We take this understanding of the word-formation paradigm to be a very fruitful way to provide the ease of tension between processes (understood as rule-application) and products (which might not necessarily arise from the same process but share all their properties as lexical objects, including their morphotactics). We also believe that the word-formation paradigm is indispensible for any analytical undertaking for which analogy is a central mechanism of productive, synchronic word-formation. Thus one local paradigm can be taken as a rough template for analogical construction of further lexical objects which do not inherit or derive any necessary semantic properties from an implicated process of derivation, counter theories of necessary argumental relations in synthetic nominal compounds, see Guevara and Scalise (2004), that will be inherited in a back-formed compound verb, for example. The word-formation paradigm as a network of lexico-semantic relations between words avoids the procedural implications but preserves the potentiality of analogical creations succumbing to conceptually (onomasiologically) determined relations, deriving from "pragmatic pressure" (Booij and Lieber 2004: 350). The lexico-semantic relations in a word-formation paradigm are based on conceptual metonymy and are underlined by frames as the central type of knowledge structure with direct relations with lexical items (to be discussed in the next section).

For the purposes of our argument, following Beecher (2004: 1) we define a word-formation paradigm as "patterns of relationships among derived words", where derived is used in the wide sense of constructed, encompassing all types of complex words. The patterns of relationship are determined by the onomasiological categories with which a specific conceptual space can be associated and which underlie potential words in a language. Once a

[3] Even though we use it as a theoretical construct, the derivational (or the word-formation) paradigm is not a mere theoretical invention. Psycholinguistic research on the morphological family size effect (see e.g. Moscoso del Prado Martín et al. 2004) and the processing of compounds (Gagné, Marchak and Spalding 2010; Gagne and Spalding 2009; Libben and Jarema 2006) has provided ample evi,dence for the psychological reality of the word-formation paradigm and the strongly paradigmatic organization of the mental lexicon.

concept has been emancipated for naming, i.e. has been onomatologically realized (see Štekauer 1998), it sets up, in the form of expectations, a template of possible incidences in different onomasiological types, whose lexical realization is guided by metonymic relations. This constitutes the first type of word-formation paradigm (or word-formation family). This type is a mould for the alternative construal of a linguistically conceptualized domain matrix. Alternative construal relations are lexical topicalizations over a single domain-matrix. It is an onomasiological replica of a frame. Potentially any element can be morphotactically encoded in the symbolic inventory, e.g. *work*$_{[N]}$, *work*$_{[V]}$, *work-er*, *work-ing*, *work-ings*, *work-aholic*. The second type of word-formation paradigm is based on same-constituent chains which actualize the same construal over diverse domain matrices, e.g. *-er*: *work-er*, *teach-er*, *read-er*, *sing-er*, *sleep-er*, etc. There is constant crosspollination between the two types of paradigms and both underlie the gradual emergence of more or less productive syntagmatic processes, but only the first type is exclusively prompted and guided by metonymies within or across frames.

3. Metonymy in word-formation

Metonymy is considered a basic cognitive strategy by many scholars, among whom Langacker (1987) and Janda (2011), but it's mostly exploited as an analytical tool at the lexical level (and above) mainly in relation to polysemy, referential chains, and figurative expressions in languages. It is traditionally understood (at least in the structuralist tradition) as a linguistic relation between *signifiés* of words, (e.g. Jakobson (1956), Ullmann (1967)). Within the cognitive linguistics framework, it is understood as a conceptual phenomenon, or as Panther and Thornburg (2003, 2004, 2007) define it, as sets of inferential pathways or natural inference schemas. Despite the numerous points of contention, see Barcelona (2003), Koch (1999, 2000, 2001), Kövesces and Radden (1998), Panther and Thornburg (2007), Piersman and Geeraerts (2006), Radden and Kövesces (1999), among many others, in defining the nature, scope and natural sources of metonymy, there seems to be a general consensus that its *modus operandi* is conceptual contiguity. We side with Koch (2000) in conceiving of metonymy as a powerful meaning generating mechanism in word-formation, based on contiguity, where "contiguity is the relation existing between elements of a prototypical conceptual/perceptual frame or between the frame as a whole and each of its elements" Koch (2000: 1), where each element in the frame can constitute (sub-)frames. Admittedly, for Koch "frame" has "a very general sense, comprising also 'scene', 'scenario', 'script' etc." (ibid.). This view of the all-encompassing nature of frames is not unique, as Barsalou and Hale (1993: 131) contend "[h]uman knowledge appears to be frames all the way down." Frame seems to be the most widely accepted operationalization of extralinguistic factors that have direct bearing on linguistic units at the conceptual level. Fillmore (2006: 378) defines the correlation between frames, construal mechanisms and lexical items as a mutually implicating one in which frame is "the structured way in which the scene is presented or remembered […]. [W]e can say that the frame structures the word-meanings, and that the word 'evokes' the frame". As an operational term for individuating and organizing highly schematizied conceptual content, a frame names a gestalt anchored into an actional core. The direct consequence of frames in word-formation is the construal and perspectivization of different backgrounding and foregrounding relations between concepts and the lexical items, where lexical items evoke frames and frames are also capable of evoking conceptually related lexical items.

Working on nominal compounds, Onysko (2010) contends that the semantic frame of the head lies at the center of attention and the sub-frames in it are possible candidates for specification, "the semantic frame of the head offers a basic conceptual map from which

specifiers can emerge via the instantiation of inherently contiguous sub-frames or meaning potentials" (Onysko 2010: 251). In his view, the modifier is conceptually grounded in the semantic frame of the head noun and the word formational process of nominal compounding (in English and German) is guided by contiguous (or metonymical) conceptual relations in the semantic frame of the head. The degree of contiguity between a certain conceptual domain and the head frame can be determined on the basis of the frequency of onomasiological extensions of this conceptual domain in compounds. This can lead to identification of productive and less productive frame internal contiguities (ibid.). The role of frames and conceptual metonymies in the creation of compound verbs is parallel to that in nominal compounds, but the result is not head specification, rather it is uniquely perspectivized scenic representation.

4. Word-formation paradigms, metonymy and compound verbs in English and Bulgarian

Compound verbs[4] are rather heterogeneous from the point of view of syntagmatic word-formation processes. They can result from compounding – e.g. *stir-fry*, *злодействам* (*zlodeystvam*, 'evil-do', *do evil*) back-formation – *baby-sit*, *умопомрачавам (се)* (umopomrachavam (se), 'mind-darken', *become deranged/cause somebody to become deranged*) and conversion – *bear hug*. As word-formation products, or a lexical class, compound verbs display uniform properties arising from the powerful role of word-formation paradigms in synchronic word-formation, with constructions accounting for the unique, pattern-based but non-compositional meaning which the specialized construction [XY]V actualizes. The formation of compound verbs relies on the interplay of three basic mechanisms – paradigmatic word-formation as defined by Beecher (2004), metonymy as analyzed by Janda (2011), Koch (1999, 2000, 2001), and Bagasheva (2012, 2014) and analogical modelling as proposed by Booij (2007, 2010a,b), Plag (2006), and Krott (2009). The ubiquity of what Ruiz de Mendoza (2011) calls the 'cognitive operation' (i.e. metonymy) in word-formation, based on conceptual frames, as these are defined by Fillmore (1985, 2006), and executed with the help of paradigmatic, synchronic word-formation, motivates and guides the spontaneous enrichment of word-formation paradigms with dynamic, relational construal of the respective domain matrices.

There is one important difference between compound verbs in English and Bulgarian, which does not significantly affect the uniformity of analysis suggested here. English abounds in compound verbs in comparison to Bulgarian. The domains for which in English compound verbs exist cover virtually the whole span of human existence, while compound verbs in Bulgarian are restricted to a few domains and are fully lexicalized. Just to illustrate: a sample of compound verbs naming physical activities (including cooking verbs, drying verbs, feeding verbs, and motion verbs) in English *deep-fry, French-fry, spin dry, rough dry, spoon-feed, force-feed*, *cold-cock, upend, bottle brush, mud wrestle, deadlock, frog-march, piggyback, railroad, shuttle-cock, cat-foot, pussy-foot, cliff-hang, couch-hop, cartwheel, nose-dive*, contrasted with an empty set in Bulgarian. The same can be illustrated with verbs

[4] The analysis proposed here is based on the study of 427 CVs in English and 76 in Bulgarian (the sources from which these have been extracted are cited after the References). The data set excludes i) preposition-V compound verbs and ii) self-V compound verbs. These two groups have been excluded from the analysis because the status of the former as compound verbs in English has been contested (Plag 2003; Lieber 2004, 2009; etc.) and such verbs are not attested in Bulgarian. The second group is characterised by uniform semantics in the two languages – the establishment of a peculiar thematic role *Involved* which combines Agent and Patient (Affected), with the meaning of the second constituent preserved. Any verb in Bulgarian (bar semantic constraints, e.g. verbs of cognition and behavioural verbs) is legible input for such compounding.

relating to financial activities in English: *ear-mark, bankroll, crowd-surf, fund-raise, charge-cap, short-change*, etc. with not a single compound verb in this domain in Bulgarian. There are a few domains in which the incidence of compound verbs is comparable in the two language, such as speaking verbs (including wider senses like 'persuasion' and the like) in English: *small talk, fast-talk, sweet-talk, chin wag, backbite, foul mouth, badmouth*, etc. and in Bulgarian: *злословя* (zloslovya, 'evi-speak', *badmouth*) *славословя* (slavoslovya, 'fame-speak', *praise*) and *словоблудствам* (slovobludstvam, 'word-abuse' *blasphemy*).

On the whole it appears that compound verbs in English satisfy onomasiological needs in all kinds of conceptual fields and realize a fully productive constructional idiom, backed-up by a generalized word-formation paradigm, while in Bulgarian, the constructional idiom seems virtually unproductive. Besides this overall difference, there can also be detected a marked preference for packaging Participants and Themes in Bulgarian compound verbs, with Circumstances and Instruments strongly disfavoured, while such constraints do not seem to operate in English. Yet, in both languages compound verbs share the property of naming a single event no matter how complex the internal constituency of the event is and do not involve the integration of separate events into a single whole. This applies even to verb-verb compounds (e.g. *crash-land, kick-start, spin-dry, stir-fry*), which exist only in English and are never created in Bulgarian. The first semantic component in such compounds loses its independent status as a separate activity in the process of conceptual integration and gets streamlined into a Manner, attribute-value specification of the second component that sets the interpretative frame of the whole. Consistent with the semantic preference for lexicalizing Manner, most semantically regular compound verbs in English end up with a Manner component interpretation as in, for example, *rough-dry, gift-wrap*, etc., while no such configuring is admitted in Bulgarian.

Despite the outlined differences, from the applied frame semantic analysis[5] it transpires that compound verbs in both English and Bulgarian arise out of frame-based metonymies which are lexicalized by morphotactic strategies backed up by the word-formation paradigms. In the creation of compound verbs in both languages two basic types of metonymic operations are employed: i) onomatological realization of value specification for a frame constituent or attribute achieved by the latter's emancipation from part of *the background frame* into the *designated profile*[6] of the new lexical concept (e.g. *spoon-feed* against *feed*) and ii) word-formation paradigm-induced alternative construal metonymy (dubbed *event-schema metonymy*, Dirven (1999: 279). The second process parallels alternative communicative construal in conversion, described by Farrell (2001) as category underspecification.

The first type of metonymy underlies what we call value-foregrounding compound verbs, in which the basic process of conceptual integration is the emancipation of a second focal point in the profiling of the event. This is achieved by foregrounding a specified value for a frame element and triggering a portion of the potential background frame into what the word designates or its profile. The choice of a core frame element or only a potential circumstance element is dependent on the ease of recoverability; i.e. it is tied up with the range of possible values for that frame element and the graded salience of frame constituents (core component vs. circumstance elements). A core element which is unpredictable within a bearable range

[5] The analysis has been carried out following the definition of frames, including core participants and circumstance attributes, at FrameNet at https://framenet.icsi.berkeley.edu/fndrupal/. Copyright 2000-2011, International Computer Science Institute.

[6] A word sense's semantic frame (what the word 'means' or 'evokes') = profile + background frame; A word sense's *profile:* what the word designates, asserts; c. A word sense's *background frame*: what the word takes for granted, presupposes" (Goldberg 2010: 40; emphasis added).

of possibilities in a frame is most likely to be promoted to the profile of a compound verb. There is a direct correlation between predictability rating and the likelihood of being foregrounded in a compound verb. Whenever the core elements are restricted and therefore predictable, it is one of the non-core elements that gets conceptually promoted – e.g. *feed* (only foodstuffs to living organisms) and *dry* (entities containing a certain amount of moisture) and the different values assigned account for the creation of new members of the respective family (*spoon-feed, force-feed, drip-feed*, etc.). Thus value-foregrounding compound verbs in English end up with a Manner component interpretation.

The second type of metonymy is operative in the creation of we recognize as frame-creating compound verbs (e.g. *red shirt, carge-cap, deepsix*, *ръкополагам* (rakopolagam, 'hand-put', *ordain*), *благославям* (blagoslavyam, 'sweet-speak', *bless*)). Event schema metonymy kicks in after metaphoric (and lexicalization) operations in a nominal/adjectival compound have been completed (e.g. *cold-shoulder*). The nominal compound is used as a source for the creation of the compound verb. Frame-creating compound verbs are associated with the activation of a generic space shared with other lexical items (an implicated parent nominal compound) and the subsequent focal specialization and relational construal leading to the creation of a new lexical concept. Paradigmatic ties provide the impetus and guarantee the reprofiling of the conceptual complex as a dynamic, relational one. Here metonymy operates over composites.

In both English and Bulgarian compound verbs can be categorized into two groups: a) pure metonymy-based compound verbs (or the value-foregrounding compound verbs – e.g. *blind date, speed date*, *niche date; водоснабдявам* (vodosnabdyavam, 'water-supply', supply with water)*, гласоподавам* (glasopodavam, 'voice-give', *vote*)) and B) metonymy-in-metaphor (or the frame-creating compound verbs – e.g. *dipstick, railroad, главоблъскам (се)* (glavoblaskam (se)*,* 'head-trash', *worry*) *главозамайвам (се)* (glavozamayvam se, 'head-dizzy', *get a swell head*), based on the nature of the frame modifications which account for their semantics. The members of the first group of compound verbs are considerably transparent and their second component is directly evoked by the frame, while the first is conceptually derivative via value specification. In frame-creating compound verbs, even though available, the two morphotactic components are not directly integrated into the profile of a relational concept but capitalize on an already metaphtonymically configured nominally construed conceptual complex (usually encoded in a compound noun or adjective). Bar any socio-pragmatic constraints, any nominal compound in English can give rise to a compound verb, following paradigmatically conditioned and metonymically motivated patterns of meaning computation. In Bulgarian, despite the fact that the same types of metonymies and word-formation paradigms determine the creation of compound verbs, there are greater constraints on the productivity of compound verbs. Establishing the nature and sources of these constraints is a promising research agenda.

5. Concluding remarks

Before we outline future work, which we hinted at in the preceding section, we need to bring together all loose ends. First the time is ripe for focused analyses of compound verbs for at least in English creating compound verbs is a steadily growing tendency, e.g. Ackema and Neeleman (2004), Bauer (1983), Erdmann (2000, 2009), Nagano (2007), Wald and Besserman (2002), among others. The available analyses, negligible in comparison to the ones devoted to nominal and adjectival compounds, are focused on specific problems, e.g Erdmann (2009), Nagano (2007) or specific types of compound verbs, e.g. Renner (2008), Wald and Besserman (2002). In more comprehensive works, compound verbs are usually mentioned in passing, e.g. Adams (2001), Bauer (1983), Lieber and Štekauer (2009), Vogel

and Scalise (2010) or they are analyzed using the concepts and models for nominal compounds. Even in the most recent overview of English morphology, Bauer, Lieber and Plag (2013: 465-466, 471-472), compound verbs are explicitly classified into argumental vs. non-argumental, endocentric vs. exocentric, and coordinative vs. subordinative, with the employed criteria being a mixture of syntactic, morphological and semantic considerations. To avoid any such bundling up of criteria and dimensions of analysis, we adopted one meaning-based dimension, namely the role of metonymy in compound verbs. For the sake of parsimony and uniformity, we also chose a paradigm-based approach to word-formation, for the reason that it helps us circumvent different meaning computation mechanisms associated with some of the recognized syntagmatic processes yielding compound verbs. As Becker (1993: 1) claims, quoting Saussure, "morphology is the system of paradigmatic relations between words, new words being formed in analogy to existing ones" (Becker 1993: 1). He elaborates even further "[i]n a paradigmatic morphological theory, words need not have inherent morphological structure. They have their structure through their relations to other words" Becker (1993: 3). Without evoking back-formation, conversion and compounding and expecting the products of each syntagmatic process to have diverse properties, it is possible to consistently analyze word-formation products with uniform properties. We need to recognize a compound verb creating process in English, if as Booij (2001: 10) claims "together, productive processes define the set of possible complex words of a language, and specify how the lexicon of a language can be extended in a systematic way" (Booij 2001: 10-11). The specific nature of this compound verb creating process is the line of research which naturally follows from the argumentation laid in the sections above.

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Morphosemantic features of the third verb type (*jeti* verbs) in Croatian

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1. Introduction

Croatian verbs are categorized into conjugational classes and/or types. Recent works have shown a range of 3–4 verb classes and/or 6–10 different verb types. The starting point for most categorizations is phonological shape and changes in thematic suffix from the infinitive to the present or vice versa; however some other parameters (like changes to the stem) also play a role.

When presenting Croatian verb morphology in scholarly literature, the focus is almost always entirely on form. The morphological shape of a verb is not seen as being related to its meaning – that is, no categorial meaning is attributed to morphological types.

Some recent works – Bošnjak Botica (2011), Jelaska and Bošnjak Botica (2012)[1] – view conjugational verb typology in Croatian as a prototypically organized category (Rosch 1978, Lakoff 1987). The notion of prototype can be defined as a subcategory that is most representative of the category as a whole, as a central subcategory (Langacker (1987: 371), Lakoff (1987: 39ff), Nesset (2000: 109)). According to this definition, a category typically consists of a nucleus of central or prototypical members, which are characterized by the possession of a list of salient attributes, and various more or less non-central or peripheral members, which owe their membership in the category to the fact that they share some (but not all) of the salient attributes of the prototypical members (e.g. Galton (1995: 122), Raffaelli and Kerovec (2008: 146)).

In line with the tenets of cognitive linguistics, which state that grammatical categories, even phonological ones, have structural meaning (e.g. Bybee and Slobin (1982), Taylor (1995; 2008), Jelaska and Gulešić-Machata (2005)), Jelaska and Bošnjak Botica analysed phonological differences in conjugation, defining forms in relation to morphological differences and differences in verb meaning assignable to the types as categories. As shown for Russian in Nesset (2000), prototypicality may also be applied to verb-class hierarchy. Based on established criteria (the most salient properties) for Croatian, Bošnjak Botica and Jelaska consider one verb type to be a prototype of the conjugational category, while the others are at varying distances from the prototype. Conjugational types are represented as fuzzy sets containing concepts, and the properties of each concept contribute to their representativeness within the category. Each class (*Cr. skupina, grupa*) is a category organized around a phonological form (the thematic vowel in the present tense) that has one or more subcategories, e. g. verb types (*Cr. vrsta*) depending on their infinitive form, where both the thematic vowel and the preceding consonant or suffixes play a role. Each type is also viewed as a category, organized into verb subtypes (*Cr. razredi*), which display different degrees of membership.

Verbs are hierarchically organized into classes, types and subtypes following the same or similar principles. Classification based on the most salient properties enables the selection of verbs with a higher or lower degree of prototypical meaning within one verb type. Prototype

[1] Presentation at the *Slavic Cognitive Linguistic Conference*, Zagreb 2012.

theories have not been directly applied to conjugational classification in other Slavic languages,[2] but some other aspects have been studied on the basis of the idea of the prototypicality of the Russian verb class hierarchy, Nesset (2000).

This paper will attempt to demonstrate which morphosemantic relations (Raffaelli and Kerovec, 2008) can be established within the third verb type (*jeti* verbs)[3], or more specifically, which verb meanings can be realized using the pattern **-je-+ti (+se)** in Croatian. We argue that the third verb type is hierarchically organized around its prototypical meaning TO BECOME or TO BE.[4]

2. Morphological features of the third verb type

Table (1) presents the most recent classification of Croatian verb classes and types according to Jelaska (2005), Bošnjak Botica (2011, 2013). The basic principle is the similarity or dissimilarity of the thematic vowel (suffix)[5] in the present (marked with a capital letter). Regardless of the differences in classification and approaches to some conjugational issues, most contemporary Croatian grammarians label the verb type discussed here (*jeti* verbs) as the third type.

Table 1: Croatian Verb Classes (I, II, III) and Types (1–10)

I. *a*

1. *gledati*: gleda-A-ti 'to watch$_{inf}$': gled-A-m 'watch$_{1.sg.pres}$'

II. *i*

2. *moliti*: mol-I-ti 'to pray$_{inf}$' mol-I-m 'pray$_{1.sg.pres}$'
3. *vidjeti*: vid-JE-ti 'to see$_{inf}$' vid-I-m 'see$_{1.sg.pres}$'
4. *trčati*: trč-A-ti 'to run$_{inf}$' trč-I-m 'run$_{1.sg.pres}$'

III. *e*

5. *pisati*: pis-A-ti 'to write$_{inf}$' pi*s*[6]*-j*E-m 'write$_{1.sg.pres}$'
6. *smijati se*: smij-A-ti se 'to laugh$_{inf}$' smij-E-m se 'laugh$_{1.sg.pres}$'
7. *vjerovati*: vjer-ov-A-ti 'to believe$_{inf}$' vjer-uj-E-m 'believe$_{1.sg.pres}$'
8. *krenuti*: kre-nU-ti 'to start$_{inf}$' kre-nE-m 'start$_{1.sg.pres}$'
9. *davati*: da-vA-ti 'to give' da-jE-m 'give$_{1.sg.pres}$'
10. **athematic verbs**: 10.1 *znati*: zna-ø-ti 'to know', 10.2 *piti*: pi-ø-ti 'to drink', 10.3 *smjeti*: s-mje-ø-ti 'may, to be allowed', 10.4 *umrijeti*: u-mrije-ø-ti 'to die', 10.5 *uzeti*: uze-ø-ti 'to take', 10.6 *čuti*: ču-ø-ti 'to hear', 10.7 *rasti*: ras-ø-ti 'to grow', 10.8 *trti*: tr-ø-ti 'to rub', 10.9. *reći*: rek-ø-ti 'to say'.

[2] As far as the authors of this paper could find in the literature.

[3] Verbs ending in *jeti* where this *-je-* is not a thematic suffix but part of a root (e. g. smjeti 'may, be allowed to') belong to the class of athematic verbs and won't be considered in this article.

[4] In Croatian the verbs mentioned have two aspectual forms, imperfective (progressive) and perfective. In this paper, *to become* is considered both imperfective and perfective unless it has been marked as perfective.

[5] Both terms appear in Croatian linguistic terminology. For most of the types, the thematic suffix is a vowel, however it would be more accurate to say that the *thematic vowel* is the ending of the *thematic suffix*.

[6] The preceding consonant undergoes jotation (in this example, the alternation of *s+j* > *š*). The same type of alternation affects other consonants within this class.

Hence, the third verb type (*vidjeti* 'to see') belongs to the second (*i*) class – verbs with the thematic *-i-* in the present. Instead of the present-day thematic suffix *-je-* in the infinitive, there was once the Old Slavonic *jat (ê)* which is mostly realized as *je* in standard Croatian, but can also be realized as *i* or *e* in the Croatian dialects (*viditi*, *videti*). The *root* (*zelen-*, *vid-*, *star-*) + the thematic suffix *-je-* form the *stem* (*zelenje-, vidje-, starje-* etc.) of the verb.

Research at the Institute of Croatian Language and Linguistics (from 2004 to 2006) has made it possible to collect about 24,000 verbs, of which about 500 belong to the third type. The medium to small quantity of this verb type has prompted detailed semantic analysis through corpus research (Croatian Language Repository) and other sources (web, media, scientific publications). A questionnaire/experiment concerning the third verb type was also carried out with a sample of 50 native speakers (Bošnjak Botica 2011). This research made clear that the third verb type was semantically organized around the prototypical meaning "be or become (X)", which can be directly related to its thematic suffixes (*-je-* in the infinitive > *-i-* in the present).

Verbs that belong to the third type can be divided into two groups or subtypes – (1) verbs with an adjectival root, and (2) verbs with a non-adjectival root. About one half of the non-prefixed *jeti* verbs (125 of them) have an adjectival root. Only the deadjectival subtype is open and productive (although this productivity is very low).

(1)	adjectival root		
a.	$zelen_{adj}$+$je_{them.suff}$+$ti_{inf.suff}$	*zelenjeti*	'to become green', imperf.
b.	po_{pref}+$zelen_{adj}$+$je_{them.suff}$+ $ti_{inf.\ suff}$	*pozelenjeti*	'to become green', perf.
c.	$zelen_{adj}$+$je_{them.\ suff}$+$ti_{inf.suff}$+ se_{clitic}	*zelenjeti se*	'to be green, show oneself as green'
(2)	non-adjectival root		
a.	vid_{noun}+$je_{them.suff}$+$ti_{inf.suff}$	*vidjeti*	'to see'
b.	$pred_{pref}$+vid_{noun}+$je_{them.suff}$+$ti_{inf.suff}$	*predvidjeti*	'to predict'

3. Morphosemantic analysis

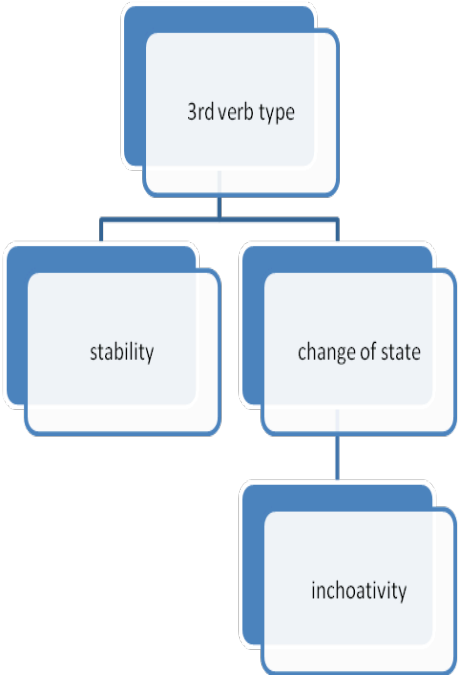
As mentioned above, grammatical (morphological) features like thematic suffixes are not usually related to the lexical meaning of a verb. In Croatian, such a relationship can only be found in these *jeti* verbs derived from adjectives (Babić 2002: 512-513). A certain number of these verbs do have a particular meaning mentioned above. In addition, it is possible to differentiate a few meanings gathered around one overarching concept – STATE. This general concept covers several groups of features (spanning from the most common and productive to the smallest and non-productive): appearance, colour, condition, sensation, emotions, position/motion, sound and meteorology.

(2) Semantic features of the third verb type

a. APPEARANCE: *mršavjeti* 'to lose weight', *ćelavjeti* 'to go bald', *posijedjeti* 'to go grey'
b. COLOUR: *pocrnjeti* 'to tan / to darken', *zacrvenjeti* se 'to turn red', *bijeljeti* 'to turn white'
c. CONDITION: *starjeti* 'to age', *oživjeti* 'to come to life', *zatrudnjeti* 'to get pregnant'
d. SENSATION: *ožednjeti* 'to become thirsty', *ogladnjeti* 'to become hungry', *smrdjeti* 'to stink'
e. EMOTIONS: *voljeti* 'to love', *željeti* 'to want', *stidjeti se* 'to be shy'
f. POSITION / MOTION: *lebdjeti* 'to hover', *visjeti* 'to hang', *vrtjeti* 'to spin',
g. SOUND: *cviljeti* 'to whine', *šutjeti* 'to keep quiet'
h. METEOROLOGY: *daždjeti* 'to rain', *grmjeti* 'to thunder'

The central or prototypical meaning of *becoming* or *being* can be attached to the first four features (APPEARANCE, COLOUR, CONDITION, SENSATION). These verbs have an adjectival root (*deadjectival verbs*) that designates something as being in a particular visible or observable state. Moreover, these features seem to be the only ones that can actually produce new verbs of the third type. Although their number is limited and depends on the available adjectives, one cannot exclude the possibility of creating a new verb. There is, for example, the verb *zatopljeti* 'to become warm', which is a relatively new verb, introduced in weather forecasts (in line with *zahladnjeti* 'to become cold'). One can perhaps imagine verbs such as *ponarančastjeti* 'to become orange' or *rozjeti se* 'show oneself as pink', etc. As we will see further, verbs of colour are very interesting to analyse. Although the majority of verbs in the category of sensation are deadjectival, there are also verbs with non-adjectival roots as well (*boljeti* 'to hurt', *svrbjeti* 'to itch', or *vidjeti* 'to see'). Verbs presenting other concepts belong to the less prototypical (emotions), and peripheral members (position / motion, sound and meteorology) of the third type, and there are very few of these. It may look a bit unusual to put a verb like *šutjeti* 'to be quiet' into the group of SOUND, but we define it as being related to sound (the presence or absence thereof). The same may also be said of the category of POSITION / MOTION, wherein verbs like *letjeti* 'to fly' or *sjedjeti* 'to sit' are placed.

BE and BECOME stand out as the central meanings of the entire type. This is in line with Jespersen's claim about the stability and change of state (Jespersen 1992). The majority of *jeti* verbs are intransitive, aside from a small number of very common verbs expressing emotion or sensations, such as *voljeti* 'to love', *željeti* 'to want', *vidjeti* 'to see'. All deadjectival *jeti* verbs are intransitive and denote either stability or inchoativity.



As can be seen, some of the *jeti* verbs listed above may contain the additional element *se* (*zacrvenjeti se* 'to become red', *stidjeti se* 'to be shy').

In the Croatian language, verbs with the *se* element, whether this is considered a particle or a pronoun, are traditionally referred to as reflexive verbs. However, this category also includes verbs that do not express reflexivity. Such verbs are included because of the formal designation present with every verb – the *se* element. In this paper the *se* element is considered to be only a particle and cannot be treated as a pronoun, which means that it is a

part of the morphological and lexico-semantic structure of the verb, i.e. a part of the verb itself (Sells, Zaenen and Zec 1987, Oliva 2001, Medová 2009, Oraić Rabušić 2013).

Having related the formal (morphological) and semantic features of the third type, the scheme of the morphosemantic analysis is provided in section (3).

(3) Morphosemantic features of the third verb type

a. X_{adjCOL}+***JE***+*ti* to become X

A verb with the thematic suffix *-je-* with an adjectival root that designates a colour means *become* (imperfective, progressive: *žut+je+ti* > *ujesen lišće žuti* leaves turn yellow in the fall) or *become* (perfective, containing a prefix, e. g. po*žutjeti* > *lišće je brzo požutjelo ove godine*, the leaves turned yellow quickly this year).

b. X_{adjCOL}+***JE***+*ti* + ***SE*** being X, to show oneself as X

When a *jeti* verb with an adjectival root designating colour is followed by the clitic *se*, its meaning is *being* or *displaying oneself as* the adjective in the root. Such cases are always imperfective (*žut+je+ti +se* > *lišće se žuti,* leaves are turning yellow) unless they have been prefixed by the prefix *za-* (za*žutjeti se*: 'to intensely become yellow' > *cvijeće se zažutjelo u travi,* the flowers turned yellow in the grass).

The difference between the two prefixed adjectival *jeti* forms (*požutjeti* and *zažutjeti se*) lies in the presence of the clitic *se*, which is obligatory for the prefix *za-* in this case.

c. X_{adjOTH}+***JE***+*ti* to become X

The meaning of other verbs with an adjectival root and the thematic *-je-* is *become* (imperfective: *mršav+je+ti* 'to lose weight' > *mršavim iako dosta jedem*, I'm losing weight even though I eat plenty, or *become* (perfective, containing prefix, e. g. s*mršavjeti*: 'to become skinny, to lose weight' > *od ljeta je namjerno smršavio*, he has intentionally lost weight since summer).

d. *X_{adjOTH}+***JE***+*ti* + ***SE***

Unlike those deadjectival *jeti* verbs concerned with a colour, verbs with other adjectival roots cannot take the clitic *se* unless they are preceded by certain prefixes (*iz-, na-, raz-, uz-, za-*). In such cases, they are no longer imperfective and their meaning is different from 'being, showing oneself as'. This phenomenon is limited to a very few cases (e.g. raz*bjesnjeti se* 'to become enraged') and even then they are almost synonymous with more frequent *iti* verbs (the second verb type in the presented classification) with the same root (e. g. *raz+bjesn+i+ti +se* > *razbjesnili su se kad su vidjeli rezultat*, they became enraged when they saw the result). Thus it can generally be stated that there are no *jeti +se* verbs with an adjectival root other than colour.

From the examples above, we have seen that *jeti* verbs not preceded by prefix are generally imperfective and intransitive, as well as unaccusative.[7] Although few exceptions are evident, deadjectival *jeti* verbs are interesting as an evident example of how morphological devices (the thematic suffix) reflect on syntactic structure (verb valency). In other words, intransitivity may be predicted when the conjugational type is known (its thematic suffix in the infinitive).

[7] For more on this notion, see Levin & Hovav (1995).

Jeti verbs not being derived from an adjective (more peripheral members) are difficult to relate to BE or BECOME. Most of them are intransitive as well, however some can be transitive (e. g. '*voljeti* 'to love', *vidjeti* 'to see').

3.1. Same adjectival root, different thematic suffixes: *jeti* and *iti* verbs

Croatian scholarly literature draws a parallel between *jeti* verbs with an adjectival root and *iti* verbs with the same root in terms of their lexical meaning and, consequently, their syntactic features. A certain number of deadjectival verbs that belong to the third type are paired with second-type verbs (with the thematic suffix *i* in the infinitive and in the present) that share the same root. These *iti* verbs are transitive (causative), denoting 'to MAKE sb/sth X' (third *crvenjeti* 'to go red, to blush', second *crveniti* 'to make sb/sth red; third *izludjeti* – to become crazy, perf., second *izluditi* 'to make sb crazy, to drive sb crazy', perf., third *oživjeti* 'to come to life', second *oživiti* 'to revive sb'). The fact that intransitive and transitive (causative) deadjectival verbs have different forms has been proven in many languages, diachronically and/or synchronically.[8] Croatian language handbooks strongly advise language users to distinguish these verbs according to their form and meaning (by choosing *jeti* for the intransitive BE and BECOME and *iti* for the causative to MAKE sb/sth BECOME or BE). Furthermore, Croatian Neo-Štokavian also has a difference in accent (long rising vs long falling tone) between the present tense of deadjectival *jeti* and *iti* verbs (recorded in the newest school dictionary of Croatian), but several surveys have shown that this is no longer relevant and that their present forms have the same accent.[9]

However, a more detailed analysis of the syntactic structure of deadjectival verbs is beyond the scope of this paper and will be investigated in subsequent research. See more on this topic in Jespersen (1924/1992), Lipka (1982), Levin and Rappaport Hovav (1995), Kjellmer (2001), Rappaport Hovav and Levin (2002).

(4) Morphosemantic features of the deadjectival second verb type

a. X_{adjCOL}+***I***+*ti* > to make/making sth/sb X

Verbs with a colour adjective and the thematic suffix *-i-* in the stem denote TO MAKE/MAKING somebody or something the same colour as the adjective: *žut+i+ti* 'to make sth/sb yellow' > *žutimo uskrsna jaja*; we dye / we are dyeing Easter eggs yellow.

b. X_{adjCOL}+***I***+*ti* + ***SE*** to make oneself X

Verbs with a colour adjective, the thematic suffix *-i-*, and the clitic *se* denote that the subject makes or is making itself the same colour as the adjective or applies / is applying that colour to itself: *žut+i+ti+se* 'to make oneself yellow' > *djeca se žute žutom bojicom*; the children are painting themselves yellow with yellow paint.

c. X_{adjOTH}+***I***+*ti* > to make sth/sb X

Verbs with another adjective and the thematic *-i-* denote TO MAKE/MAKING somebody or something like the adjective in the stem: *o+živ +i+ti* 'to revive sb' > *oživili su pacijenta*; they revived the patient.

[8] E.g. Jespersen's claim about originally different formative elements of intransitive and causative deadjectival verbs from a historical point of view (1927: 165.5, according to Kjellmer 2001: 154).

[9] Some Neo-Štokavian local dialects still keep mentioned difference.

d. X_{adjOTH}+***I***+*ti* + ***SE*** to become X or make oneself X

Iti verbs with another adjective root and the clitic *se* can express the same meaning as *jeti* verbs without the clitic: perf. o+*bogat*+*i*+*ti* +*se* 'to become rich', *obogatio se brzo*; he grew rich quickly, imperf. *sušiti se* 'to dry' > *rublje se suši* 'the laundry is drying'.

e. $X_{non\text{-}adj}$ +***I***+*ti* + ***SE*** to become X or to make oneself X

Unlike non-adjectival *jeti* verbs, non-adjectival *iti* verbs with the clitic *se* can express the meaning of to become (when prefixed) or be, to show oneself as (when non-prefixed), e.g. *umiriti se*, 'to calm down, to become still' > *dijete se umirilo kad je čulo glazbu*, 'the child calmed down when she heard the music'; *sjajiti se* 'to sparkle, to shine' > *na njezinu prstu sjaji se prsten*, 'a ring is shining on her finger'.

The last two examples bring us to the conclusion that the clitic *se* attached to *iti* verbs can express the same meaning as the thematic suffix *-je-*: BECOME or BE. This can explain why **sušjeti* 'become dry', **razveseljeti se* 'cheer up' or **bogatjeti* 'to become rich' have not been attested, while *sušiti se*, *razveseliti se*, and *bogatiti se* have.

Reflexive verbs with the *-i-* thematic suffix have the meaning *to make oneself X* only when there is a counterpart from the same adjectival stem with the *-je-* thematic suffix: *oživiti se* 'to revive oneself' / *oživjeti*; 'to come to life', *izluditi se* 'to make oneself crazy' / *izludjeti* 'to become crazy', *oslijepiti se* 'to make oneself blind' / *oslijepjeti* 'to become blind', *crveniti se* 'to make oneself red' / *crvenjeti* 'to blush', *žutiti se* 'to make oneself yellow' / *žutjeti* 'to become yellow' etc.

When reflexive *iti* verbs do not have equivalents from the same adjectival stem with the *-je-* thematic suffix, their meaning is TO BECOME X: *obogatiti se* 'to become rich', *razveseliti se* 'to cheer up', *ukrutiti se* 'to stiffen' if prefixed, or TO BE X: *veseliti se* 'to rejoice, to be happy', *ljutiti se* 'to be angry' etc. These verbs are not accepted in *jeti* form **obogatjeti*, **razveseljeti se*, **ukrutjeti,* **veseljeti*, **ljutjeti se* etc). Hence, the meaning *to become X* may be expressed by either *jeti* verbs or reflexive *iti* verbs.

A questionnaire on the usage of *jeti* and *iti* verbs was completed by 50 native speakers of Croatian(Bošnjak Botica 2011). The speakers were asked to put the verb into the infinitive form they use daily (first part) and into the form that they believe is preferred by the standard language (second part). The results show that speakers are aware of the morphosemantic relationship BECOME – BE – CAUSE between these two types where deadjectival verb is concerned, but that they choose the phonologically and morphologically less complex form, which is *iti*, in less formal language situations. When asked to put the verb into the preferred form for BE and BECOME the vast majority chooses the *jeti* form.

4. Salient attributes

After analysing the morphosemantic and partially syntactic properties of *jeti* verbs, we can identify the salient attributes that can help us define which *jeti* verbs should be considered a prototype of the third type. These attributes are:

a. imperfectivity

All verbs that belong to the third verb type are imperfective (progressive) unless they are prefixed (except the verb *vidjeti* 'to see', which can be both imperfective and perfective).

b. intransitivity and unaccusativity

Most *jeti* verbs are both intransitive and unaccusative. This means that the subject does not actively initiate the action of a verb, it is not an agent, e.g. *posijedjeti* 'to become gray', *rumenjeti se* 'to blush', *stidjeti se* 'to be shy', etc.

c. adjectival root

We have argued that a new verb can appear with the third type only if it has been derived from an adjective. This makes this type slightly productive (although it has been marked as unproductive in some works, e.g. Dressler et al. 1996). A new verb can be produced either as a new lexical unit (e.g. *poljubičastjeti* 'to become purple') or as an intransitive mate of an existing transitive *iti* verb (e.g. *ozdravjeti* 'to recover' vs *ozdraviti* 'to heal, to cure') in order to morphologically (formally) differentiate between the BECOME and CAUSE meaning.

d. inchoativity

Given that almost all *jeti* verbs denote STATE as their defining (necessary) feature (Hampton 1995), the meaning of BECOME proves to be their characteristic feature ensuring the productivity of the third type in modern Croatian.

Hence, a prototype verb of the third verb type is IMPERFECTIVE (when not prefixed), UNACCUSATIVE, DEADJECTIVAL, and expresses STATE (stability or inchoativity). The prototypical meaning of the thematic suffix *-je-* denotes STATE. Among deadjectival verbs, this meaning can be realized as BECOME (*starjeti*, 'to age') or BE/SHOW ONSELF AS if combined with clitic particle *se* (*crvenjeti se* 'to show oneself as red')

However, a certain number of *iti* verbs (with the thematic suffix *-i-*) can also denote BECOME or BE/SHOW ONESELF AS, especially if they are followed by the clitic particle *se*, e.g. *razveseliti se* 'to cheer up' > *razveselila se kad je ugledala psića*, 'she cheered up when she saw the puppy'. This means that these two devices are at some point synonymous in verb derivation. If a verb already exists in the *iti* form (which is prototypically causative) but can have both a causative and inchoative meaning, it will make its verb pair either by forming a verb with the thematic *je* (*ozdraviti* > *ozdravjeti* **ozdraviti se*[10]) or by adding the particle *se* to its existing form (*sušiti* > *sušiti se* 'to dry' **sušjeti*). As of yet, there is no clear explanation why *-je* is present in some cases and *i+se* in others. What is known for sure is that the clitic *se* is more likely to appear with a non-adjectival root denoting BECOMING, e.g. *urazumiti se* 'to come to one's senses', *hladiti se* 'to cool', *ukipiti se* 'to go rigid' etc. Perhaps these alternations have to do with the prototype construction, which is causative for these verbs: *hladiti* 'to make something cold' and consequently *hladiti se*: 'to make oneself cold' > actually 'to become cold'.

5. Conclusion and future work

This paper attempted to analyse the relationship between the morphological (formal) and semantic properties within one conjugational type in Croatian. About 500 verbs recorded as third verb type members (in this case, *jeti* verbs) were classified into eight semantic fields: appearance, colour, condition, sensation, emotions, position / motion, sound, meteorology. We argued that the prototype verbs of the third type refer to appearance, colour, condition and sensation, and that they are overwhelmingly deadjectival, that fewer prototype verbs refer to

[10] This form *ozdraviti se* could exist as 'make oneself healthy, cure oneself'.

emotions and position / motion, while those verbs denoting a sound or meteorological phenomenon are considered peripheral members of the category and are not related to any adjective. They all denote some sort of state from which BECOME and BE prove to be prototypes for the entire third verb type.

We demonstrated how morphological devices, i.e. inflection, can change the verb from unaccusative into causative form and *vice versa* by choosing a certain thematic suffix (*-je-* or *-i-*). In other words, this thematic suffix has morphosyntactic value.

Deadjectival *jeti* verbs and deadjectival *iti* verbs form inchoative-causative verb pairs, which will be further investigated, as will be the distribution of *jeti* and *iti+se* constructions.

The third verb type demonstrates more prototypical morphological form than the second verb type, and evinces a more prototypical meaning.

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Lexical parsability and morphological structure

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1. Introduction

A classical tenet in the psycholinguistic literature on the mental lexicon is that parsed affixes are associated with independently activated access units that tend to spread activation to other affix-sharing words, and that activation levels strongly correlate with the affix productivity. A number of influential papers (Hay 2001, Hay and Baayen 2002, Hay and Plag 2004) suggested that parsability criteria interact with frequency to define morphological productivity and word structure constraints in the lexicon. For example, the frequency of a derivative (e.g. *government*) relative to its base (*govern*) is shown to be a good predictor for parsability/productivity. The higher the base/derivative frequency ratio is, i.e. the higher the frequency of a base *relative* to the frequency of its derivative, the more likely the morphological structure of the latter to be perceived, and the associated affix to be used productively.

One model which posits an explicit connection between parsing and productivity is Baayen's (1993) dual processing race model of morphological access, where the full form of a morphologically complex word such as *government* is represented as a one-unit access representation, together with units corresponding to its constituent parts (*govern* and *-ment*). Upon presentation of *government*, both the whole-word and compositional representations compete for activation, as a function of i) contextual information of previously activated units (priming), and ii) how often the units have been activated. In the absence of strong contextual effects, if the frequency of *government* is greater than that of *govern*, then the unit corresponding to the former will reach a critical selection threshold quicker, and will be used as an access representation. Accordingly, *government* is accessed as a whole. In a competition between units corresponding to *dazzle* and *dazzlement*, on the other hand, decomposition will get the upper hand, due to the greater frequency of *dazzle* over *dazzlement*. On average, for *-ment* to remain productive, words containing it must be parsed sufficiently often. In this way, the resting activation level of that affix (i.e. the level of activation at which the affix unit starts its race for reaching the selection threshold) remains high, thus conferring it a significant advantage over other possible competitors (whose starting point is lower). In this way, the model posits a strong connection between productivity and decompositional parsing in perception. High rates of decompositional access ensure the productivity of an affix. Conversely, an affix which is contained by many words accessed as a whole is unlikely to be productive.

To capture the fact that words encountered frequently have different lexical properties from words encountered relatively infrequently, all models must assume that accessing a word in the mental lexicon in some way affects the access representation of that word. However, in all these models, access representations are assumed to be about given symbolic objects, which are part and parcel of the training environment, with no or little questioning of their developmental history. Now, for *government* to be mapped onto two access units (*govern* and *-ment*), the units must be perceived and stored independently. This does not only imply a parsing stage, for the input word *government* to be split into its parts and mapped onto the corresponding access units. It also presupposes an alignment between, say, the lexical representations of *government* and *dazzlement*, for them to be perceived and recoded in terms of partially overlapping (access) representations. This point holds no matter whether one is willing to endorse a direct access model for lexical representations (with no mediation of peripheral, modality-specific access units, as proposed by Marslen-Wilson and Zhou (1999), or a mediated access model of lexical access (Forster 1976, Caramazza et al. 1988, Baayen et al. 1997). The correlation between frequency of input forms and

perception (or lack of perception) of their structure, shows that it is not possible to decouple representations from the processing operations defined over representations. Access representations in the lexicon differ exactly because they are differentially processed in serial perception and storage.

2. Lexicon, memory and inflection

The connection between frequency and perception has been the focus of intense investigation in the literature on working memory (Gathercole and Baddeley 1989, Papagno et al. 1991), which studies the human ability to recode and retain sequences of linguistic items (e.g. letters, segments, syllables, morphemes or words). Items that are frequently sequenced together are known to be stored in long-term memory as single chunks, and accessed and executed as though they had no internal structure. This increases fluency, eases comprehension and also explains the possibility to retain longer sequences in short-term memory when familiar chunks are presented, see Cowan (2001). Even more interestingly for our present concerns, parts belonging to high-frequency chunks tend to resist being perceived as autonomous elements in their own right and being used independently. In the present paper, we set out to develop the connection between processes for short-term and long-term storage and aspects of morphological organisation in the mental lexicon.

Memory processes for serial cognition are helpful in establishing the explanatory link between the developmental course of word memory traces in the mental lexicon and their organisation and role in word perception, access and productivity. In particular, we intend to illustrate here how frequency yields the "wholeness" effect, why frequently-used words compete with members of their own lexical families (such as inflectional or derivational paradigms) and why they tend not to participate in larger series of paradigmatically homologous words (*government*, *department, argument* etc.). With this purpose in mind, we will make use of Temporal Kohonen's Self-Organising Maps (TSOMs) (Koutnik 2007, Ferro et al. 2010; 2011), which define a class of unsupervised artificial neural networks mimicking the behaviour of small aggregations of neurons in the cortical areas involved in the classification of sensory-motor data. In TSOMs, processing consists in the serial activation of specific memory nodes upon presentation of a particular time sequence of input stimuli. Through repeated exposure to such sequences, nodes get specialised for both nature and context of each stimulus, with temporal connections between consecutively-activated nodes defining the map's expectation for an incoming stimulus. TSOMs provide a general framework for putting algorithmic hypotheses of the processing-storage interaction to the empirical test of a computer implementation. Unlike classical perceptron-like neural architectures trained on back-propagation, they allow scholars to entertain a truly emergentist view of morphological competence, based on a number of realistic assumptions concerning acquisition of word structure. In the ensuing section, we focus on a few implications of this view from the perspective of lexical representations.

3. Emergent lexical representations

Emergentist, associative views on the (morphological) lexicon, see Bybee (1995), Bates and Goodman (1999), Burzio (2004) among others, treat word forms as primitive units and their recurrent parts as derivative abstractions over word forms. According to this perspective, full forms constitute the basis for morphological processing, with sub-lexical units resulting from the application of morphological processes to full forms. Morphology acquisition amounts to learning the relations between fully-stored word forms, which are concurrently available in the speaker's mental lexicon and jointly facilitate processing of morphologically-related forms.

In a network-based interpretation of the associative view (Bybee 1995) word forms sharing meaning components and/or phonological structure are associatively connected with one another, as a function of formal transparency, item frequency and size of morphological family (Fig. 1). In the figure, phonological transcriptions of a few Italian verb forms are assumed to be stored

independently, with shared sound sequences being mutually linked through associative connections. Dashed lines represent connections between words that are only formally similar, and solid heavier lines represent connections between words that are both formally and semantically similar. Hence, different forms of the same verb (paradigmatically-related forms) and forms sharing the same inflectional ending (paradigmatically homologous forms) are connected through solid lines, with nodes corresponding to shared endings being highlighted in grey. Similar-sounding words are connected by dashed lines only.

According to Bybee, the strength of lexical connections is affected by frequency. High-frequency word forms have greater lexical autonomy, i.e. their lexical connections with other morphologically related forms are weaker. Hence, the strength of a pattern is inversely proportional to the number of times a particular sequence (a full form, a stem or an affix) instantiates the pattern. On the other hand, the strength is directly proportional to the number of different contexts where the sequence is found, i.e. to the number of outgoing connections leaving a particular node, or a particular sequence of nodes, entering the pattern (see for example, the number of connections emanating from the inflectional ending *-o* in *vengo*, *tengo* and *temo*).

Figure 1: A network-based model of an associative lexicon containing a few Italian verb forms. The network represents 3 forms of the verb VENIRE 'come' (*vengo* 'I come', *vieni* 'you come' and *vengano* 'they come' subjunctive), 2 forms of the verb TENERE 'keep/hold', and the form *temo* 'I fear'. Verbs are provided in phonological transcription (adapted from Bybee 1995).

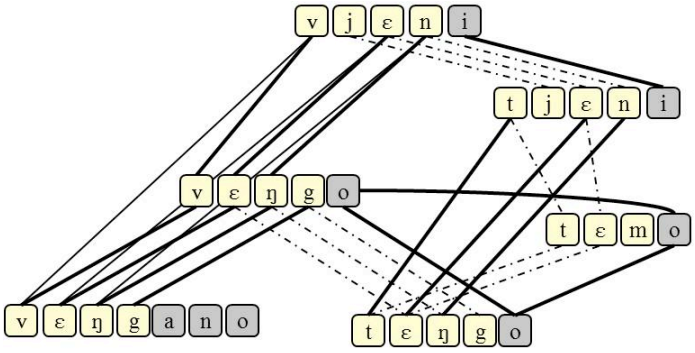
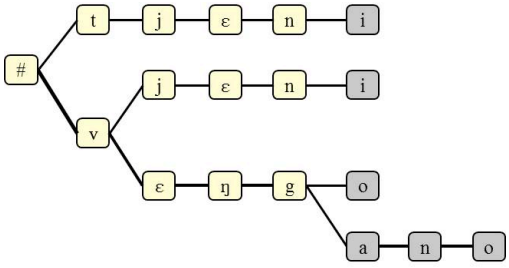
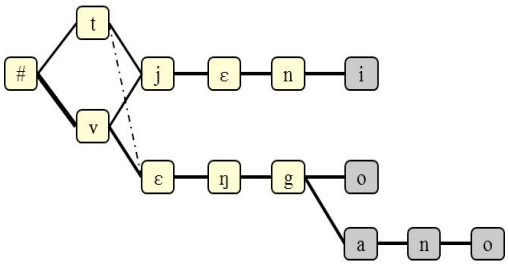


Figure 2: A tree-based (a) and a graph-based (b) representation of four phonologically transcribed Italian verb forms

a)



b)



The tree-like representation of concurrently-stored forms in Fig. 2a exemplifies a different type of data structure. Redundant patterns are represented by shared chains of connected nodes, where nodes stand for basic representational units (e.g. letters or sounds), and directed (rightwards) arcs link two consecutively occurring units. In a probabilistic interpretation of a word-tree, the strength of each connection reflects how often the units corresponding to connected nodes are seen one after the other. Hence, a high-frequency form tends to develop a chain of strongly connected nodes. The strength of connections defines the level of entrenchment of a form in the lexicon and can be interpreted dynamically as the conditional probability with which a particular form is expected to occur, when an increasingly longer part of the word is perceived. In the tree, word forms belonging

to the same paradigm (say *vengo* 'I come' and *vengano* 'they come' subjunctive) share a chain of nodes representing the common stem. The chain bifurcates upon encountering different inflection suffixes (*-o* and *-ano* respectively). In a tree, any two forms never meet again after the first bifurcation point. Traversing a tree-like representation of the lexicon, from its start-of-word symbol ('#') down to the leaf of any particular branch, simulates the process of progressively narrowing down the range of lexical entries sharing the same onset, until a point is reached where only one alternative remains available, in the spirit of cohort models of lexical access (Marslen-Wilson 1987). Fig. 2b depicts yet another data structure for the same set of forms. Whenever possible, separate branches may converge as the result of two words sharing the same tails (e.g. *vieni* 'you come' and *tieni* 'you hold'). The structure allows any node to be reached by more rightwards connections at the same time. This produces a considerable reduction in the number of nodes needed to represent a set of morphologically-related words.

In previous work (Marzi et al. 2012a; 2012b), we showed that TSOMs dynamically simulate self-organisation processes leading to the data structures of Fig. 2. To better understand the relationship between frequency, entrenchment, morphological parsability and productivity in these processes, we need to know more about the use of TSOMs as models of lexical storage and processing. It is important to emphasise at this stage that the main difference between the lexical network in Fig. 1 and the data structures of Fig. 2 lies in the way associative relations are modelled. Tree-like and graph-like structures make use of lexical connections between consecutively occurring units to model both entrenchment of individually stored forms and associative relations between concurrently stored forms. On the other hand, network models resort to two different mechanisms (lexical entrenchment and lexical association) to account for the inverse correlation between frequency and lexical productivity. A graph-like approach is more in line with recent theoretical models of emergent lexical organisation, e.g. Burzio (2004) and neuro-functional architectures of the language processor, e.g. Catani et al. (2005), which blur the distinction between storage and computation, along with the dichotomy between morphological representations and morphological rules. We will return to these points in the concluding section.

4. Self-organising maps for lexical storage and processing

A TSOM is a grid of topologically-arranged memory nodes trained to selectively respond to classes of input stimuli occurring in specific temporal contexts (Pirrelli et al. 2011). Neighbouring nodes on a TSOM are activated by similar input stimuli, where similarity reflects the nature of the stimulus and its time-bound distribution.

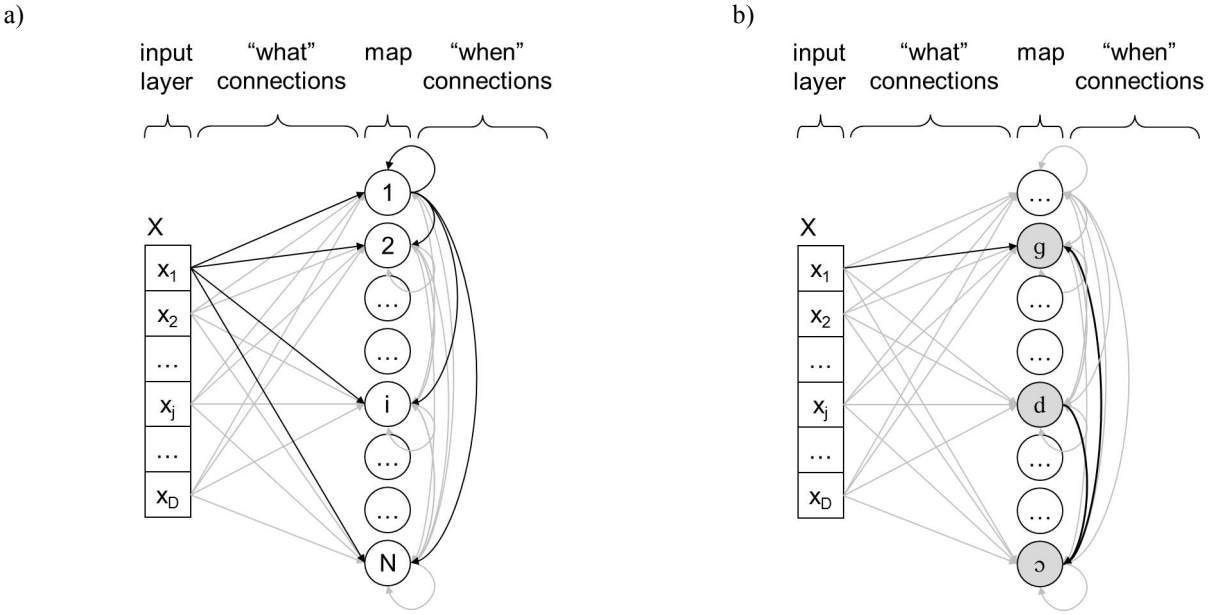
Each map node receives information from an INPUT LAYER, representing the most peripheral level of input encoding (see Fig. 3a). "What" connections define the communication channel between the input layer and the map proper. On top of that, each map node communicates with any other node through pre- and post-synaptic weighted connections, referred to in Fig. 3a as "when" connections. TSOMs define an interesting class of artificial neural architectures for simulating processes of lexical organisation.

4.1 Recoding

At an appropriate level of abstraction, word forms consist of temporal sequences of sensory stimuli. The lexical form /'dɔg/, for example, can be input to a TSOM as a time-bound signal, made up out of three segments presented at consecutive time steps. At each step, the most highly activated node responding to the current stimulus (or *Best Matching Unit*, hereafter BMU) is selected as the "winner" and represents the map's response to the stimulus. After presentation of the form /'dɔg/, the map will have selected three different winners (BMUs), one at each time step. The resulting CHAIN of BMUs represents the way the temporal stimulus /'dɔg/ is RECODED and perceived by the map (Fig. 3b). Input recoding is thus based on the integrated pattern of node activation resulting from exposing a TSOM to an input word. At this level, the map caches recurrent processing steps

through memory nodes, and it uses them over again whenever possible. Hence, recoding lies at the core of the map organisation. Stimuli that have been processed by identical or neighbouring nodes will be recoded through identical or neighbouring nodes. Patterns of node activation thus give information about how close two stimuli are processed and eventually stored by a TSOM.

Figure 3: a) outline architecture of a TSOM; b) an activation chain at time step 3, after the last segment /g/ of /'dɔg/ is input to the TSOM.



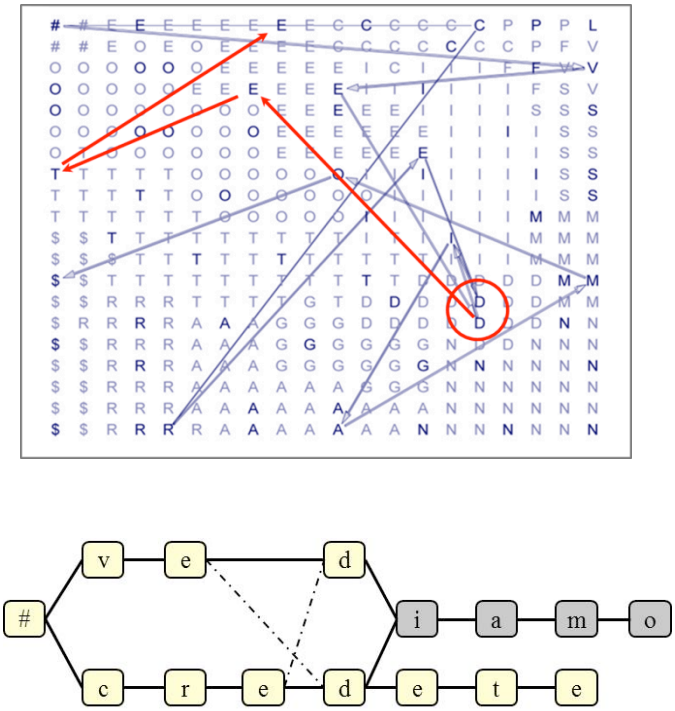
4.2 Training

Unlike nodes in feed-forward back-propagation neural networks, map nodes are not pre-wired to respond to specific classes of stimuli. In fact, recoding is the end result of training a TSOM on a representative set of stimuli (e.g. a sample of inflected verb forms with their frequency distribution in a reference corpus).

Training consists in showing the map one input form at a time, each sampled according to its distribution. All forms are sampled in one training epoch and the process is repeated over again for several epochs (e.g. 100). During training, nodes that respond most strongly to specific stimuli (BMUs) get increasingly attuned to the distinctive features of those stimuli. Since nodes are sensitive to both the nature of an input stimulus (e.g. the acoustic features of the sound /g/ in /'dɔg/) and its temporal context (the fact that the sound occurs in word final position, or it is preceded by a vowel), a TSOM is likely to develop many different nodes for the same stimulus, with each node being specialised to respond to a particular contextual realisation of the stimulus.

When one node is selected as the current BMU, its connections are adjusted. "What" connections become closer to current values on the input layer (Fig. 3b). At the same time, "when" connections between the current BMU and the BMU at the immediately preceding time step are strengthened. Since the overall activation level of a map node is the summation of input activation (flowing from the input layer through "what" connections) and context activation emanating from the previous BMU (through "when" connections), an adjusted BMU will be more likely to win over again when the same stimulus is presented to the map in the same context. Due to this training dynamic, selective specialisation of nodes is the natural bias of a TSOM. Other things being equal, a TSOM tends to structure the lexicon as a word-tree (Fig. 2a).

Figure 4: BMU activation chains for *vediamo-vedete-crediamo* on a 20×20 map (top) and their word-graph representation (bottom).



4.3 Redundancy in a lexical TSOM

However, things are not always equal. Concurrently stored forms may compete for the same pool of memory nodes due to the interplay of several factors: i) amount of available memory resources; ii) "wordlikeness" (i.e. amount of shared formal redundancy) of input words; iii) frequency of input words; iv) plasticity of the map. If an input word is not wordlike, i.e. if it consists of a sequence of symbols which is not typical of (many) other words in the lexicon, it is more likely to activate dedicated nodes. If a wordlike input word is shown to a TSOM only occasionally, it will fail to develop dedicated nodes. Conversely, high-frequency words have a tendency to develop diverging branches of nodes. Finally, plasticity defines the map's readiness to adjust connection weights. During training, the map loses its plasticity, so weights are adjusted less and less adaptively as training progresses.

Figure 4 shows two activation chains for the Italian verbs *crediamo* ('we believe') and *vediamo* ('we see') on a 400-node TSOM trained on Italian inflected verb forms. On the map, each node is labelled with the symbol (letter) the node responds most strongly to. Solid lines represent Hebbian connections linking consecutively activated BMUs. The two chains thus describe the path the map goes through upon recognising the two input words, one letter at a time. The paths are more distant on the roots *cred-* and *ved-*, and tend to converge topologically as soon as more letters are shared by the input forms. Eventually, the substring *-iamo* activates the same BMUs. A more symbolic representation of the two chains is offered by the directed word graph (Fig. 3, bottom), where vertices correspond to map nodes, and arcs stand for "when" connections. It can be shown (Marzi et al. 2012b) that co-activation of a pool of BMUs by morphologically-related input words i) reflects the extent to which the map perceives their formal relationship and ii) is a logical precondition to morphological generalisation.

5. The dynamic of word acquisition

To address issues of frequency, productivity and developmental acquisition, we ran two experiments. In the first experiment, we intended to investigate the interconnection between time of acquisition and frequency distribution of inflectional paradigms. In particular, we wanted to understand to what extent word frequency affects acquisition, and what is the role of the relative frequency distribution of forms belonging to the same paradigm in the acquisition of the whole paradigm. In a second smaller-scale experiment, we used artificial "mini-paradigms" to explore the incremental behaviour of paradigm cells with respect to issues of morphological generalisation. The experiment was intended to understand the dynamic of inter-paradigmatic COACTIVATION of paradigmatically-homologous forms as an explanatory basis for morphological productivity.

5.1 Experiment 1: the time-course of paradigm acquisition

The time-course of lexical acquisition is known to be affected by several factors, ranging from word length, word frequency and time of acquisition, to wordlikeness, perceptual salience and even emotional valence. From a memory-based perspective, it makes sense to focus on a few low-level, pre-theoretical and even pre-morphological factors influencing this dynamic. We suggest taking this perspective seriously for several reasons: it is open to computational and algorithmic investigation, it focuses on some founding, cognitively-grounded factors which have extensively been explored in the relevant literature, and it allows establishing a more direct connection between behavioural evidence and neuro-functional aspects of word processing. For this purpose, we first monitored the time course of acquiring a representative sample of realistically-distributed German verb forms, to establish their epoch of acquisition. We then compared this time-course with another artificially-induced time-course of the same forms, under the assumption that forms were presented to a map with a uniform frequency distribution (as opposed to real corpus-based distributions).

5.1.1. Materials and methodology

We selected from CELEX (Baayen et al. 1995) the top 50 high-frequency German verb paradigms. From each paradigm belonging to the original sample, we extracted 15 inflected forms including the full set of present indicative and praeteritum forms, the past participle, the infinitive and the present participle. All forms were encoded as strings of capitalised letters, starting with '#' and ending with '$'. Umlauted characters were encoded as lower-case digraphs (e.g. '#HoeREN$' for *hören*) and the sharp s 'ß' as 'ss' (e.g. '#HEIssEN$' for *heißen*). In both cases, pairs of lower-case letters are processed as one symbol. All letters were encoded on the map's input layer as mutually orthogonal binary vectors.

Each input word was administered to a TSOM one letter at a time, with "when" connections being reset upon presentation of '#'. We experimented with two training regimes. In one regime, input forms were administered according to a function of their frequency distribution in CELEX, to simulate more realistic conditions of input exposure. In the second regime, all forms were shown to the map the same number of times (5 each). We trained 5 different maps under each training regime for 100 epochs. Finally, we compared the behaviour of the two groups of maps (realistically-trained maps vs. uniformly-trained maps) on two tasks: word recognition and word recall.

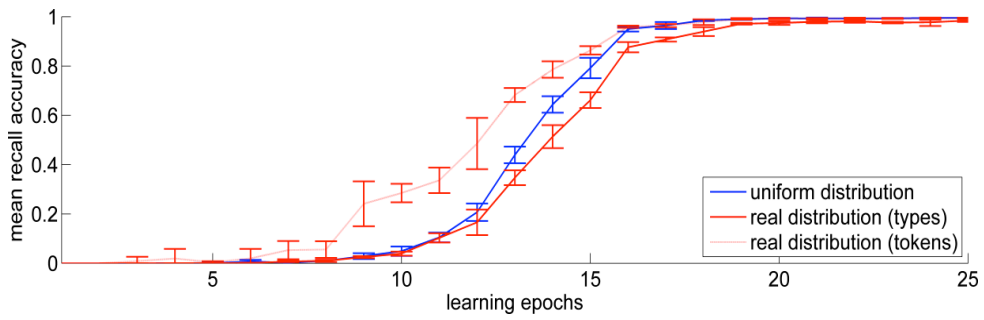
Word recognition consists in recoding an input form as an activation chain of BMUs over the map. Errors occur when an input letter activates a BMU associated with a different letter. An input word is recognised correctly if each BMU in the activation chain is correctly associated with the current input letter. Word recall simulates the reverse process of retrieving a sequence of letters from an activation chain of BMUs. This is achieved through spreading of activation from the start-of-word node ('#') through the nodes making up the activation chain. At each time step, the map outputs the individual symbol associated with the currently most highly-activated node. The step is repeated until the node associated with the end-of-word symbol ('$') is output. Errors occur when

the map misrecalls one or more symbols in the input string, by either replacing it with a different symbol or by outputting correct symbols in the wrong order. Partial recall, i.e. the correct recall of only a substring of the target word (say '#GEB$' for '#GEBE$'), is also counted as an error. Due to the dynamic interplay between short-term processing (recognition) and long-term storage (acquisition), for a word to be recalled accurately, it must first have been recognised accurately. Hence, correct word recall tend to take place a few epochs after correct word recognition.

5.1.2. Results

Figure 5: a) the time course of lexical acquisition of realistically distributed (red line) vs. uniformly distributed (blue line) lexical forms; results are provided for both type (solid lines) and token counts (shaded line) as a fraction of all input words (recall accuracy); b) average frequency of correctly recalled words by learning epochs; c) average length of correctly recalled words by learning epochs. Counts are averaged over the 5 instances.

a)



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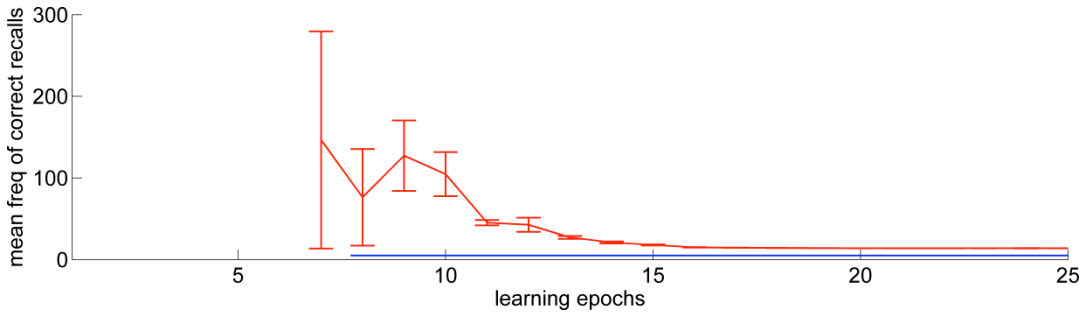

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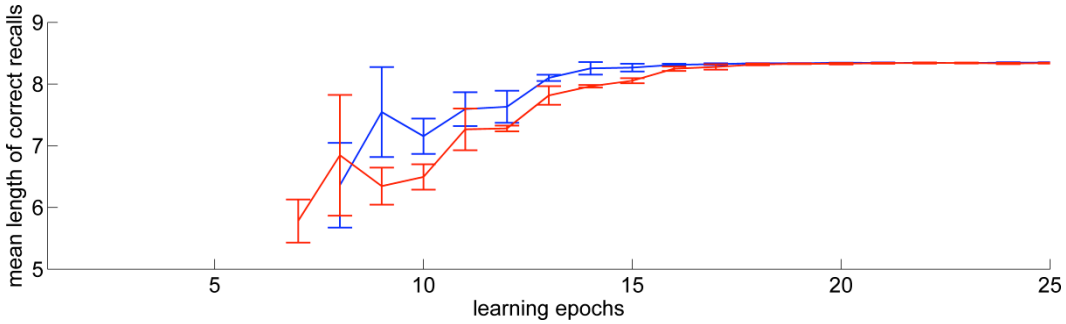


Fig. 5a plots the incremental time course of word acquisition for the two groups of TSOMs: the realistically-trained and the uniformly-trained maps. For any given word form, we define its time of acquisition by a TSOM as the first epoch starting from which the form is RECALLED correctly. Unlike word recognition, which mostly depends on the current input stimulus, word recall entirely depends on internal recoding, and requires that fine-grained information about the nature and timing of each symbol is stored in the internal state of the map. The plot shows how many words are acquired at each epoch, as a fraction of all input words. Hence, unity means that all input words were acquired (by being recalled correctly). Counts are averaged over the 5 instances of each group, with standard deviation represented by whiskers.

Results are shown by both TYPE and TOKEN frequency. By counting types, we consider the number of different forms[1] that are accurately recalled at each epoch, and divide the number by the total number of different forms used for training (750). By counting tokens, we consider the number of times all forms that are recalled at each epoch appear in the training set (as a function of their frequency distribution in CELEX), divided by the overall number of times the map is exposed to all words (10,286). For the realistically-trained map group, we show results by both type and token frequency counts. Clearly, for the uniformly-trained map group, type and token results coincide.

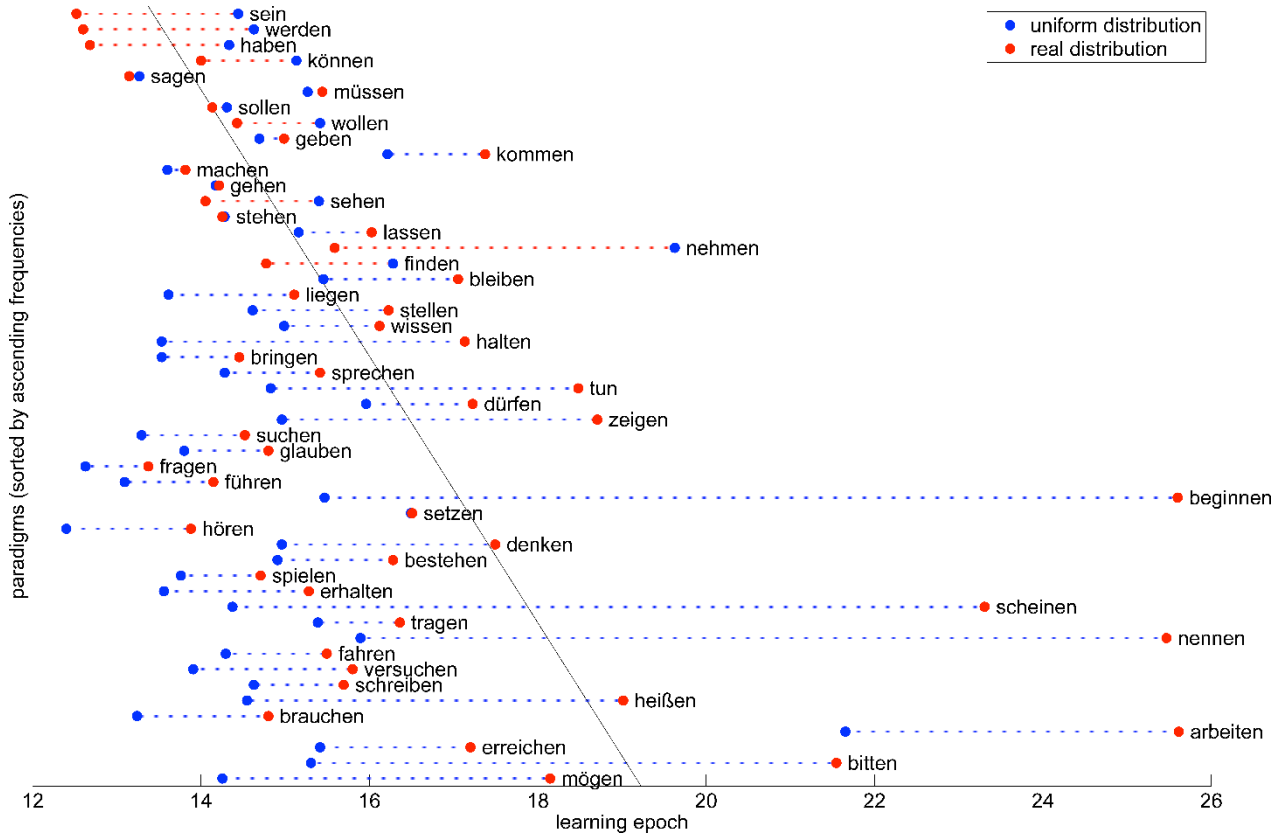
Note that the realistically-trained group acquires word types more slowly than a uniformly-trained group does, particularly in the 10-15 epoch range, suggesting that there is a statistically significant advantage ($p < 0.005$ at epoch 30) in having all forms presented an equal number of times during training. This reflects a learning bias of TSOMs. The training algorithm minimises the most frequently repeated mismatches between an input stimulus and its internal recoding. Thus, a map trained on realistically-distributed data tends to acquire first those forms that happen to be encountered more often, while "neglecting" less frequent words, as shown by the mean frequency of correctly recalled forms at each epoch (Fig. 5b). This also negatively correlates with word length (Fig. 5c), with longer words being learned comparatively later than shorter words. Due to the inverse correlation between word frequency and word length in the lexicon (more frequent words are generally shorter than less frequent words), maps trained on real distributions tend to consistently acquire shorter words across learning epochs than uniformly-trained maps do.

In TSOMs, words are not memorised as isolated wholes and word surface frequency is not the only frequency factor affecting acquisition and lexical organisation. A TSOM is also demonstrably sensitive to the frequency of sublexical patterns, i.e. strings that are shared by more words. As a general trend, high frequency words are learned first, and low-frequency words that share some recurrent patterns with high-frequency words are learned more quickly than isolated words. The role of formal redundancy in lexical acquisition is clearer when word frequency distributions tend to be uniform or strongly balanced. When most input words are presented equally often, the map will tend to memorise frequently-occurring sublexical patterns first. We can say that a map trained on a uniform distribution of forms puts a premium on general patterns of formal redundancy, thus memorising words by regularity rather than by frequency. Although the notions of regularity and frequency are often correlated in the lexicon (e.g. regular patterns are systematically repeated both intra- and inter-paradigmatically in regular paradigms), there are cases, such as highly frequent but paradigmatically isolated inflected forms, where this correlation is reversed. As a result, irregular paradigms (i.e. paradigms containing many alternating stems) would be harder to learn if they were distributed uniformly. This is clearly shown when we move from the time course of word acquisition to the time course of paradigm acquisition.

For each paradigm, we define its time of acquisition by a TSOM as the mean epoch at which all forms of the paradigm are RECALLED correctly. Mean acquisition epoch of a paradigm thus provides an estimate of the average time it takes for all forms of the paradigm to be recoded in a time-sensitive way, and be recalled accurately from their corresponding activation chains. In Fig. 6, we plotted the acquisition time of each German verb paradigm over both training conditions, CELEX-based distribution (red dots) and uniform distribution (blue dots). On the vertical axis, paradigms are ordered by ascending frequency values. The black line interpolates red dots, regressing frequency ranks on acquisition epochs in the realistic training condition, and showing an inverse correlation between paradigm frequency and time of acquisition. A brief inspection of the graph confirms what we observed for individual words. In the vast majority of cases, paradigms are acquired more rapidly when they are presented with a uniform frequency. A closer look reveals that only a few high-frequency highly irregular paradigms (e.g. SEIN, WERDEN), whose alternating stems are extensively attested, show an advantage in the skewed training condition. We shall return to this point in the general discussion.

[1] For our present purposes, homographic forms instantiating different paradigm cells (e.g. *geben*) are counted as distinct word types.

Figure 6: Mean acquisition time of paradigms ranked by ascending frequencies in the CELEX-based training condition. Blue dots represent averaged acquisition epochs in the uniform training condition, and red dots averaged acquisition epochs in the CELEX-based training condition. The black line interpolates red dots only, showing an inverse correlation between paradigm-frequency and learning epoch.



5.2 Experiment 2: the role of frequency in word parsability and productivity

Experiment 1 shows some non trivial aspects of the learning dynamic of a complex inflectional system. We observed that high-frequency words are learned first, as well as high-frequency paradigms. However, the vast majority of paradigms (and the totality of regular paradigms), are learned more efficiently under a uniformly-distributed training regime. We suggest that this behaviour is due to uniformly-trained TSOMs being able to organise recoded words in a deeply interconnected network of associations, where more nodes are shared and connections are less deeply entrenched.

A more entropic map should be in a better position to generalise to unknown words. To understand more about this dynamic, we ran a second experiment using artificial mini-paradigms, small collections of abstract letter strings whereby we can control the considerable complexity of learning a real paradigm-based inflectional system by making simplifying assumptions on the nature of the training set.

5.2.1. Materials and methodology

A 64 node map was trained on the same artificial data set, with four different training regimes, as illustrated in Table 1 below.

Table 1: Frequency distributions of two artificial mini-paradigms in four different training conditions

paradigm id	items	Frequency			
		condition 1	condition 2	condition 3	condition 4
1	#BDY$	5	100	5	5
1	#BDZ$	5	100	5	5
1	#BDX$	0	0	0	0
2	#ADZ$	100	100	5	5
2	#ADX$	100	100	5	100
2	#ADY$	0	0	0	0

The training set consists of two artificial mini-paradigms: {#BDY$, #BDZ$, #BDX$} and {#ADZ$, #ADX$, #ADY$), each including two attested forms and one unknown form (training frequency = 0). There are two uniformly-distributed training sets (conditions 2 and 3), and two skewed ones (conditions 1 and 4). In condition 1, forms are distributed evenly within each paradigm, but with different frequencies across paradigms. In condition 4, there is a difference in the frequency distribution of the two paradigms (totalling respectively 10 and 105 tokens), and a difference in the distribution of paradigm members (5 and 100) for one of the two paradigms.

A 64 node map was trained for 100 epochs on each regime 10 times, with the same input protocol of Experiment 1. Eventually we examined the behaviour of 40 trained TSOMs. Each map was then tested on word recall for both attested (training) and non-attested (test) word forms. Results are aggregated and averaged by the four conditions of training.

5.2.2. Results

On average, uniformly-distributed paradigms (training conditions 2 and 3) reach a stable acquisition state at epoch 7.3 and generalise to unknown forms at epoch 7.5. Their per-form dynamic through learning epochs is remarkably similar, in spite of their considerable difference in terms of absolute frequencies. Although, in training condition 2, forms are presented 100 times each, compared with 5 times each for training condition 3, their averaged learning curve is almost indistinguishable. This observation confirms the hypothesis that absolute frequencies are not as important as relative frequencies are, and provides further support to the idea that learners are more sensitive to entropy-based effects than to mere frequency distributions Moscoso et al. (2004).

Unevenly-distributed paradigms (training conditions 1 and 4) get to a stable acquisition state between epoch 7 and epoch 7.3 on average, but generalise statistically significantly later: at epoch 8. Although data are fairly preliminary, due to the small scale of this experiment, they confirm that frequency is certainly helpful for entrenchment, but it is less conducive to generalisation. Competition is the most powerful determinant of this frequency-based dynamic, as shown by the rate of acquisition of individual forms in low-entropy vs. high-entropy paradigms. The form #ADX$ which is presented 100 times in both training conditions 1 and 4, is learned more quickly and more consistently when it is in the company of a low-frequency (rather than high-frequency) paradigm member (#ADZ$). But although #ADX$ is acquired more rapidly in a less competitive context, the overall paradigm of #ADX$ is acquired more slowly than in the other, more competitive condition. This is because the rapid consolidation of a deeply-entrenched chain eventually hinders consolidation of other lower-frequency forms of the same paradigm.

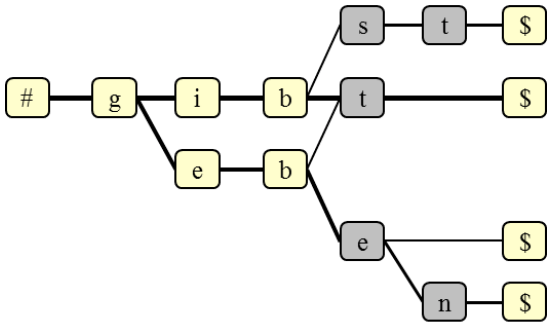
Note that the crucial contrast condition in frequency distribution is provided WITHIN each paradigm, rather than ACROSS paradigms, suggesting that there is competition between members of the same paradigm. This is confirmed when we look at the rate of acquisition of #ADX$, which also affects the developmental dynamic of generalisation to #BDX$, a test form belonging to a different paradigm. #BDX$ can in fact take advantage of the early consolidation of #ADX$ in long-term memory, exploiting the final part of its chain (-DX$). On the other hand, it is more difficult for a paradigm dominated by a high-frequency form, to generalise to novel forms.

6. General discussion

Frequency is the most powerful determinant of storage: highest-frequency forms are the first ones to be learned. However, since all words are concurrently engaged in the "acquisition race", what matters is the ranking of competitors by frequency, rather than their absolute frequencies. In the end, the relative distribution of frequencies shapes both topological organisation and time course of acquisition.

Frequency reverberates on all levels of lexical organisation. There are frequency effects for individual words, as well as frequency effects above the word level (e.g. inflectional paradigms), and below the word level (sublexical patterns). There is a hierarchy of frequency effects, which has far reaching consequences on the time course of lexical acquisition. It is important to appreciate that what favours entrenchment on one level can be a detrimental factor on another level. This is due to the effects of frequency on memory entrenchment, and to the effects of entrenchment on the organisation of stored words.

Figure 7: A graph-based representation of the present indicative forms of German GEBEN ('give'), Thicker arcs represent stronger associative connections and can be interpreted probabilistically as expectations on incoming stimuli.



Generally speaking, entrenchment is known to favour individual access and holistic perception, and disfavour coactivation (spreading of activation to other neighbouring forms) and perception of internal structure. Our simulations provide a possible explanatory mechanism of this effect and an account of its impact on paradigm acquisition. The deeply-entrenched activation chain associated with a high-frequency form will tend to attract other forms of the same paradigm (to the extent they share the same stem). This is detrimental for acquisition of other forms of the same paradigm, either by exposure o by generalisation. Fig. 7 illustrates the graph-based organisation of a fraction of the paradigm of German GEBEN on a map trained on CELEX-based frequencies. In CELEX, the form *gibt* (3rd person singular) is considerably more frequent than any other member of its own paradigm. The immediate effect of the early entrenchment of *gibt* is to strongly attract other forms of GEBEN, which "parasitically" exploit its activation chain. However, this makes acquisition of these forms more difficult in the end, since the map develops a strong expectation for one particular ending (present indicative, 3rd person singular) and perceives other endings as far less likely to occur. In both word recognition and recall, deeply-entrenched chains are more difficult to be abandoned once they are activated.

In low-entropy inflectional paradigm, few forms recur highly frequently, followed by some medium-frequency forms and a long tail of low-frequency words. Accordingly, high-frequency forms are learned at early epochs, followed by lower frequency forms that can benefit from this early acquisition by exploiting the activation chains developed by their predecessors. But the role of path-breaking high-frequency forms may have a cost for learning. At the beginning, the map devotes most resources (in terms of number of nodes and connections) to memorise them. After this initial stage, it takes longer for the map to restore a balance and make room for other low-frequency items. The main effect of this dynamic is that unevenly distributed word paradigms are learned

more slowly, since they require a redistribution of memory resources to make room for lower-frequency members. The more low-frequency items are there to be learned, the longer it will take for resource reallocation to restore the balance. This general trend is confirmed by the time course of the 50 (partial) German paradigms in Experiment 1, showing a clear advantage in the learning race for uniformly-distributed paradigms.

Morphological (ir)regularity interacts with this dynamic in interesting ways. In German verb inflection, morphologically strong verbs can exhibit extensive stem alternation (e.g. *geben*, *gibst*, *gab*, or *finden, fand, gefunden*). If frequencies are uniformly distributed, then stem alternants are learned more slowly, with a prolonged period of over-generalisation. On the other hand, irregular alternants are usually preserved by their relatively high token frequency. Hence, there may be an advantage in learning unevenly-distributed paradigms if they happen to contain high-frequency alternating stems, as shown by the comparatively small group of high-frequency paradigms in the top left corner of the regression plot of Fig. 6.

On the other hand, regular paradigms always benefit from uniform distributions. Since all forms of a regular paradigm share the same default stem, all of them will contribute to a rapid consolidation of the corresponding activation chains. Under the hypothesis of a uniform distribution of these forms, the map will develop these chains concurrently, in a smooth, incremental way. Hence, such a high-entropy map is more conducive to lexical acquisition. This is again confirmed by Experiment 1, showing that all regularly-inflected verb paradigms are learned earlier if they are presented with uniform distributions.

A balanced competition for memory resources slows down the learning rate of individual words, but eventually ensures a more effective allocation of resources and a smoother convergence towards global lexical organisation. This general trend interacts with intra-paradigmatic redundancy and (ir)regularity. Due to the frequency-by-irregularity interaction, skewed distributions may in fact favour acquisition of those paradigms exhibiting extensive stem alternation, by giving stem alternants the frequency boost necessary to offset the prevalence of default stems.

What about generalisation? How do frequency distributions affect the propensity of a map to acquire non-attested forms by a generalisation step? Experiment 2 on artificial micro-paradigms was intended to preliminarily address these questions. Once more, we observed that uniform distributions tend to favour generalisation to unknown word forms. We suggest that the reason for this behaviour is lexical competition. A stored stem appearing in a high-frequency form (e.g. *gib-* in *gibt*) builds up a strong expectation for one specific ending to follow. Hence, it is considerably more difficult for such a stem to accept a novel ending than for another stem in a low-frequency form. All in all, what makes paradigm generalisation difficult is the same mechanism that slows down acquisition of input forms in the first place: frequency-based entrenchment. Entrenchment triggers a predictive behaviour of the map, based on probabilistic expectations. If there is a strong expectation for a possible ending, other alternatives are disfavoured. This inhibits the propensity of the map to acquire both low-frequency endings and completely novel endings from other paradigms.

To sum up, the most favourable internal state for learning is an unbiased one (highest entropy of competing alternatives), as this state most heavily depends on the current stimulus, rather than on the map's internal expectations. In order words, a balanced state between competing alternative connections is most faithful to the incoming signal, and, eventually, the most open one to generalisation. It should be appreciated that what represents an advantage at the level of single word learning, turns out to be a disadvantage at the level of paradigm learning. The paradigm appears to define the morphological domain where frequency effects are perceived at the level of lexical organisation. It is not clear, at the present stage of our investigation, if other morphological families, such as the series of forms sharing the same paradigm cell (e.g. all present indicative first person singulars) exhibit the same effects. We have reasons to believe that they do, although the effect is partially obscured by the path-breaking role of deeply-entrenched chains in the acquisition of other forms in the same morphological series. More experimental evidence will be needed to address these points.

7. Conclusion

Computer simulations of lexical processing and storage provide a methodological middle ground for testing models of word acquisition. Tracking the time course of paradigm acquisition at a fine level of detail is notoriously hard, due to i) the difficulty of monitoring levels of metalinguistic awareness in a developmental perspective and ii) the existing gap between psycho-cognitive hypotheses of lexical architecture and recent acquisitions of the neuro-functional basis of the perisylvian language network.

Through careful data analysis of the computational behaviour of TSOMs, we gained specific insights into these issues and suggested possible modelling and explanatory mechanisms together with their neuro-functional correlates. Simulations of the incremental acquisition of German verb paradigms in different training conditions support the hypothesis that perception of structure (parsability) and morphological productivity strongly correlate in the inflectional lexicon. In particular, by monitoring longitudinal progress in storage and generalisation of differently distributed inflectional paradigms, we showed that: i) high-frequency forms are stored and accessed significantly earlier than low-frequency forms; ii) deeply entrenched forms tend to block usage of other forms in the same paradigm.

Any cognitively-motivated hypothesis of lexical architecture must assume that accessing a word leaves its traces in the lexicon. This is a logically necessary step to take, if one wants to model the fact that high-frequency words have different characteristics from low-frequency words. Successfully accessing an item must hence have two consequences: i) modify the item's representation and ii) increase the probability that the item will be successfully processed in the future. Existing models capture this process in two fundamentally different ways: a) by raising the resting activation level of the relevant lexical entry (see, e.g. Norris et al. 2000, McClelland and Elman 1986); or b) by assuming that processing a word involves adding a new exemplar to the appropriate exemplar repertoire (e.g. Johnson 1997a, 1997b; Daelemans and van den Bosch 2005).

All these models assume that accessed representations already exist, thus making a fundamental distinction between representations on the one hand, and processes applying to representations on the other hand. We propose to refer to them as "distinctive" models, to mean that they apportion issues of representation and issues of processing to logically distinct modelling mechanisms. According to a "distinctive approach", the lexicon is a box, words are its content, storing words amounts to placing content into the box, accessing words corresponds to the reverse process of getting words out of the box. Last but not least, accessing a word representation implies that something changes in the accessed content. However, the approach appears to neglect that lexical representations are acquired dynamically, and little is understood in modelling lexical storage and access if one is not in a position to explain how representations come into existence in the first place.

The present contribution offers a computationally explanatory basis to address this fundamental issue. From an acquisitional standpoint, words do not define an independently-given content, but are treated like input stimuli causing a particular change in the activation state of the lexicon. Conceptually, the activation state represents what is perceived by a memory map after input exposure and it is not to be confounded with the stimulus itself. In addition, such an internal state presents a short-term and a long-term dynamic. In the short-term, it consists in a chain of consecutively responding BMUs, whose level of activation decays as soon as the map is exposed to novel inputs[2]. In the long-term, BMUs forming the current chain are modified incrementally through an adaptive caching process, for them to be more likely to be activated when the same input is presented to the map. Clearly, no distinction is made here between representations and processing. BMUs are both representational units, i.e. the specialised, long-term activation patterns

[2] In fact, we can assume that the level of activation of a BMU at time *t* starts diminishing as soon as another input unit is presented to the map. This is one of the most common assumptions made in the memory literature to explain so-called recency effects.

indexing individual input stimuli, and processing units, dynamically responding to particular classes of stimuli. For this reason, we suggest calling this type of approach "integrative" as it deals with lexical representation and lexical processing as the same process on two different time scales[3].

This is in line with what we know about the neuro-architectural basis of the human language processor, supporting an integrative account of lexical processing/acquisition as the complex result of general-purpose operations on word stimuli: e.g. working memory, long-term storage, sensory-motor mapping, rehearsal, unit integration, unit analysis, executive control, time-series processing (Catani et al. 2005, Shalom and Poeppel 2008, Friederici 2012). Our investigation credits the proposed computational framework with psycholinguistic plausibility, and grounds parsability-based models of morphological productivity on a specific, explicit proposal of lexical architecture. This provides an explanatory basis for both psycholinguistic and linguistic accounts of morphological structure, and offers an intermediate framework for scientific inquiry bridging the gap between linguistic units and functional units in neurosciences. Finally, it makes the interesting suggestion that principles of morpheme-based organisation of the mental lexicon are compatible with a learning strategy requiring memorisation of full forms.

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Typing time as an index of morphological and semantic effects during English compound processing

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1. Introduction

Words have internal structure and readers often use parts of words to determine word meaning (Graves 2006). Indeed, language-users' awareness of morphemic structure has been linked with enhanced vocabulary growth (Baumann et al. 2002, Brusnighan and Folk 2012; Levin, Carney and Pressley 1988; Wysocki and Jenkins 1987) and reading comprehension outcomes in both developing readers (McCutchen, Logan and Biangardi-Orpe 2009) and university students (Kemp and Bryant 2003). However, precisely how language users make use of morphological structure is not yet known. Moreover, although the role of morphemic structure in comprehension has received increased attention by researchers, the role of morphemic structure in language production is less well-studied. Indeed there has been recent debate as to whether morphemic representations exist (see, for example, Baayen et al. 2011 for a model that does not use morphemes, and Marantz's 2013 response as to why morphemes are essential). In the current project, we examine the role of morphology during the written production of English compounds. Because compound words vary in terms of the semantic transparency of their constituents, we also examine whether the impact of morphology is affected by semantic transparency.

1.1 Involvement of constituent representations

A key empirical and theoretical question in psycholinguistic approaches to this issue has centered on the extent to which representations of the constituents are accessed during the processing of multi-morphemic words. For example, what role do *dog* and *house* play in the representation and processing of the compound word *doghouse*? Theoretical approaches differ substantially in terms of the extent to which morphological structure plays a role in the processing of morphologically complex words (see Kuperman, Bertram, Baayen 2010 for an overview), due to the different emphasis placed on storage and computation.

Although there is no consensus about which particular theory is most viable, empirical findings most strongly support theoretical approaches that allow for morphological decomposition because many studies demonstrate the involvement of subunits in the processing of morphologically complex words. For example, the processing of multi-morphemic words is influenced by the frequency of the constituents (Andrews 1986; Burani, Salmaso and Caramazza 1984; Alegre and Gordon 1999; Baayen, Dijkstra and Schreuder 1997; Bradley 1980; Burani and Caramazza 1987; Colé, Beauvillain and Segui 1989; Meunier and Segui 1999; Niswander, Pollatsek, Rayner 2000; Taft 1979). Also, the more productive a constituent is, as indicated by morphemic family size (i.e., the number of derived and compound words formed from a particular morpheme), the easier it is to process a complex word containing that constituent (Bertram, Schreuder and Baayen 2000; de Jong et al. 2002). In sum, the data are consistent with a maximization-of-opportunity view which posits that the lexical system is highly productive and, during comprehension, actives both whole-word and constituent representations (Libben 2005, 2010).

1.2 Are morphemes involved in language production?

Marantz (2013) provides an overview of the role of morphology in linguistic theory and argues that morphemes are a necessary aspect of language. Most relevant, however, for our research project is the question of whether morphology is used during language production. That is, even though morphemes have been identified by linguists, are these structural units always involved during language processing or are there some situations in which morphemes are not used? Libben (2005, see also Libben and Weber 2014), for example, suggests that some properties of words should be viewed as properties of the state of participants rather than as external entities. That is, linguistic structures might best be thought of as psychological entities rather than as linguistic entities. Therefore, it is useful to examine which structures are involved during language processing as well as factors that might affect the use of such structures.

Psycholinguistic evidence suggesting that language production involves the use of morphemic structures has come from a variety of production tasks including picture naming, handwriting, and typing. For example, the time to name an object in a picture was faster when a morphologically related word was presented on prior trials (Zwitserlood, Bölte, Dohmes 2002); exposure to either the word *rosebud* or *tearose* speeded the naming of a picture of a rose on a subsequent trial. In a subsequent experiment, Zwitserlood et al. (2002) found that the influence of distractors that were both morphologically and semantically related to the picture (e.g., *buttermilk* - *butter*) and distractors that were only morphologically related to the picture (e.g., *butterfly* - *butter*) were nearly identical (cf. Zwitserlood, Bölte and Dohmes 2000). The results suggest that the facilitation was due to the representations sharing a morpheme.

Further evidence comes from the finding that multimorphemic words require more processing time than do monomorphemic words. Roelofs and Baayen (2002) found that preparation time prior to saying a word aloud was longer for Dutch multi-morphemic words (e.g., *bijval*) than for mono-morphemic words (e.g., *bijbel*). Studies that measure latency and movement during handwriting (Pynte, Courrieu and Fenck 1991; Orliaguet and Boë 1993 have also found differences between multimorphemic and monomorphemic words. Orliaguet and Boë 1993 presented a word (e.g., *bois*) in a sentence that supported either the monomorphemic meaning (e.g., *bois* 'wood') or the multimorphemic meaning (e.g. *bois* which is formed from *boi*+ *s* and is the first person singular of 'to drink'). After hearing the sentence, participants wrote the word ten times as their handwriting movements were recorded. Latencies were longer when the word was preceded by the sentence supporting the multimorphemic meaning, which suggests that processing was being affected by the morphemic structure of the word. Kandel, Alvarez, and Vallée (2008) used French suffixed words and found longer delays prior to the writing of a suffix such as *-ette* when it was part of a suffixed word (e.g., *boulette*) than when it occurred in a pseudo-suffixed word (e.g., *goélette*). Similarly, Kandel et al. (2012) found that suffixed words required more processing time than did pseudo-affixed words; the time to produce the letter preceding the syllable boundary was longer for suffixed words than for pseudo-suffixed words and the delay prior to the syllable boundary was longer for suffixed words. In contrast, no differences were observed for prefixed and pseudo-prefixed words. These studies suggest that morphological planning occurs in a serial order (i.e., non-initial morphemes are planned after initial morphemes).

Studies examining typing also show that there are longer delays prior to the morpheme boundary (Sahel et al. 2008; Will, Nottbusch and Weingarten 2006). Furthermore, the type of morpheme affected the size of the increase; Weingarten, Nottbusch and Will (2004) report a study that found that inter-letter typing latencies were longer for digraphs that spanned the

boundary of two stem morphemes (e.g., *Korn-ernte* 'corn harvest') than between two derivational morphemes (e.g., *an-erkennen* 'acknowledge'). In sum, previous research using verbal production and written production tasks indicates that morphemes act as planning units during the production of complex words.

An interesting aspect of the effect of morphological complexity is that it slows production (i.e., it introduces delays in the output of complex words), but aids comprehension. For example, in terms of comprehension, Ji et al. 2011 found that lexical decision times were faster for opaque and transparent compounds relative to frequency-matched monomorphemic words. Also, manipulations that enhanced decomposition slowed the processing of opaque compounds and removed the processing advantage provided by complexity. These results were attributed to meaning computation and subsequent competition. That is, when a compound is encountered, it is decomposed into its constituents and the system attempts to combine these constituents to derive a meaning (see, for example, Gagné and Spalding 2009, 2010; Ji, Gagné and Spalding 2011). In the case of opaque compounds, the computed meaning conflicts with the established meaning and processing is slowed as the system attempts to resolve this conflict. Given this difference in comprehension and production, it is important to consider both types of processing to gain better insight into how the language system represents and uses morphological complexity. A question that is particularly relevant is whether meaning competition arises during production.

1.3 Does semantic information affect the involvement of morphology?

Importantly though, compound words vary in the semantic transparency of their constituents. Semantically transparent constituents (e.g., *snow* and *ball* in *snowball*) contribute to the compound's meaning, whereas semantically opaque constituents (e.g., *hum* and *bug* in *humbug*) do not. Key questions in this field revolve around the relationship between constituent activation and constituents' semantic transparency (e.g., Ji et al. 2011; Libben et al. 2003; Fiorentino and Fund-Reznicek 2009; Marelli et al. 2009; Marelli and Luzzatti 2012; Monsell 1985; Roelofs and Baayen 2002; Sandra 1990; Shoolman and Andrews 2003; Zwitserlood 1994). Do constituent representations become available for all compounds or only for semantically transparent compounds? More specifically, do all constituents' representations become available or do representations only become available for semantically transparent constituents?

Previous research on the comprehension of compounds has shown that the constituents' representations become activated during the processing of compounds (e.g., Fiorentino and Fund-Reznicek 2009; Sandra 1994; Zwitserlood 1994), and the semantic transparency of these constituents can affect the overall ease with which a compound is recognized (e.g., Libben 2010; Ji et al. 2011). For example, compounds with opaque heads take longer to process than do compounds with transparent heads (Libben et al.2003).

In terms of production tasks, however, the impact of semantic transparency is less clear because studies examining the production of compounds have yielded conflicting results concerning the role of semantic transparency. Roelofs and Baayens (2002) found equivalent performance for production of transparent compound words (e.g., *bijval*), and for opaque complex words (*bijrol*) in a verbal production task, which suggests that morphological complexity is encoded independently of semantic transparency. Consistent with this claim, some researchers have found that opaque and transparent compounds were equally effective at aiding the naming of a picture. For example, Dohmes, Zwitserlood and Bölte (2004) conducted a picture-naming task with distractors using German compounds and found that both opaque and transparent compounds aided picture naming; e.g. *Wildente* ('wild duck') and *Zeitungsente* (false report, literally 'newspaper duck') aided naming of a picture of a duck

to the same extent (see also Luttmann et al. 2011). A similar result was obtained with Dutch compounds; Koester and Schiller (2010) had name a picture (e.g., *ekster*). The picture was preceded by one of several words which participants read aloud. Two of the words were compounds that used the same morpheme as the picture name; the compound was either semantically related to the picture name (e.g., *eksternest* 'magpie nest'), or semantically unrelated (e.g., *eksteroog* literally 'magpie eye' but means 'corn'). The third word (e.g, *gnoom* 'hobgoblin') was morphologically and semantically unrelated to the picture name. In a separate set of items, the picture (e.g., *jas* 'coat') was preceded either by a compound that was morphological related (*jaszak* 'coat pocket'), by a morphological unrelated word (*jasmijn* 'jasmine'), or by related word (e.g., *otter* 'otter'). It took less time to name the picture when it was preceded by the morphologically related primes than by the unrelated prime, and the benefit from the semantically transparent and opaque compounds did not differ. The data point to the involvement of morphemes because mere form overlap (e.g., *jasmijn* prior to *jas*) did not produce a benefit.

In contrast, other studies, using written production, have found effects of semantic transparency. Sahel and colleagues (2008) used a written production task in which participants typed German compounds. There was an elevation in typing time at the morpheme boundary for both semantically transparent and opaque compounds, which suggests that morphology operates without recourse to the meaning of the constituents (see also Aronoff 1994 for a similar claim). However, the latency at the morpheme boundary was affected by semantic transparency for low frequency compounds such that the latency was shorter for opaque compounds than for transparent compounds, which suggests that morphological planning can be affected by semantic transparency. Libben and Weber (2014) examined typing times for English compounds that varied in the transparency of the first and second constituent. They found that the latency increase at the morpheme boundary was smaller for opaque-opaque (OO) compounds than for transparent-transparent (TT) and opaque-transparent (OT) compounds. The increases in typing time at the boundary for OO and transparent-opaque (TO) compounds were statistically equivalent.

In sum, it appears that the lexical representations of compounds are morphologically structured, but it is not yet known the extent to which semantic transparency impacts the production of compound words. Some studies indicate that processing system is sensitive to morphemic structure irrespective of semantic transparency, whereas others have found that the impact of morphemic structure is greater for transparent compounds than for opaque compounds.

1.4 Aim and Overview of the Experiments

We conducted two experiments using a progressive demasking (PDM) paradigm (Grainger and Segui 1991). In this task, the stimulus is initially obscured on the computer screen then gradually becomes more visible. Combined with the PDM task, we examined inter-letter typing speed by having participants type the word after it had been identified. The typing task allows us to measure how much time is spent in different regions of a word (Libben, Weber and Miwa 2012; Libben and Weber 2014; Sahel et al. 2008; Will et al. 2006) and, thus, is particularly useful for identifying the extent to which morphemes are involved in the processing of the word. If participants are sensitive to a word's morphological structure, then we should observe elevated typing times at the morpheme boundary (see Libben 2011). To illustrate, the typing time for the letter *h* in the word *doghouse* should be longer than for the preceding letter (e.g., *g*) because it is the start of the second morpheme.

In addition to examining the role of morphology on written production, we examined the possible involvement of semantic information in two ways. First, we manipulated semantic

transparency. In both experiments we varied the transparency of the first constituent while holding the transparency of the second constituent constant so that we were able to compare the impact of having a transparent versus an opaque first constituent. In Experiment 1, the head (i.e., second constituent) of the compound was semantically transparent, whereas in Experiment 2, the head was opaque.

Second, we manipulated the availability of the meaning of the first constituent by preceding the presentation of the compound (e.g., *strawberry*) with a word that is either semantically related (e.g., *hay*) or unrelated (e.g, *pine*) to the first constituent (e.g, *straw*). This manipulation allows us to examine whether emphasizing the meaning of a constituent causes processing difficulty for compounds with semantically opaque constituents.

In sum, the specific aims of the current set of experiments was to examine the role of morphological structure on written production, to assess whether the availability of the meaning of the first constituent influences the written production of a compound, and to determine whether the influence of priming depends on the semantic transparency of the first and second constituents.

2. Experiment 1

Previous research (e.g., Libben et al. 2003; Marelli and Luzzatti 2012; Marelli et al. 2014) found that the semantic transparency of the head noun influenced the processing of compounds. In the current experiment, we focus on compounds with transparent heads.

2.1 Methods

2.1.1 Materials and design

Eight-eight compound words with transparent heads (second constituents) were used. The compounds varied in terms of the semantic transparency of the first constituent such that half the items had an opaque first constituent (e.g., *strawberry*) and half had a transparent first constituent (e.g. *soupspoon*). Two primes were selected for each compound based on the relatedness to the first constituent of the compound. The related prime (e.g., *hay* for *strawberry*) was selected using Latent Semantic Analysis (LSA) scores (Landauer 2002; Landauer and Dumais 1997) and the unrelated prime (e.g., *pine* for *strawberry*) was selected from the SUBTLEXus database (Brysbaert and New 2009) by searching for words that matched the related prime in terms of word length and word frequency (within 10% of the frequency per million measure).

2.1.2 Procedure

Each trial began with the message "Ready?" on the computer screen and participates initiated the trial by pressing the space bar. Next, the prime and target were presented using a Progressive Demasking technique (PDM) in which a stimulus slowly becomes visible. Initially, a mask (which was a row of hash marks, ##########) was displayed followed by a brief presentation (40 ms) of the prime. Next, a mask was displayed followed by the target (i.e., the compound). The duration of the mask-target remained constant at 1015 ms, but the display time of the target increased relative to the display time of the mask. During the first cycle, the mask was displayed for 1000 ms and the target for 15 ms. This sequence was repeated with the presentation of the target being increased by 15 ms and the presentation of the mask being decreased by 15 ms for each sequence. From the participants' perspective, the target appears to emerge from the mask. Participants press a computer key as soon as they have identified the word. Next, participants typed the word that they had identified and the

computer recorded inter-letter typing latency. Inter-letter typing latency is the time between the onset of typing one letter and the offset of typing the subsequent letter and can be used to examine which subunits are involved in word production (see Libben et al. 2012; Libben and Weber 2014; Sahel et al. 2008). Our main variable of interest was inter-letter typing latency at various parts of the word.

2.1.3 Participants

All participants in the current experiment and following experiments spoke English as their native language. Fifty-four introductory psychology students at the University of Alberta participated for course credit. The data from eight participants were excluded due to high error rates. Thus, the analyses that we report are based on 46 participants.

2.2 Results and discussion

The data was analyzed using Linear Mixed Effects (LME) models (see Baayen, Davidson and Bates 2008; Pinheiro and Bates 2000) using the *mixed* function in Stata 13. In all models, subject and items were used as random factors. The dependent variable, typing latency, was log-transformed to reduce skewness.

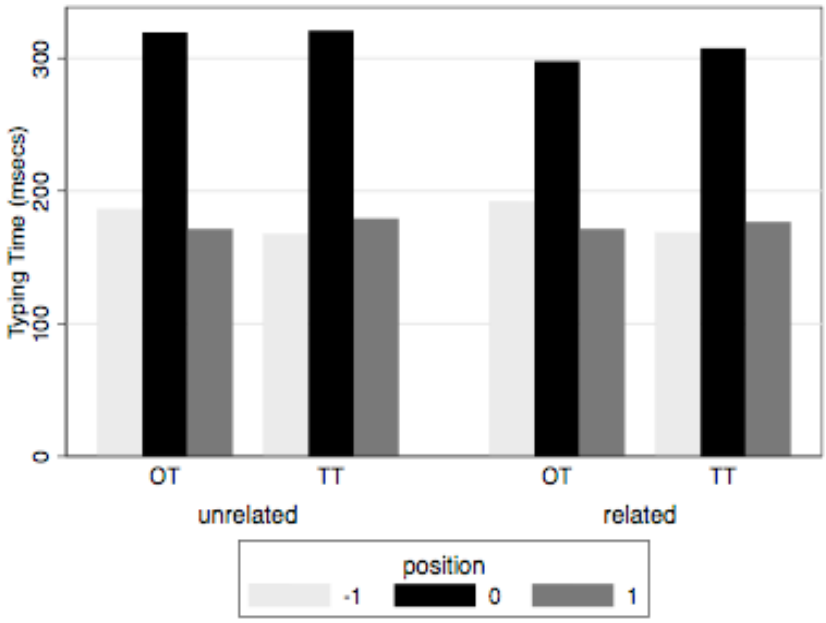
We performed separate sets of analyses which each targeted a specific region of the word. We looked for differences in typing time just before and just after the morpheme boundary. We also conducted separate analyses to examine the initiation time for the first and the second constituents.

2.2.1. Morpheme boundary effect

To examine whether there was evidence of the use of morphology during written production, we compared the typing time for the letter before and at the boundary; e.g., for the word *strawberry* we compared the times for typing the letters *w* and *b*. As indicated in Figure 1, typing time was elevated at the first letter of the second constituent relative to the preceding letter, $z = -22.57$, $p < .0001$, which indicates that participants were sensitive to morphology. Typing times were also affected by semantic information; the influence of position (i.e., before v.s. at the boundary) interacted with prime (i.e., semantically related vs. unrelated), $z = 2.17$, $p = .03$, and with the semantic transparency of the first constituent, $z = -2.84$, $p = .005$.

Subsequent analyses of these two interactions revealed that the increase was larger in the semantically unrelated prime condition than in the related prime condition, $z = 2.07$, $p = .04$; the prime affected the time to type the letter at the boundary (i.e., at the first letter of the second constituent), $z = -2.38$, $p = .02$, not at the letter prior to the boundary, $z = .55$, $p = .58$. This result suggests that increasing the meaning of the first constituent might lead to the morphemic representation of that constituent being more strongly available which in turn boosts the activation of the entire morphemic structure. For example, exposure to the word *hay* activates related words, including the word *straw*. The increased availability of the meaning of *straw* increases the availability of the morpheme *straw* on its own as well as its representation in the word *strawberry*. This makes it easier for the production system to make use of the morphological structure for *strawberry*.

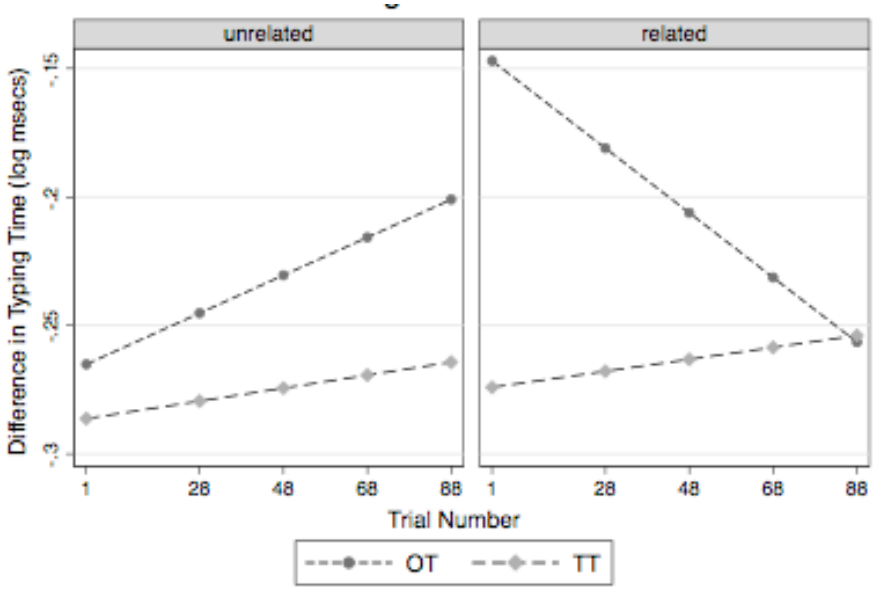
Figure 1: Typing time for letters before, at, and after the morpheme boundary in Experiment 1



Our analyses also revealed that the increase in typing time at the boundary was larger for TT compounds than for OT compounds, z = -5.00, p < .0001. This increase was due to an effect of first constituent's semantic transparency at the pre-boundary position, z = -2.76, p = .006. There was no effect of the first constituent's transparency at the boundary, z = .91, p = .36. In other words, typing time at the pre-boundary position (e.g., at the end of the first constituent) was faster for compounds with transparent first constituents than for compounds with opaque first constituents, but the typing time for the first letter of the second constituent was equivalent for TT and OT compounds. This result indicates an impact of semantic transparency in that opaque constituents take longer to type than do transparent constituents.

In a separate set of analyses, we examined whether the boundary effect changes across the experiment. To do this, we included trial number as a predictor variable in the model and examined whether it interacted with the other variables. There was a four-way interaction between prime, compound type, position (pre vs. post boundary) and trial, z = 2.44, p = .02. Figure 2 shows the difference in typing time before and at the boundary across trial. As can be seen in this graph, the boundary effect was influenced by prime type and by compound type. Overall, the boundary effect was larger for OT compounds than for TT compounds and this effect was relatively consistent across the experiment (i.e., the effect does not greatly change from the first trial of the experiment to the last trial). However, in the related prime condition, the boundary effect was much greater for OT compounds than for TT compounds for early trials, but the effect was equivalent for OT and TT compounds at later trials; during the course of the experiment, the boundary effect was reduced for OT compounds. These findings indicate that the production system adapts across the course of the experiment.

Figure 2: Difference in typing time for the letter before and after the morpheme boundary in Experiment 1

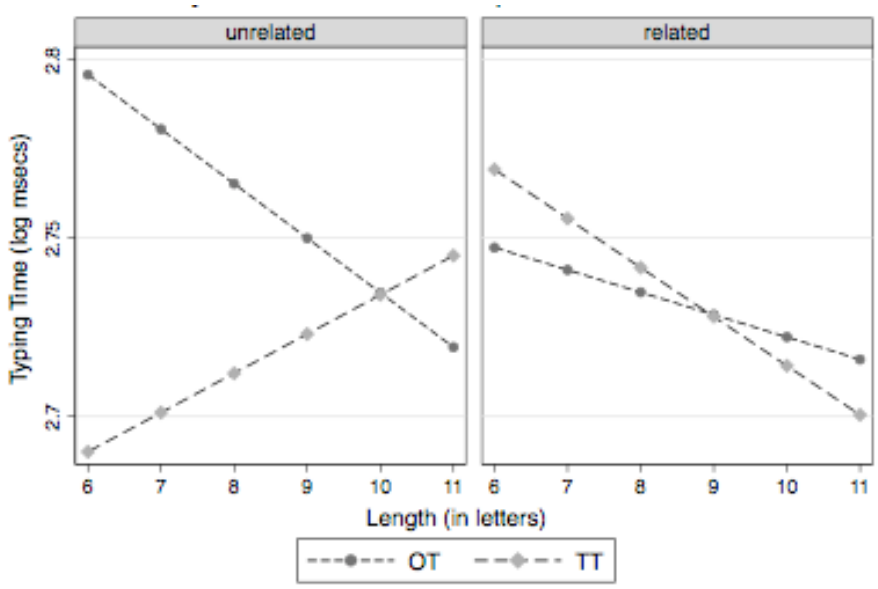


2.2.2 Typing latency for the first letter of the first constituent

We found an influence of semantic information on the production of the first constituent. The LME model indicated that the time to initiate typing the word (i.e., the typing time for the first letter of the first constituent) was affected by prime, z = -2.28, p = .02, as well as by compound type, z = -2.42, p = .02, and these two variables did not interact with each other, z = 1.67, p = .10. Overall, OT compounds took more time to initiate than did TT compounds.

Because the compounds varied in length, we also conducted analyses that included length (i.e. number of letters) as a predictor variable. As illustrated in Figure 3, there was a three-way interaction between prime, compound type, and length, z = -2.56, p = .01, and thus we decomposed this interaction. The effect of length differed depending on whether the compound was preceded by a semantically related or unrelated prime and on the semantic transparency of the first constituent. The effect of length was equivalent for the OT and TT compounds in the related prime condition, z = -.68, p = .49, but was greater for the TT than for the OT compounds in the unrelated prime condition, z = 2.38, p = .02.

Figure 3: Typing time for the first letter of the first constituent in Experiment 1

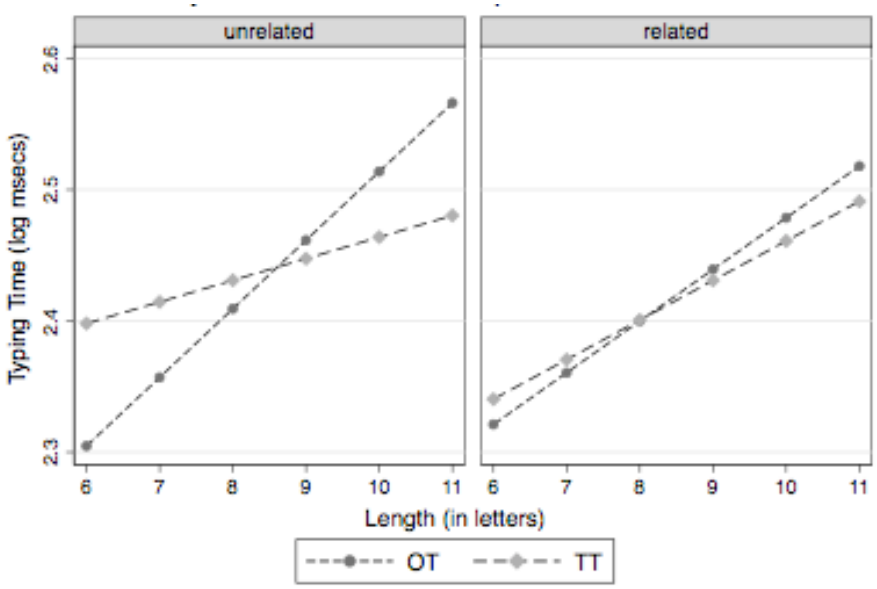


Another way to describe the three-way interaction is that influence of the prime and length differed depending on compound type. For the TT compounds, prime and length interacted, z = -2.56, p = .01, such that in the unrelated prime condition typing latency was unaffected by length, z = 1.37, p = .17, whereas in the related prime condition typing latencies showed a trend to be faster for longer words than for shorter words, z = -1.73, p = .08. The OT compounds showed a different pattern in that prime did not interact with length, z = .98, p = .33; typing latency was faster in the related condition than in the unrelated condition regardless of length, z = -2.01, p = .04.

2.2.3 Typing latency for the first letter of the second constituent

Time to initiate typing the second constituent was affected by Prime, z = -2.31, p = .02, but not by compound type, z = .62, p = .54.

Figure 4: Typing time for the first letter of the second constituent in Experiment 1



However, the influence of compound type was evident once stimulus length was included in the model. As illustrated in Figure 4, there was a three-way interaction between prime, compound type, and stimulus length, z = 2.28, p = .02. Both compound types showed an increase in typing time for longer words than for shorter words; z = 4.99, p < .001 for OT compounds and z = 2.40, p = .02 for TT compounds. However, the prime differentially affected the impact of length depending on compound type. In the unrelated prime condition, the impact of length was greater for OT compounds than for TT compounds, z = -2.45, p = .01, whereas in the related prime condition, the impact of length was equivalent for OT and TT compounds, z = -.63, p = .53.

2.3 Summary of results

Consistent with previous results reported by Libben and colleagues (Libben et al. 2012; Libben and Weber 2014), we find an morphemic boundary effect in that the inter-letter latency is longer at the boundary than before the boundary. In addition, we find that semantic information (both in terms of semantic transparency and of semantic priming) influenced production. For example, the size of the morphemic boundary effect was affected by prime

and by semantic transparency. Conversely, the effects of semantic transparency differed depending on morphemic region. For example, in the unrelated prime condition, the impact of length was greater for TT compounds than for OT compounds during the initiation of the first constituent, but the reverse was true during the initiation of the second constituent.

In terms of the initiation of the first constituent, OT compounds slowed production relative to TT compounds. In terms of the initiation of the second constituent, the impact of compound type was dependent on prime type and on stimulus length; there was no difference between TT and OT compounds in the related prime condition, whereas in the unrelated prime condition, stimulus length influenced whether TT or OT compounds were produced more quickly.

3. Experiment 2

Experiment 1 showed that written production was influenced by morphemic structure and by semantic information (i.e., by semantic transparency and by the availability of the meaning of the first constituent). In the current experiment, we examine whether these factors influence the production of compounds with opaque heads.

3.1 Methods

3.1.1 Materials and design

One hundred compound words with opaque heads (second constituents) were used. As in Experiment 1, the items varied in terms of the semantic transparency of the first constituent. Half the items had an opaque first constituent (e.g., *pineapple*) and half had a transparent first constituent (e.g. *jailbird*). Two primes were selected for each compound; one was semantically related to the first constituent (e.g., *crime* is related to *jail*) and one was unrelated (e.g., *books* is unrelated to *jail*). The primes were selected using the same procedure as described in Experiment 1.

3.1.2 Procedure

The procedure was identical to one used in Experiment 1.

3.1.3 Participants

Forty-four introductory psychology students at the University of Alberta participated for course credit. The data from one participant was removed prior to analysis due to a computer malfunction during data collection and another due to a visual impairment. The data from an additional nine participants were excluded due to high error rates. Thus, the analyses that we report are based on 33 participants.

3.2 Results and discussion

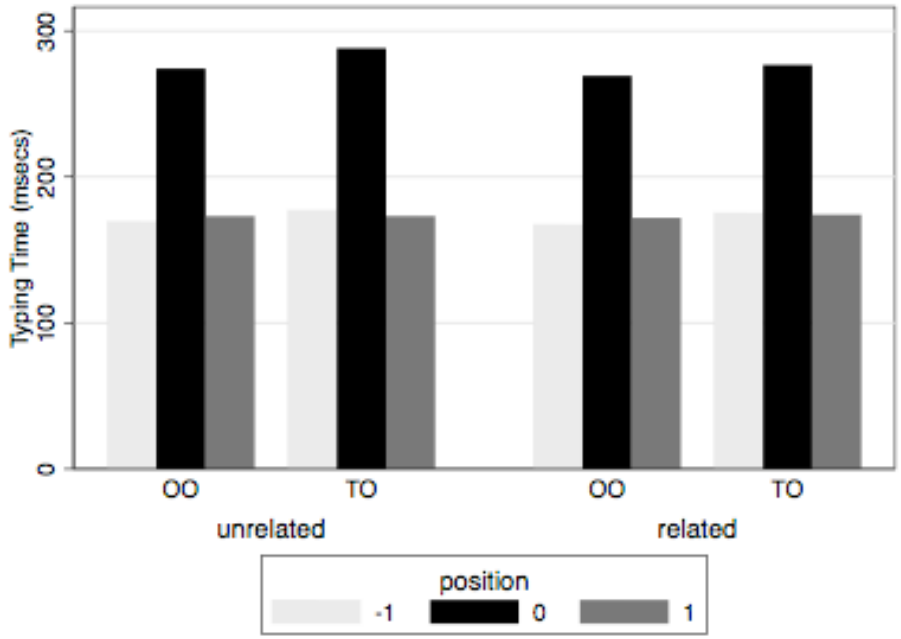
We used the same analysis strategy as for Experiment 1, in which we conducted separate analyses for each morphemic region. Our dependent variable was log-transformed typing latency.

3.2.1 Morpheme boundary effect

As indicated in Figure 5, typing time was elevated at the first letter of the morpheme boundary relative to the preceding letter, $z = 19.85$, $p < .0001$. However, unlike in Experiment

1, the difference between typing latency for the letter before and at the boundary was not affected by prime, z = .41, p = .68, nor by compound type, z = .21, p = .84. As in Experiment 1, we conducted a separate analysis to determine whether the boundary effect changed across the experiment. However, trial did not interact with any of the other variables, all p's > .30.

Figure 5: Typing time for letters before, at, and after the morpheme boundary in Experiment 2



3.2.2 Typing latency for the first letter of the first constituent

As in Experiment 1, we used prime (related vs. unrelated), compound type (OO vs. TO), and length as predictor variables in the model. Unlike Experiment 1, these three variables did not interact, z = -.22, p = .83, nor were there any two-way interaction involving these variables. Therefore, we considered a simpler model that included the variables without any interaction terms. In this model, typing times for TO compounds were faster than for OO compounds, z = -2.35, p = .02, and neither prime (z = 1.14, p = .26) nor length (z = 1.46, p = .14) were valid predictors. It took more time to initiate typing of OO compounds) than of TO compounds.

3.2.3 Typing latency for the first letter of the second constituent

Prime, compound type, and length did not interact, z = -.28, p = .78, nor were there any two-way interaction involving these variables. A model without any interaction terms indicated that time was not affected by compound type (z = .29, p = .77) nor by prime (z = .45, p = .65). However, there was a trend for typing times to be longer for longer compounds than for shorter compounds, z = 1.83, p = .07.

3.3 Summary of results

Morphemic structure influenced written production; inter-letter latency increased at the morphemic boundary and the impact of various semantic variables depended on morphemic region. The initiation of the first constituent was affected by the semantic transparency of the

first constituent, whereas the initiation of the second constituent was not affected by this variable.

4. General Discussion

Linguists have identified several levels of structure within language, and psycholinguists have sought to identify which structures affect processing of language. In this sense, the psycholinguistic data is used to determine which types of linguistic structures are used by language users (for a discussion of the role of psychocentricity in arbitrating which linguistic constructs are psychologically valid, see Libben and Weber 2014). In the case of compounds, debate has continued over whether the morphemes of semantically opaque constituents are involved in processing. Our data contribute to the ongoing discussion by illustrating that morphemic structure is involved in written production, even for opaque compounds, and that semantic transparency also plays a role.

The typing task was useful for examining these issues because it is a natural task (for our participant population) in that it is something that the participants engage in everyday. Also, this task does not require the use of filler materials (such as nonwords). Even though typing is highly practiced, it still is sensitive to the variables that we manipulated. The primary advantage of the typing task is that we can get processing measures at specific regions within the word to determine whether morphology affects ease of processing.

The increase in typing latency at the morpheme boundary suggests that written production for English compounds relies on structured representations. If unitary representations (i.e., whole-word representations) were used, then there would be no increase at the boundary. Furthermore, the nature of the structures appears to be morphemic rather than semantic because we found a robust morphemic boundary effect regardless of the transparency of the head nouns and of the modifiers. Thus, our results are consistent with previous claims in the literature that morphemes act as planning units during production (Koester and Schiller 2008; Roelofs 1996; Roelofs and Baayen 2002). In particular, people appear to be planning the production of compound words in terms of their morphological units. They output the first constituent and then re-access the morphemic structure of the compound to obtain the structure corresponding to second constituent, which introduces a brief delay between the two constituents in terms of inter-letter typing latency. This interpretation is consistent with previous research involving typing and handwriting (e.g., Kandel, Alvarez, Vallée 2006; Libben and Weber 2014; Sahel et al. 2008) that also found processing delays at morpheme boundaries.

The priming effect observed in Experiment 1 also suggests that the use of morphemic structures is independent of semantic information (see Roelof and Baayen 2002 and Koester and Schiller 2008 for a similar conclusion) because boosting the availability of the first constituent (via the related prime) affected written production even when the meaning of that constituent was unrelated to the meaning of the compound (i.e., when the first constituent was opaque). For example, both *straw* and *berry* were easier to initiate when *hay* was briefly presented prior to the compound (i.e., *strawberry*) even though *straw* is semantically opaque. This suggests that the locus of the semantic priming effect ultimately was not semantic in nature but rather morphemic. Furthermore, boosting access to the first constituent of the compound's morphemic structure also benefited access to the second constituent within that structure.

As noted in the Introduction, there has been conflicting evidence in the literature concerning the effects of semantic transparency. Our results contribute to that debate by providing several pieces of evidence that demonstrate effects of semantic transparency. First, we found that opaque first constituents appear to produce processing difficulties, particularly

when the second constituent was also opaque; compounds with opaque first constituents took longer to initiate then did compounds with transparent first constituents. This suggests that the processing system is sensitive to the semantic transparency of the constituents. It could be the case that opaque constituents take more time to access because the semantic representation is not linked to the representation of the whole compound (as suggested by Zwitserlood 2004), or it could be that the semantic representation of opaque constituents must be suppressed (see, for example Ji, Gagné and Spalding 2011) and that this suppression takes processing resources, which slows production.

Second, the semantic transparency of the second constituent altered the impact that the prime had on written production. When the head of the compound was transparent (as in Experiment 1), the boost provided by the related prime to the morphemic representation of the first constituent aided the production of both constituents by making the morphemic structure of the entire compound easier to access. However, when the head of the compound was opaque (as in Experiment 2), the prime did not yield this benefit in processing, even when the first constituent was semantically transparent. We propose that emphasizing the morphemic structure for compounds with opaque heads increased conflict among potential meanings for the compound because the computed, literal, meaning of the compound is not of the same category as the conventional meaning. For example, the conventional meaning of *hogwash* (e.g., nonsense) is very different from computed meaning (e.g., a wash for hogs) This competition must be resolved and offsets the benefit of the related prime (see El-Bialy, Gagné and Spalding 2013 and Ji et al. 2011 for other research that has found competition-based processing difficulties for opaque compounds).

Finally, the semantic transparency of the second constituent also influenced the way in which semantic transparency of the first constituent and prime interacted. For example, the size of the boundary effect was affected by the prime only when the head was semantically transparent (i.e., in Experiment 1). Also, when the head was transparent, the impact of length was greater for TT compounds than for OT compounds during the initiation of the first constituent in the unrelated prime condition, but the reverse was true during the initiation of the second constituent. This pattern was not observed when the head was opaque. Similarly, the related prime condition removed the processing advantage for compounds with transparent first constituents in that there was no difference in typing time for the start of the second constituent for TT and OT compounds. These results indicate that written production is sensitive to semantic transparency.

The observation that the priming effect that was obtained in Experiment 1 did not occur when head was opaque (i.e., in Experiment 2) is consistent with research by El-Bialy et al. (2013) that found that the priming effect in a lexical decision task depended not only on the transparency of the constituent that was being targeted by the prime, but also on the semantic transparency of the other constituent. This finding is consistent with the suggestion that semantic transparency might be a psychological property rather than strictly a linguistic property (see Libben 2005; Libben and Weber 2014); the effect of transparency is not constant across constituents and across priming conditions. That is, the influence of transparency depends on the processing context. Similarly, the data indicate that the two types of semantic information that we manipulated (i.e., semantic transparency and activation of the meaning of the first constituent) produced different effects, which indicates that the nature of semantic priming is different from the nature of semantic transparency and that the influence of transparency differs depending on the extent to which the meaning of the first constituent is available.

Taken together, our data indicate that morphemic structures are involved in the production of English compounds but that semantic transparency and the availability of the meaning of the first constituent also play a role. Although our results point to the involvement of both

morphemic and semantic information, the way in which these sources of information are used appears to be complex in that the influence of the variables frequently interacted. Thus, it is not surprising that the literature concerning the role of semantic transparency has not yet yielded a clear consensus. We propose that the semantic transparency of each constituent must be considered in order to obtain a clearer picture of what is occurring during the use of the morphemic structures associated with compound words.

Acknowledgements
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Deadjectival nominalizations: suffix rivalry and synonymy

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1. Introduction

The study of French deadjectival nouns (Bécherel 1976; Martin 2010; Alexiadou & Martin 2012) highlights the profusion of suffixes that can be concatenated to a same adjectival base to coin apparently synonymic nouns. See examples (1)-(3).

(1) AIGRE$_A$ >*-eur* AIGREUR$_N$ (TLF)
'sour, bitter' 'sourness, bitterness'
Property of being sour / Property of being bitter

(2) AIGRE$_A$ >*-esse* AIGRESSE$_N$ (Web, 23 occurrences)
'sour, bitter' 'sourness, bitterness'
Lorsque l'aigresse entre en jeu, [...] on laisse sa bouche se laisser captiver par de telles saveurs
'When sourness arrives, [...] we let our mouth captivated by such flavours'

(3) AIGRE$_A$ >*-itude* AIGRITUDE$_N$ (Web, 13500 occurrences)
'sour, bitter' 'bitterness'
non, pas par amertume, ou par aigritude, ou par solitude
'not out of resentment, or out of bitterness, or out of loneliness'

Morphology specifies the relationship between form and meaning of expressions in a particular language. With regard to this definition, this paper presents an original situation. The variety of suffixations leads to the creation of a lot of doublets. I propose to map the relationships between suffixes using the results of doublets semantic analysis.

The paper is structured as follows. Section 2 presents the underlying data. Section 3 sets out two starting hypotheses about the construction of deadjectival nouns in French. Section 4 focuses on the synonymy of sets of elements. It presents the synonymy scale used to sort the sets according to their synonymy degree. Section 5 provides an overview of doublet mapping.

2. Data underlying the study

2.1. Data collection and data sorting

The first step is the extraction of all the words ending with a given graphic sequence (*-ité*, *-(e)té*, *-eur*, *-esse*, *-ise*, *-ice*, *-erie* and *-itude*) from the biggest multivolume French dictionary of general language: namely the *Trésor de la langue Française informatisé* (henceforth noted TLF*i*).

In a second phase, new forms (i.e. missing from TLF*i*) are extracted from the machine readable *Le Monde* newspaper corpus (years 1987, 1991, 1995, 1999).

In the third and final phase of collection, new forms are searched on the Internet. For this purpose, a list of potential deadjectival nouns is automatically generated using the TLF*i* dictionary list of adjectives. These candidate nouns are used as Yahoo^{TM} queries by means of the WaliM robot (Namer 2003). These online data have been collected between 2007 and 2011.

Data collected on the Internet constitute a common element in recent morphology studies (cf. Dal & Namer 2010; Hathout 2009; Aronoff & Lindsay 2010), though its use is still in discussion (cf. Lüdeling et al. 2007; Hathout et al. 2008, 2009).

Once the forms have been collected, wrong sequences are manually discarded, for instance slags: misprints, typing errors, spelling mistakes, etc., or nouns which are not adjective-based, although ending with the same suffixal segment /œʁ/ like DANSEUR 'dancer', or /ɛs/ like TIGRESSE 'femal tiger', etc.

2.2. Mordan: database constitution

In all, the MORphological Database of deAdjectival Nouns (named Mordan and freely searchable at https://apps.atilf.fr/mordan) contains 3,983 pairs made of deadjectival nouns (noted A*suf*$_N$[1]) and base adjectives (A) extracted from three sources of data: a list of 1,681 nouns comes from the TLF*i*; a list of 157 nouns originates from the newspaper corpus of *Le Monde* and a list of 2,145 nouns has been collected from the Web.

Each pair (A, A*suf*$_N$) receives additional information obtained from the corpus data. A given pair (A, A*suf*$_N$) is encoded by means of specific features, such as its phonological, morphological, semantic or historical properties. Neological units require a real (attested) context in which they appear as additional information. This context allows reading the semantic information carried by the new lexical unit. The URL is specified to access the Web page where the context is found. Moreover, Mordan supplies potential pragmatic effects (e.g. the writer's intended impact may be funniness). This information is required to provide an account of differences among suffixations.

Among the 3,983 analyzed deadjectival nouns, 1,566 are part of a set of two or more nouns sharing the same adjectival base. An extensional definition of a set is denoted by enclosing the list of members in curly brackets:

(4) $\hat{A}CRE_A = \{\hat{A}CRET\acute{E}_N , \hat{A}CREUR_N\}$.

655 sets of nouns were found, i.e. 457 sets of size two, 148 sets of size three, 43 sets of size four, 6 sets of size five and 1 set of size six. In what follows, I will focus on these sets of nouns.

3. Hypotheses

Alternation may result from different parameters.

- Hyp. 1: These suffixations product true synonyms. Suffix choice is either random or function of the attraction (or repulsion) between a base stem and a suffix. However, the systematic reading of the stem's last sound does not lead to a significant result (e.g. 14% of base stems end with /t/ despite the seeming repulsion between *-ité* and stems ending in /t/).

[1] A*suf*$_N$ is for a noun ($_N$) coined on an adjective (A) by means of suffixation (*suf*). For example, A*ité*$_N$ refer to the deadjectival nouns formed by suffixing *-ité*.

- Hyp. 2: There are semantic differences between these suffixations, related to semantic properties of involved bases, following Aronoff & Cho's (2001) proposition for *-ship* and *-hood*, or semantic constraints involved by each suffixation (cf. Martin 2010).

Crossing the lexematic approach (Aronoff 1976) and natural morphology (Dressler 2005), I propose an alternative hypothesis based on (i) the degree of synonymy between words, according to semantic tags that reflect possible interpretations of A*suf*$_N$ (e.g. a given A*suf*$_N$ may denote a property and potentially a concrete object / an event / an attitude), (ii) the historical properties of the different suffixations to show that availability of A > A*suf*$_N$ suffixations are not equivalent and (iii) their pragmatic properties. I will show that the suffixes involved are not in rivalry, nor in distribution but in alternation.

The high number of sets can be explained by a semantic distribution of the suffixations or by their rivalry. In this paper, the expression *affix rivalry* is dedicated to the substitution of an affix by another one without semantic change (following Lignon 2002). So, I will call *rival affixes* two different affixes are found in synonymous lexemes. On the contrary, the *semantic distribution* of affixes implies the formation of pairs of lexemes with different meanings. Each affixation expresses individual properties. In other words, the synonymy of the elements of a set has to be taken into account in order to determine whether or not suffixes are rival.

To make the analysis easier, sets have been reduced to pairs (a total of 799 pairs). This enables to study suffixes in pairs.

4. Data processing

4.1. Degrees of synonymy

Synonymy is the key concept which allows to determinate whether two suffixes are rival or semantically complementary. It is therefore essential to define precisely what synonymy means.

Cruse (2004: 154-157) distinguishes three categories of synonymy: absolute synonymy, near-synonymy and propositional synonymy. According to Cruse, **absolute synonyms** have a complete identity of meaning. They are equally normal in all contexts. Very few pairs of words are absolute synonyms.

Contrary to absolute synonyms, **near-synonyms** can be substituted only in certain expressions. Finally, **propositional synonyms** can be substituted in any expression. However, propositional synonyms involve differences in expressive meaning, stylistic level or field of discourse.

Because of the high number of pairs I have to treat, these definitions need to be adapted. The degree of synonymy of a pair will be calculated using the semantic informations encoded for the two A*suf*$_N$. Each noun stored in Mordan is tagged according to the contexts in which it occurs. Semantic labels are given following a test procedure. For a given noun, a hundred of utterances were examined, in order to obtain the semantic labels (in pointed brackets).

Examples (5)-(8) below illustrate each category of synonymy.

(5)

a.	BALOURDISE	'clumsiness'	<QUALITY / ATTITUDE / OCCURRENCE>
b.	BALOURDERIE	'clumsiness'	<QUALITY / ATTITUDE / OCCURRENCE>

(6)

a.	AMPLEUR	'size/extent'	<QUALITY>
b.	AMPLITUDE	'amplitude/range'	< MEASURE >

(7)

a.	GLAUCITÉ	'creepiness'	<QUALITY>
b.	GLAUQUERIE	'creepiness'	<QUALITY / OCCURRENCE>

(8)

a.	SENSIBILITÉ	'sensitivity'	<QUALITY / ATTITUDE / OCCURRENCE> ; neutral
b.	SENSIBLERIE	'sentimentality'	<QUALITY / ATTITUDE / OCCURRENCE> ; pejorative connotation

The pairs of A*suf*$_N$ have been sorted as follows:

- The pairs with the same semantic tags, like {BALOURDISE, BALOURDERIE} in (5), are considered to be absolute synonyms.
- Consequently, pairs of nouns sharing no semantic tags, like {AMPLEUR, AMPLITUDE} in (6), are considered to be semantically distinct nouns.
- Pairs of nouns sharing one or more tags but not all of them, like {GLAUCITÉ, GLAUQUERIE} in (7), are considered to be near-synonyms.
- Finally, pairs of nouns with the same semantic tags but having expressive differences, like {SENSIBILITÉ, SENSIBLERIE} in (8), are considered to be propositional synonyms. Observed morphopragmatic effects are negative evaluations and games.

These four cases are individually discussed in Sections 4.2 to 4.5.

4.2. Absolute synonyms

The pair of A*suf*$_N$ illustrating absolute synonyms given in (5) is analyzed in examples (9-10). Nouns BALOURDISE and BALOURDERIE appear in the same syntactic structures (a, b, c) used to determinate the possible reading of an A*suf*$_N$ (here quality, attitude, occurrence).

(9)

a.	*la balourdise de deux banquiers = deux banquiers* ***sont*** *balourds*		
	'clumsiness of two bankers'	'two bankers are clumsy'	<QUALITY>
b.	*être très maladroit,* ***faire preuve d'****une grande balourdise*		
	'to be awkward, being mishandling'		<ATTITUDE>
c.	*Le cinéma* ***commet*** *encore* ***des*** *balourdises d'une force neuve*.		
	'Cinema is still doing clumsy things with a new energy'		<OCCURRENCE>

(10)

a.	*Ce scénario* ***est d'une grande*** *balourderie*.	
	'This is a clumsy film script'	<QUALITY>
b.	*Il* ***a fait preuve de*** *balourderie en se félicitant bruyamment*.	
	'He showed clumsiness by congratulating itself noisily'	<ATTITUDE>
c.	*On s'expose à* ***dire des*** *balourderies*.	
	'We may say clumsy things'	<OCCURRENCE>

Sometimes, the speaker / writer hesitates between the two forms. This is an important evidence of their absolute synonymy. See the following example:

(11) *Parce que si cette balourderie, ou balourdise, tombe dans les mains de* [...]
'Because if this clumsy thing falls into the hands of […]'

4.3. Distinct meanings

The nouns of pair {AMPLEUR, AMPLITUDE} are built on adjective AMPLE 'large' and are semantically distinct. In sentences (12) and (13), the two nouns appear in comparable contexts (measuring). However, they cannot be subsituted for each other without causing agrammaticality. Noun phrases *ampleur thermique* (13) and *amplitude des fraudes* (12) would be inappropriate. In fact, AMPLITUDE is a measure noun whereas AMPLEUR is a quality noun.

(12) *Trop tôt pour mesurer l'ampleur des fraudes aux législatives*.
'It is too early to measure the scale of fraud in the legislative elections'

(13) *On peut également mesurer l'amplitude thermique journalière*.
'The daily range of temperatures can also be measured'

Both nouns AMPLEUR and AMPLITUDE express measure but they are not related to the same measuring scale. On one hand, AMPLEUR is defined as a dimensional property (cf. how large is something or someone). On the other hand, AMPLITUDE is defined as "the distance between the top and the bottom of a wave" (Cambridge Dictionaries Online).

4.4. Near-synonyms

The pair {GLAUCITÉ, GLAUQUERIE} has been ranked among near-synonyms because the semantic tags of the two nouns do not entirely overlap. Both nouns may be interpreted as "the property of being creepy", as illustrate examples (a) below but only GLAUQUERIE can refer to an occurrence, cf. (b) sentences.

(14)
a. *le public francophone ne supporte pas les récits d'une grande glaucité*
'francophone audience cannot stand very creepy stories
b. ?*ne pas savoir qui utilise ce pseudo pour faire des glaucités*
'not know who is using this alias to do creepy things'

(15)
a. *inventée un soir de grande glauquerie*
'invented during a creepy evening'
b. *ne pas savoir qui utilise ce pseudo pour faire des glauqueries*
'not know who is using this alias to do creepy things'

4.5. Propositional synonyms

Finally, the set {SENSIBILITÉ, SENSIBLERIE} has been ranked among propositional-synonyms because of they share the same semantic tags and exhibit expressive differences. The first element of the set is more neutral, while the second is evaluative. In sentences (16)-(17) for example, SENSIBILITÉ and SENSIBLERIE differ in expressive meaning.

(16) *Si notre intelligence et notre sensibilité se développent* […]
'If our intelligence and our sensitivity develop […]'

(17) *plus de fausse pudeur ni de sensiblerie de mauvais aloi*
'No false modesty or dubious sentimentality anymore'

In addition to the cases shown in examples (5)-(8) and developed in (9)-(17), some sets include nouns that are both near-synonyms and propositional synonyms (18). In this case, near-synonymy prevails. Then, the nouns of the pair {MODERNITÉ, MODERNERIE} are considered to be near-synonyms.

(18)

a.	MODERNITÉ	'modernity'	<QUALITY>
b.	MODERNERIE	'modernity'	<QUALITY / CONCRETE OBJECT> ; pejorative connotation

Pairs of nouns have been sorted according to their degree of synonymy, in the manner described. The sorting result is discussed in the next section.

5. Results

One given set of nouns is an instantiation of a particular pattern. For example, the pair {MODERNITÉ, MODERNERIE} includes two nouns from adjective MODERNE 'modern' and is an instantiation of the pattern {A*ité*$_N$, A*erie*$_N$}. This allows the identification of significant trends:

- If a given pattern {N1, N2} produces a majority of semantically distinct nouns N1 and N2, then the suffixes implied are semantically distributed.
- On the contrary, if a given pattern {N1, N2} produces a majority of absolute synonyms, then this pattern implies rival suffixes, cf. Section 5.2.
- Finally, patterns {N1, N2} that produce a majority of propositional synonyms or near-synonyms need a closer look, cf. Sections 5.3 and 5.4.

All instantiations of each pattern have been sorted according to their degree of synonymy, in the manner described in the previous section. In other words, for each pattern, I have listed the pairs of absolute synonyms, semantically distinct nouns, near-synonyms and propositional synonyms, cf. Table 1. The pattern {N1, N2} is given in column 1, the number of its instantiations in column 2. Among the pairs instantiating a pattern, the number of absolute synonyms is reported in column 3, the number of near-synonyms in column 4, the number of propositional synonyms in column 5 and the number of pairs of semantically distinct nouns is given in column 6.

Table 1 is widely commented in Sections 5.1 to 5.4.

Table 1: Patterns sort according to the degree of synonymy of their instantiations.

	1. Pattern	2. Number of instantiations	3. Absolute synonyms	4. Near synonyms	5. Propositional synonyms	6. Distinct meaning
1	{A*ité*$_N$, A*ité*$_N$}	38	**33** **86,84%**			5 13,16%
2	{A*té*$_N$, A*té*$_N$}	4	**3** **75%**			1 25%
3	{A*esse*$_N$, A*esse*$_N$}	2	**2** **100%**			
4	{A*erie*$_N$, A*erie*$_N$}	5	**5** **100%**			
5	{A*itude*$_N$, A*itude*$_N$}	4	**3** **75%**			1 25%

6	{A*ité*$_N$, A*té*$_N$}	30	**29** **96,67%**			1 3,33%
7	{A*ité*$_N$, A*ice*$_N$}	2	**2** **100%**			
8	{A*té*$_N$, A*ise*$_N$}	3	**3** **100%**			
9	{A*té*$_N$, A*eur*$_N$}	4	**4** **100%**			
10	{A*ité*$_N$, A*esse*$_N$}	58	**54** **93,10%**	1 1,72%		3 5,18%
11	{A*té*$_N$, A*esse*$_N$}	16	**14** **87,5%**	1 6,25%		1 6,25%
12	{A*ité*$_N$, A*eur*$_N$}	32	**27** **84,38%**	3 9,38%		2 6,24%
13	{A*ise*$_N$, A*itude*$_N$}	23	**15** **65,22%**	7 30,43%	1 4,35%	
14	{A*eur*$_N$, A*esse*$_N$}	30	**18** **60%**	8 26,67%		4 13,33%
15	{A*erie*$_N$, A*ise*$_N$}	31	**16** **51,61%**	14 45,16%		1 3,23%
16	{A*ité*$_N$, A*ise*$_N$}	18	**9** **50%**	8 44,44%		1 5,56%
17	{A*esse*$_N$, A*itude*$_N$}	36	14 38,89%	2 5,56%	**15** **41,67%**	5 13,89%
18	{A*ité*$_N$, A*itude*$_N$}	93	29 31,18%	20 21,51%	**41** **44,09%**	3 3,23%
19	{A*té*$_N$, A*itude*$_N$}	16	2 12,2%	5 31,25%	**9** **56,25%**	
20	{A*erie*$_N$, A*itude*$_N$}	32	7 21,88%	**22** **68,75%**	2 6,25%	1 3,12%
21	{A*eur*$_N$, A*erie*$_N$}	21	6 28,57%	**11** **52,38%**	3 14,29%	1 4,76%
22	{A*esse*$_N$, A*erie*$_N$}	49	15 30,61%	**28** **57,18%**	4 8,16%	2 4,08%
23	{A*ité*$_N$, A*erie*$_N$}	188	43 22,87%	**118** **62,77%**	11 5,85%	20 10,64%
24	{A*té*$_N$, A*erie*$_N$}	21	8 38,10%	**9** **42,86%**	3 14,29%	1 4,76%
25	{A*erie*$_N$, A*ie*$_N$}	20	9 45%	**9** **45%**	2 10%	
26	{A*eur*$_N$, A*itude*$_N$}	23	5 21,74%	2 8,70%	**8** **34,78%**	8 34,78%

5.1. General trends

The study of Table 1 leads to three remarks. Firstly, the examination of the patterns indicates that suffixes *-ité*, *-erie* and *-itude* are a kind of 'universal alternants'. They compete with all suffixes of the study and are implied in most of the pairs. The patterns without *-ité*, *-erie* or *-itude* are the less instantiated (only 6,88% of the pairs, that is 55/799).

Secondly, one clear deviation from this overall trend should also be noted. The pattern {A*eur*$_N$, A*esse*$_N$} counts 30 pairs of nouns. It is well instantiated in view of the few number of *-eur* and *-esse* deadjectival nouns in French (respectively 75 and 132 nouns recorded in Mordan), cf. Koehl (2010). 29,70% of pairs including a noun in *-eur* include a noun in *-esse* and 49,18% of pairs including a noun in *-esse* include a noun in *-eur*.

Finally, the most important point is that there is no pattern instantiated with a majority of semantically distinct nouns. Consequently, according to the definition of suffix distribution proposed in Section 3, we can state that the examined suffixes are not semantically distributed.

5.2. Patterns producing a majority of absolute synonyms instances (lines 1-14)

Among the patterns mostly instantiated with absolute synonyms, two kinds of patterns can be distinguished:

- Patterns 1-6 involve the same suffixation twice. For example, the pair {CHINOISITÉ 'Chinese-ness', SINITÉ 'Chinese-ness'}, instatiating the pattern {A*ité*$_N$, A*ité*$_N$}, consists of two nouns derived from the adjective CHINOIS 'Chinese' with the suffix *-ité* but they don't realize the same adjectival stem (/sin/ is the suppletive stem of adjective CHINOIS, cf. Dal & Namer 2010). CHINOISITÉ and SINITÉ are considered as absolute synonyms because they are substitutes for one another in every context. The same is true for every pairs of Table 1, lines 1-6, column 3.
  As indicated in column 6, some pairs of nouns instantiating patterns 1-6 have distinct meanings. For example, the pair {SURDITÉ 'deafness', SOURDITÉ 'property of being unvoiced'} reflects the polysemy of the adjective SOURD 'deaf'.
- Patterns 7-14 are related to a majority of absolute synonyms (60% to 100% of absolute synonyms). Three cases can be easily explained. First, patterns 7, 10, 12 involve the productive suffix *-ité* and an unavailable suffix (*-ice*, *-esse*, *-eur*). We can make the assumption that the speaker rebuilds absolute synonym nouns using a suffix more frequent in the lexicon. Second, pattern 13 involves suffixations in *-itude* and *-ise* that shares the semantic particularity of forming attitude nouns. Third, the pattern 14 implies nouns in *-eur* and *-esse* which have a lot of properties in common (cf. Koehl 2010).

5.3. Patterns with 50% of absolute synonyms instances (lines 15-16)

Half of the instances of patterns {A*erie*$_N$, A*ise*$_N$} and {A*ité*$_N$, A*ise*$_N$} are absolute synonyms and the other half are near-synonyms, propositional synonyms or semantically distinct. 51,61% of pairs realizing the pattern {A*erie*$_N$, A*ise*$_N$} have exactly the same semantic tags (cf. line 15, column 3). 45,16% of instances are near synonyms (column 4) because their A*erie*$_N$ have a concrete reading, cf. (19), contrary to the A*ise*$_N$.

(19) *une gluanterie qui mousse, quelle horreur!*
'A sticky thing that foams, how horrible!'

50% of pairs instantiating the pattern {A*ité*$_N$, A*ise*$_N$} are absolute synonyms (cf. line 16, column 3) and 44,44% are near-synonyms. Indeed, the A*ise*$_N$ are most likely to have an event

reading than the A*ité*$_N$. As an example, FAIBLARDISE 'weakling-ness' has an event reading in (20) but FAIBLARDITÉ 'weakling-ness' never has.

(20) *en faisant des faiblardises de ce genre*
'doing such weakling things'

5.4. Patterns producing with a minority of absolute synonyms instances (lines 17-26)

The remaining patterns are instantiated by less than 50% of absolute synonyms. All the patterns 17-26 contain either A*itude*$_N$ or A*erie*$_N$.

The patterns 20-25 are related to a majority of near-synonyms. These pairs all imply A*erie*$_N$ which are interpretable as quality nouns and have additional readings (event or concrete) and/or have a pejorative connotation {SINITÉ 'Chinese-ness', CHINOISERIE 'chinoiserie'}, {BLONDEUR 'blondness', BLONDERIE 'a blonde's thing'}, {VIEILLESSE 'oldness', VIEILLERIE 'old thing'}.

Patterns 17, 18, 19, 26 are linked to a majority of propositional synonyms. These pairs include A*itude*$_N$ which are interpretable as quality nouns and produce an additional morphopragmatic effect (Koehl, 2012). This can be explain by the fact that most of the new coined *-itude* nouns result from a language game consisting in substituting *-itude* to another suffix.

(21) *Le mythe de ma bellitude est brisé, ouai j'suis moche :p*
'The myth of my beauty is broken, yes I'm ugly :p'

6. Conclusion

This paper was devoted to deadjectival nouns. In particular, sets of two or more nouns derived from a same adjective were examinated. The use of a database allowed the gathering of the noun sets and their analysis. Far from being marginal, 655 sets of nouns are stored in Mordan database, namely 1566 out of 3983 nouns. The sets of size 3 and more have been reported to pairs to compare suffixations two by two. In all, 799 pairs instantiating 26 patterns have been treated.

As a first step, I have defined suffix rivalry and the degrees of synonymy. Then, the sets of nouns have been sorted according to this synonymy scale, using the semantic tags of Mordan.

Third, patterns of sets of nouns have been examined (Table 1). The first hypothesis was that there are semantic constraints involved by each suffixation. This hypothesis was discarded because no pattern is instantiated by pairs of nouns with distinct meanings.

The second hypothesis was that the suffixations product true synonyms. All the studied suffixations construct quality nouns. Nevertheless, the only case where different suffixations produce absolute synonyms is the rebuilding of nouns in *-eur*, *-esse*, *-ice* with the more available suffix *-ité*. So, the second hypothesis is discarded too.

Suffixes involved in the nominalization of adjectives in French are not in rivalry, nor in distribution but in alternation. Indeed, three of the suffixations are universal alternants. They all have a speciality. The suffixation in *-ité* is the neutral one. The suffixation in *-erie* constructs concrete nouns, event nouns and pejorative nouns. The suffixation in *-itude* recently acquired a comic effect. A forthcoming step will be to refine the grid of synonymy analysis. A finest semantic analysis would take into account the polysemy of nouns. For example VERDEUR 'greenness' is currently considered as a quality noun (and color name). A

more precise analysis would take into account the distinct qualities metaphorically denoted by VERDEUR like the 'property of not being mature', 'property of being young' or the 'property of being saucy'.

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Neoclassical compounds as relational adjectives

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1. Introduction

One way to interpret the meaning of a complex lexeme is to observe the parts of which it is constituted and the interactions between them. This compositional analysis is adopted, more or less explicitly, in the majority of studies on morphological derivation. The present study deals with mismatches that can occur between form and meaning, taking as example a special class of complex lexemes in French, so-called neoclassical compounds and we propose that some of them can be analyzed as pure relational adjectives. In particular, we focus our attention on French derivates ending in *-logique*, which, we claim, should be considered as the output of a single constructional strategy, rather than as constructed by the sequential adjunction of the element *-logue* and of the suffix *-ique*. As our main objective here is to study the lexicon and in particular the mechanisms by which it is formed, we focus our attention on neologisms, i.e. on non 'dictionarized' words. Moreover, we defend a context-based analysis, since we propose to characterize the semantics of complex lexical items not on the basis of abstract labels given by the linguist, but on the basis of their contexts of use. Behind this way of dealing with the semantics of complex lexemes there is a basic assumption which is analogous to that of distributional semantics (see Lenci 2008 and Sahlgren 2008 for an overview), according to which it is possible to find a correlation between the distribution of two words and their semantic distance. We also strongly defend the idea that taking context into account is fundamental for studying the meaning of complex lexemes, and consequently of derivational constructions. The observation of single lexemes in isolation is not sufficient to give us a precise and realistic view of how derivational morphology works, in particular for those languages for which large textual resources are now available and easy to access.

This paper is organized as follows: in Section 2 we present some general characteristics of the units which are classified as neoclassical compounds in the literature, focusing in particular on the use as pure relational adjectives of some of them in everyday language; Section 3 presents the data on which this study is conducted, i.e. a Web-based corpus of NA pairs in French, where the adjective is a constructed one ending in *-logique*; in Section 4 this corpus is compared with two other corpora based, respectively, on the French Wikipedia and on ten years of the newspaper *le Monde*; finally, Section 5 contains some concluding remarks, and sketches an explanation for the tendency for adjectives containing a neoclassical element, such as those in *-logique*, to evolve as purely relational ones.

2. The problem: neoclassical compounds as relational adjectives

The complex lexemes we consider here belong to the class of so-called neoclassical compounds (fore a more precise description, cf. Amiot & Dal 2007, 2008; Villoing 2012). Most neoclassical compounds have been originally coined in scientific and technical vocabularies, in many European languages, from the 17th century on. Today they are also found massively in everyday language (Lasserre 2013). They differ from native compounds in that they involve what we call a neoclassical element, which was a lexeme in Latin or Ancient Greek but has lost its autonomy. Neoclassical elements do not receive a unified treatment in the literature, in particular concerning their status: are they lexemes, affixes, or something in between? We are not going to solve this question in this paper, but we suspect, like Amiot &

Dal (2007), that all neoclassical elements do not belong to a homogeneous class. In particular, some of them which are really frequent and are used to form large series of lexemes (like *-crate*, *-logue* or *-cide*), can be considered as exponents of constructions: they are the formal expression of a semantic and syntactic operation, just like canonical affixes.

It can be easily observed that in many neoclassical compounds, all formally identified elements do not necessarily have the expected meaning.

(1)
a. *mine carbonifère* (138)
mine coal + contain
'coal mine'
b. *dictature pétrolifère* (559)
dictatorship petrol + contain
'petro-dictatorship'

(2)
a. *personne bibliophile* (14)
person books + lover
'book lover'
b. *connaissances cinéphiles* (825)
knowledge film + lover
'knowledge of film'

(3)
a. *région viticole* (529,000)
region wine + culture
'wine-making region'
b. *gastronomie ostréicole* (386)
gastronomy oyster + culture/farm
'oyster gastronomy'

In (1a)-(2a)-(3a) we show various contexts in which a neoclassical element (*-fère*, *-phile* and *-cole*) has the expected meaning (respectively 'production', 'lover' and 'culture/farm'), while in (1b)-(2b)-(3b) we show contexts in which the same neoclassical elements have unexpected meanings[1]. In parentheses, we specify the number of occurrences of each collocation on Google. In these latter examples, only the distribution gives us a key to interpret the meaning of the lexemes in question. Moreover, if in (3a) the meaning of *viticole* is related to the meaning of the lexeme *viticulture* 'vine-growing', in (3b) the meaning of *ostréicole* is not related to *ostréiculture* 'oyster-farming' but directly to *huître* 'oyster'. The neoclassical element *-cole* does not display the expected meaning 'culture, farm' but only marks the relation between the base lexeme *huître* and the head noun *gastronomie*. In consequence, we argue that these complex words are close to relational adjectives which involve suffixes whose only function is to relate a noun and an adjective.

As Roché (2006) – among others – argues, the suffix *-el* in *présidentiel*, built on *président*, marks a formal operation, a categorial operation but not a semantic operation. In (1b)-(2b)-(3b), the neoclassical elements *-fère*, *-phile* and *-cole* are not different in that sense from the suffix *-el*. Rainer (2013) considers that the use of the Latin element *-fère* for marking relational adjectives is due to the fact that the original Latin meaning is lost in the competence

[1] We consider that *carbon-*, *bibli-*, *viti-* and *ostréi-* are suppletive stems of the base lexemes, respectively, CARBON 'coal', LIVRE 'book', VIGNE 'vineyard' and HUÎTRE 'oyster'

of the majority of speakers who reinterpret ambiguous uses, an explanation we can extend to other cases of neoclassical compounds.

In this paper, we focus on the semantic characterization of the final sequence *-logique*, and we argue that, like *-cole* or *-fère*, it can be used to form relational adjectives. This element is part of the triad *-logue* '-logist' / *-logie* '-logy' / *-logique*. It has two distinct origins in Ancient Greek: the noun *logos* which means 'discourse' and the verb *legein* which means 'collect, gather'. These two origins are not distinguished anymore and all words in *-logie* are perceived as constructed with a unique element.

If we look at the entries of the *TLFi* dictionary, summarized in Table 1, we observe that the element *-logie* has six main meanings, the element *-logue* two, and the element *logique* is just seen as forming adjectives corresponding to nouns in *-logie*. In fact, these meanings are not clear-cut, and we find several ambiguities: *étymologie* may correspond to meanings 1 and 6, *terminologie* to meanings 1 and 4 and so on. Furthermore, the availability of each meaning is not comparable: for instance, meaning 6 is very frequent whereas meaning 5 is no more found in neologisms.

Table 1: Correspondences between *-logue, -logie* and *-logique* in the *TLFi*.

	1	2	3	4	5	6
-logie	'discourse' *étymologie*	'expression' *dactylologie* 'discourse with hands'	'works in *n* parts' *trilogie*	'collection' *terminologie*	'behaviour' *misologie* 'refusal of speaking'	'study' *cardiologie*
-logue	'practioner' *philologue*					'specialist' *cardiologue*
-logique	adjectives correspounding to nouns in *-logie*					

From a formal point of view, the nouns in *-logie* could be considered as being formed on the nouns in *-logue* by a suffix having the form *-ie* (phonologically /i/) which triggers a modification of the preceding consonant. The ending *-ie* is particularly frequent in neoclassical composition: *-phile* / *-philie*, *-phobe* / *-phobie*, *-scope* / *-scopie*, *-trophe* / *-trophie*, *-mane* / *-manie*, etc. However, if this is a genuine case of derivation, its direction is reversed compared to the other means used for constructing nouns of specialists in French. Specialist nouns formed with the suffixes *-iste* and *-ien* take nouns of disciplines as bases, but the nouns of disciplines in *-logie* would have the specialist nouns in *-logue* as bases:

(4)

a. *violon* 'violin' > *violoniste* 'violonist'
b. *musique* 'music' > *musicien* 'musician'
c. *cardiologie* 'cardiology' < *cardiologue* 'cardiologist'

A cross-linguistic observation shows that, in English, the specialist noun in *-logist* seems built on the discipline noun in *-logy*, just as specialist nouns in *-ist* and *-ien*. These considerations make us think that the lexemes in *-logue* and those in *-logie* are not linked by an oriented derivational process. Consequently, we argue here that the relation between *-logie* nouns and *-logique* adjectives is not a derivation either and that they constitute two poles (out of at least three) of a more complex lexical network which at least also contains words in *-logue*.

In order to support this hypothesis, let us analyze the lexeme *météorologique*, 'meteorological'. In a purely concatenative approach, we would analyze this complex word as

the relational adjective corresponding to the noun *météorologie* 'meteorology', identifying three elements inside it: *météoro-* 'weather', *-logie-* 'study of' and *-ique* 'related to'.

However, the different interpretations this lexeme can have in the expressions in (5) make us think that the sequence *-logique* forms not only adjectives related to a *-logie* noun, but also adjectives directly related to the base.

(5)
a. *recherches météorologiques* 'meteorological research'
   => *météorologique*: 'related to the meteorology as the study of the weather'
b. *prévisions météorologiques* 'meteorological predictions, weather forecast'
   => *météorologique*: 'related to the weather as an object of study'
c. *tempête météorologique* 'meteorological storm, weather storm'
   => *météorologique*: 'related to the weather'

If we now turn more specifically to the relations between the three elements *-logie*, *-logue* and *-logique*, we found different scenarios. First, a X-logique adjective is canonically related to a discipline noun in X-*logie*, as we see in (6) where *cardiologique* is undoubtedly constructed on *cardiologie*.

(6) *La Fédération Française de Cardiologie apporte son soutien à la recherche cardiologique*
'The French Cardiology Federation supports cardiological research'
[http://www.fedecardio.org/qui-sommes-nous/financer-la-recherche/bourses-fedecardio]

However, X-*logique* adjectives may also be related to a specialist noun in X-*logue* (7):

(7) *Je sais uniquement que j'étais myope à moins 4.75 à l'oeil gauche avec de l'astigmatie (dont je ne connais pas le degré exact étant donné que je ne comprends pas le jargon ophtalmologique et que je ne sais pas lire une ordonnance d'ophtalmologue*
'… I don't understand the ophthalmological jargon and I cannot read a prescription made by an ophthamologist'
[http://www.ophtalmologie.fr/operation-myopie/hopital-public-resultat-decevant-quelle-solution-t3840.html]

This relation is more marginal and ambiguous, since *jargon ophtalmologique* can be interpreted as the jargon used in the discipline of ophthalmology and the jargon used by ophthalmologists. Finally, and most interestingly, a X-*logique* adjective can be directly related to the base.

(8) *On est tellement habitués aux tempêtes métaphoriques (financières, médiatiques) qu'on est dépourvus face à une tempête météorologique*.
'We are so used to metaphorical storms (financial, mediatic) that we are unable to face a metheorological storm.'
[http://www.liberation.fr/chroniques/2009/01/31/-_306669]

In (8), we cannot link the X-*logique* adjective to a X-*logie* (or X-*logue*) noun. The sequence *-logique* is therefore the exponent of a construction giving relational adjectives, just like the canonical relational suffixes *-ique* or *-el-log-* has not, or has lost, its semantic values 'study', 'discourse' or 'collection'.

However, as nothing is so clear-cut in the observation of the lexicon, we also observe many cases in which the semantic interpretation is more ambiguous.

(9) *L'examen ophtalmologique de routine comprend un certain nombre d'évaluations pour réaliser un bilan complet de votre vue*.
'The routine eye examination includes a number of tests in order to obtain a global evaluation of your sight.'
[http://www.docvadis.fr/croixrousseophtalmo/page/les_maladies_de_l_oeil/les_examens_complementaires_1.html]

In (9) the collocation *examen ophtalmologique* may be analyzed as 'examination within the discipline of ophthalmology' , 'made by an ophthalmologist' or just as 'examination of the eyes'.

Furthermore, some fully lexicalized lexemes, like *biologique* 'biological/organic', progressively changed into qualifying adjectives.

(10)
a. *recherche biologique* 'research on biology'
b. *phénomène biologique* 'biological phenomenon'
c. *agriculture biologique* 'organic farming'

In (10a)-(10b) *biologique* is a relational adjective, related to biology in (10a) and directly constructed on the base *bio-* 'life' (10b). However, in (10c), the adjective cannot be specifically linked to any other lexeme and only qualifies a particular type of farming.

3. The relational use of neological relational adjectives

In order to analyse the availability of *-logique* and its semantics, we collected a corpus of adjectives containing this final sequence which are not recorded in the main French dictionaries (*TLFi* and *Le Grand Robert*). The corpus was made up by systematically searching on the Web the corresponding *-logique* adjective for a list of *-logue* / *-logie* lexemes collected from the French Google ngrams[2]. For each of these adjectives (329 overall) we searched a sample of contexts on the Web, in order to dress a list of head nouns for the NA pairs in which they appear (henceforth the "corpus of neologisms"). We collected up to 35 different contexts per adjective (roughly corresponding to the first two pages of results provided by a search engine). Overall, our corpus of neologisms contains 2,279 NA pairs with 927 different head nouns. In (11), we give a sample of the head nouns encountered most frequently with *-logique* adjectives in the corpus of neologisms:

(11)

étude	'study'	87
recherche	'research'	62
analyse	'analysis'	42
approche	'approach'	38
science	'science'	30
connaissance	'knowledge'	25
donnée	'data'	22
littérature	'literature'	20
aventure	'adventure'	17
théorie	'theory'	16
travail	'work'	16
méthode	'method'	15
problème	'problem'	15

[2] http://storage.googleapis.com/books/ngrams/books/datasetsv2.html.

aspect	'aspect'	14
examen	'exam'	14
expérience	'experience'	13
perspective	'perspective'	13
savoir	'knowledge'	13
tradition	'tradition'	13
réflexion	'reflection'	12

Before going further into the analysis, we should spend some words about the use of the Web as a linguistic resource. As it is evident from the data above, even if we limit the collection of data to the pages indexed in the first four pages of results provided by a search engine (two in the singular and two in the plural form), we obtain a number of contexts which is much larger than what we can obtain from corpora which are among the largest available for French. The choice of limiting the analysis to the first four pages (maximum 40 contexts / *-logique* adjective) was due to the need of manually verifying each context (e.g. concerning the linguistic skills of the writer), a task which can only be accomplished on a limited number of data. However, we consider that this limitation does not affect the results, since (i) for the great majority of *-logique* adjectives in our corpus, search engines do not provide more than two pages of results (95/329 adjectives have more than 10 contexts, and 8/329 have more than 20); (ii) even if it is well known that the results provided by search engines are organized according to their own criteria, these criteria are certainly not susceptible of creating a linguistic bias for the research we wanted to carry out.

We coded all the head nouns in the corpus according to their compatibility with one of the meanings commonly assumed for *-logie* and listed in Table 1. The three meanings attested are 'study of', which is found in about two thirds of the head nouns in our corpus, 'discourse on X' and 'collection of X' which, on the other side, are quite marginal. Moreover, about a third of the head nouns in the corpus are not compatible semantically with any of the meanings of Table 1, or, if they are, they are too generic and undefined to be unambiguously linked with one of them (cf. *plan* or *niveau* in such expressions as *sur le plan* X 'on the X plan' or *au niveau* X 'at a X level'). The exact figures are given in (12):

(12)

a.	'study of X' *étude* 'study' *recherche* 'research'	657
b.	others *aventure* 'adventure' *moment* 'moment'	183
c.	generic *plan* 'plan' *niveau* 'level'	63
d.	'discourse on X' *discussion* 'discussion' *débat* 'debate'	16
e.	'collection of X' *inventaire* 'inventory' *patrimoine* 'patrimony'	9

Although, as we have already observed, the distinction between the three main meanings of *-logue* / *-logie* is not always neat, we may assume – without going further into this matter – that there is a hierarchy in the semantic instruction of this morphological construction (13).

(13) 'study of X' > 'discourse on X' > 'collection of X'

A further observation of the head nouns in the NA pairs related to the 'study of X' meaning (whose interest will become clear below) allows producing a more fine-grained semantic classification of them (semantic classes are given in the order of importance):

(14)
a. object / concept
   donnée 'data'
   théorie 'theory'
b. activity
   etude 'study'
   recherche 'research'
c. property
   connaissance 'knowledge'
   savoir 'knowledge'
d. output / result
   découverte 'discovery'
   ouvrage 'work'
e. place / institution
   centre 'centre'
   institut 'institute'
f. human
   expert 'expert'
   confrere 'colleague'

Unlike the words in *-logue* / *-logie*, however, those in *-logique* display, at least in our corpus of neologisms, a large proportion of examples whose semantics is not compatible with any of the 'canonical' meanings of these neoclassical compounds. It is precisely on this class of items that we want to focus our attention, and we do the claim that they correspond to a class of purely relational adjectives.

As far as the semantic relation between a *logique* adjective and its base is concerned, those observed in our corpus of neologisms correspond to those existing for dictionarized items:

(15)
a. 'related to the science of X' (X*logie* + *-ique)*
   … chacun saura rendre grâce à ces infatigables mineurs du ***savoir discologique****.*
   ('knowledge in records')
   [http://www.pop-hits.net/article-les-promesses-de-l-aube-episode-2012-starring \:-jerry-mengo-96203143.html]
b. 'related to the specialists of the science of X' (X*logue* + *-ique*)
   Un album-concept est un ***terme discologique*** *qui traduit la volonté de la part d'un artiste ou d'un groupe de créer une œuvre filée tout au long d'un disque.*
   ('term of music industry')
   [http://fr.wikipedia.org/wiki/Vocabulaire_du_rock]

c. 'related to X' (X + *-ique*)
Le tout autour et avec les excellentissimes ***choix discologiques*** *de Sebastien Tison, dont la playlist figure dans le même blog.*
('choices of records')
[http://patwhite.com/node/4314]

We consider that we can take this as a proof of the fact that in French we have three distinct but parallel constructions whose exponents are, respectively, *-logue*, *-logie* and *-logique*, and that each of them is available with new bases. The last one, in particular, may construct derivates whose meaning is distant from the canonical ones observed with lexicalized *-logue* / *-logie* lexemes, and which, in general, is hard to characterize, due to the variety of meanings of the bases this construction applies to, and of the NA pairs its outputs enter in. This already seems an argument for classifying these adjectives among the relational ones. Moreover, it is quite frequent that in this case the noun chosen as a base designates an object for which there is no socially recognized science or discipline, and consequently no institutionalized name for it and / or its specialists, if not in an ironic or fictional use. In this case too, we may sketch a semantic characterization of the most frequent head nouns.

(16)
a. ACTIVITY / PERIOD OF TIME
aventure ***bistrologique*** (< bistro) 'adventure in a bistro'
soirée ***vinologique*** (< vin) 'wine party (evening)'
b. PROPERTY
vitesse ***escargotologique*** (< escargot) 'snail speed'
rhétorique ***injurologique*** (< injure) 'rhetoric of insults'
c. CONCRETE OBJECT
bougie ***aromacologique*** (< arôme) 'aromatic candle'
kit ***bobologique*** (< bobo) 'first-aid kit'
d. HUMAN
coach ***tarologique*** (< tarot) 'tarot coach'

Interestingly, the most frequent semantic classes for these lexemes correspond quite well to those observed for the meaning 'study of', although we cannot see any trace of this meaning in the examples above. However, although observing their proportion is interesting, as it allows making a correlation between the two sets of lexemes, one may also claim that the meanings in (16) correspond to quite general semantic classes, thus suggesting that a precise semantic characterization does not give any special cue in understanding the behavior of these adjectives. We take it as a further argument in favor of the hypothesis that they are relational adjectives.

To sum up, what we propose is that (i) among the semantic instructions of an adjective in *-logique*, there is one (corresponding to the examples *tempête météorologique* in (5c) and *choix discologiques* in (15c)) in which the meaning of the adjective is directly connected with the meaning of the base, with the *-log-* sequence providing no specific semantic contribution; (ii) the availability of this semantic value determines the possibility of having adjectives in *-logique* directly constructed on a noun with a purely relational meaning.

4. A distributional analysis of *-logique* adjectives: a comparison of three corpora

The classes and the figures listed above can give us a rough idea of the semantic value of *-ique* adjectives, in particular when they are new, non-lexicalized lexemes. However, due to the polysemy of several base nouns and head nouns and to the various ambiguities we pointed out, a precise semantic characterization of them is hard to obtain.

For this study, in particular, we compared our corpus of neologisms with the two resources *les voisins de Wikipédia* (henceforth vdW)[3] and *les voisins du Monde* (vdM)[4]. These two resources are based, respectively, on the French Wikipedia (collected in 2008) and on 10 years of the newspaper *le Monde* (1991-2000). They are tagged for syntactic context, and are presented via an interface which allows searching the syntactic relation a word enters into.

We systematically searched the head nouns for all *-logique* adjectives in the two corpora. The results (including the Web-based corpus of neologisms) are presented in Table 2, and the the ten most frequent head nouns in the vdW and wdM corpora are given in Table 3:

Table 2: Number of *-logique* adjectives, head Ns and NA pairs in the three corpora considered.

Corpus	Nr. Words	A in *-logique*	Head N	NA pairs
vdWikipédia	262 M	55	705	1,505
vdMonde	200 M	57	305	934
Web		329	927	2,279

Table 3: Ten most important head nouns in the vdW and vdM corpora.

vdW			vdM		
point	'point'	19	*étude*	'study'	15
étude	'study'	17	*recherche*	'research'	15
recherche	'research'	17	*analyse*	'analysis'	13
plan	'plan'	15	*ordre*	'order'	13
aspect	'aspect'	13	*approche*	'approach'	12
système	'system'	13	*donnée*	'data'	12
chirurgie	'surgery'	13	*point*	'point'	12
donnée	'data'	12	*raison*	'reason'	11
problème	'problem'	12	*plan*	'plan'	10
niveau	'level'	11	…		

If our main hypothesis is correct, i.e. that *-logique* adjectives tend to acquire a purely relational function, we should observe a difference between the traditional corpora (which represent, respectively, a technical and a more formal register) and the data from the Web, which represent a less formal register, possibly more suitable to provide hints on how speakers use derivational morphology in a creative way. We can expect, in fact, that the traditional corpora contain a greater proportion of head nouns which are compatible with the core meaning(s) of the adjectives in *-logique*, whereas in the corpus of neologisms we can observe a large variety of meanings among head nouns. In other words, we expect to observe

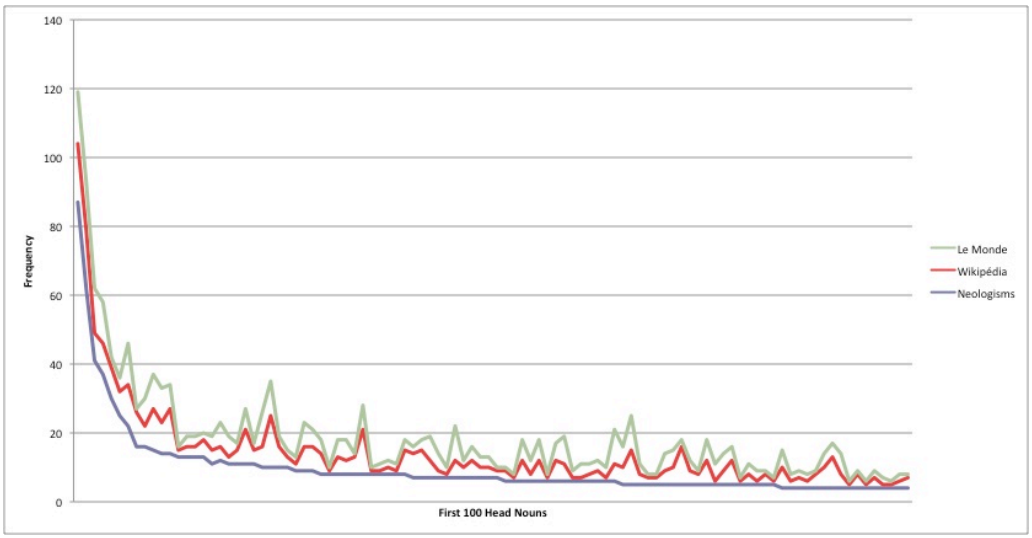
[3] http://redac.univ-tlse2.fr/applications/vdw.html
[4] http://redac.univ-tlse2.fr/applications/vdlm.html

less distance between the vdW and vdM corpora than between the latter and the Web-based corpus of neologisms.

A first observation concerns what we can call the 'density' of contexts for *-logique* adjectives. If we consider, for instance, the vdW and the Web corpus, the first has an average of 12,81 head nouns per each *-logique* adjective, whereas the second has an average of 2,81. The bigger dispersion for *-logique* adjectives in the Web corpus can be explained on the basis of the fact that they function more like pure adjectives, for which the choice of head nouns is larger, as it is less constrained by semantic factors.

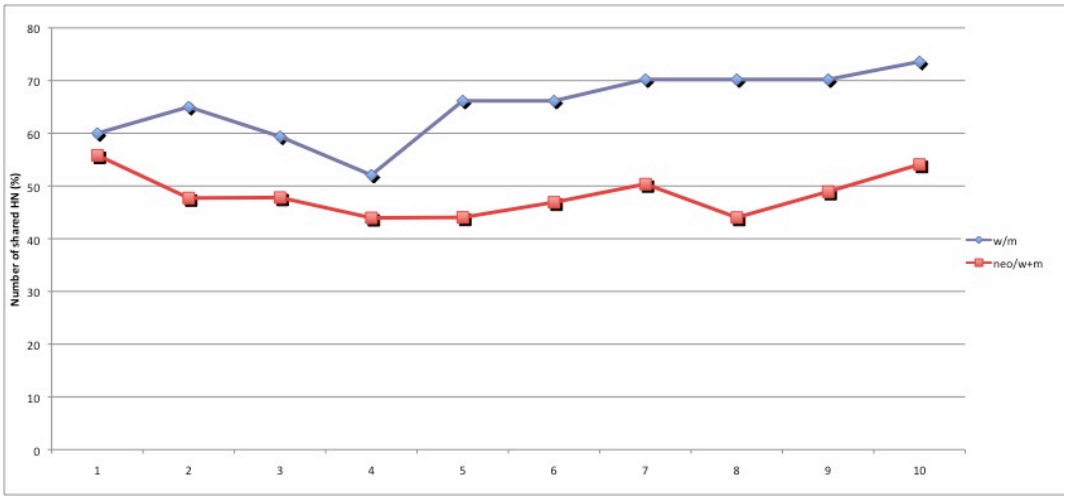
In order to obtain a more homogeneous set of data, we limited our analysis to the head nouns that appear in all three corpora (304 overall). Figure 1 shows the frequency in each corpus for the first 100 head nouns. Data were ordered according to their frequency (descending) in the Web corpus. As we can see, the two curves corresponding to the vdW and to the vdM corpora are much closer than the one referring to the Web corpus.

Figure 1: Frequency of the first 100 head nouns of *-logique* adjectives in the three corpora.



In a second time, we calculated the number of head nouns that *-logique* adjectives in the three corpora have in common, among those ranked from 1 to 100 by frequency, by portions of 10 (Figure 2).

Figure 2: Head nouns shared by the three corpora, among the 100 most frequent ones, in portions of 10.



As it can be seen, the vdW and vdM corpora systematically share more head nouns than with the corpus of neologisms, up to 73,57% among the first 100, versus 54,08% (in average, the precise figures are 63,88% between the corpus of neologisms and vdW and 44,28 between the corpus of neologisms and vdM). This suggests that in non-specialized, everyday language the use of *-logique* adjectives is less constrained, an hypothesis which is compatible with the idea of a progressive loss of the original semantic instruction linked with *-log-*.

5. Conclusion: integrating neoclassical compounds into a larger model of lexical creativity

Both the semantic observation of the corpus and the distributional analysis we provided go in the direction of our main hypothesis, i.e. that the sequence *-logique* is now the exponent of a construction in French which is autonomous, although it enters into a lexical network with at least two other constructions, namely those forming *-logue* and *-logie* nouns. Semantically, this construction is close to other constructions forming relational adjectives. That means that its main function is to transform a noun into an adjective, without any supplementary semantic load. We claimed that, for *-logique* adjectives, this is made possible by the fact that, even in the institutionalized portion of the lexicon, adjectives in *-logique* (i) can be often used to simply refer to the base noun and not to a discipline, (ii) display several systematic ambiguities among their various meanings. One question remains open though: why *-logique*, which originally is made up with a neoclassical compounding element and a relational suffix, has acquired this function? More in general why neoclassical compounding elements behave like this? In other words, why French has added new constructions, with new exponents, to those already existing for the construction of relational adjectives (e.g. *-ique*, *-ien*, *-al*, *-ier*, etc.). This seems to go against the idea of an economic organization of the lexicon and of the derivational morphology of languages, in which the ideal situation is that each meaning is constructed by one element only, and redundancy is avoided.

A first answer is that the use of *-logique* instead of, say, simply *-ique* fulfills various pragmatic functions. In many of the examples we found the adjectives in question are used in an ironic or creative manner. Moreover, there seems to be a strong tendency, at least in French, to correlate the length of a word and the fact that it belongs to a learned, prestigious register of the language, in particular when it contains a sequence that appears in genuine neoclassical compounds. There are, however, two other facts that we want to point out. On the one side, several studies on the morphology of French have shown that in this language, more than in others, word formation is strongly submitted to size constraint, and that complex words have preferred prosodic shapes, e.g. concerning the number of syllables of the derivate and/or of the base (Plénat 2009, 2011). We did not treat our corpus in a systematic way in this respect, but it seems quite clear to us that this explanation may hold for such derivates as *arbrologique* (< *arbre* ‘tree’), *biérologique* (< *bière* ‘beer’), *rhumologique* (< *rhume* ‘cold’), in which a monosyllabic base attaches to a disyllabic exponent, as disyllabic derivates are in general dispreferred in French. Moreover, it has been shown (for instance by Roché 2009, 2011b) that in order to account for the output form of complex word, it is not only necessary to refer to semantic and phonological constraints, but also to purely lexical ones. A better derivate is one that fits into a dense lexical network. Figures 3, 4 and 5 show the proportion of adjectives in *-ique* in the lexique.org database[5] according to the uni-, bi- and trigrams preceding the suffix.

[5] http://www.lexique.org

Figure 3: *-ique* adjectives in the lexique.org database according to the preceding segments (unigrams).

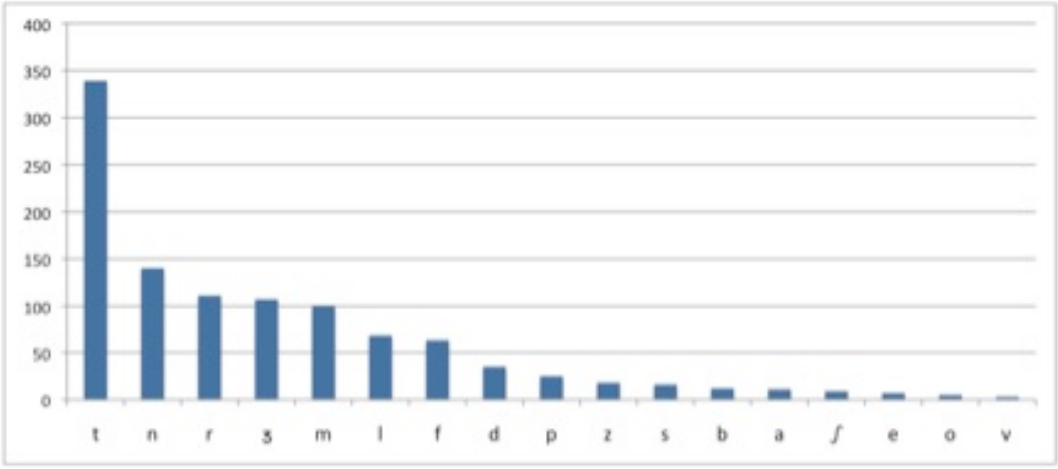


Figure 4: *-ique* adjectives in the lexique.org database according to the preceding segments (bigrams).

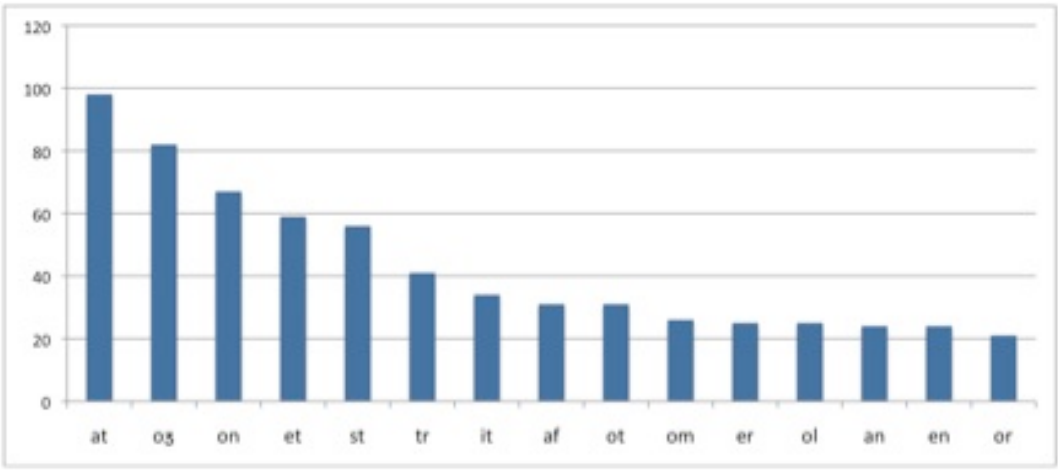
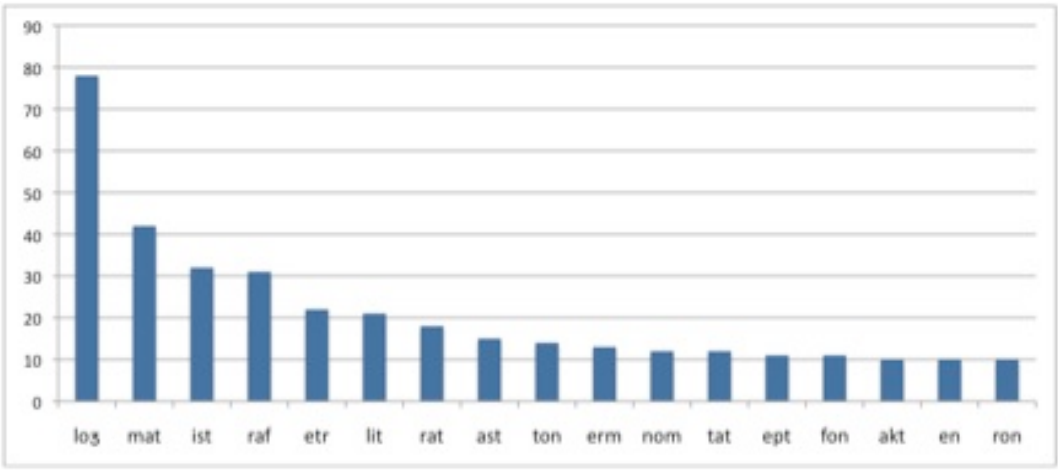


Figure 5: *-ique* adjectives in the lexique.org database according to the preceding segments (trigrams).



As we see, the segments corresponding to *-log-* are among the most common for *-ique* adjectives, and the proportion becomes dramatic when the preceding trigram is taken into account, the sequence *-logique* representing 7,2% of all *-ique* adjectives (the second one, *-matique*, represents 3,8%). We can thus consider that, even from a purely phonological point

of view, the sequence *-log-* is activated in the speakers' competence, as being one of the most likely for preceding the suffix *-ique*.

More generally, the data and the analysis we presented militate against the possibility, for complex lexemes, to be segmented into a base and one or more affixes in a discrete way. Moreover, in line with what has already been proposed for other types of suffixation in French (e.g. by Roché 2011a on *-iste*), they suggest that the traditional view of complex words as exhaustive (in which all formal elements contribute equally to meaning) and complete (in which all pieces of meaning are conveyed by a specific formal element) is too simplistic. Thus, to conclude, the rules for word formation should be viewed mainly as means for inserting new complex words into existing lexical networks rather than one-way relations between a base and a derivate.

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On the encyclopedic knowledge of gender

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1. Introduction

In the Distributed Morphology framework (Halle and Marantz 1993, Marantz 1997 and much subsequent work), henceforth DM, it is assumed that two kinds of entities are present in the syntactic derivation: formal features and roots. An important difference between these syntactic primitives is that while features may undergo decomposition in operations like impoverishment, fission and fusion, roots, on the other hand, are not subject to this kind of decomposition.[1] In this scenario, a central question that has been discussed in the literature is how the root is licensed with regard to gender features.

Given the idiosyncratic relation that seems to hold between nouns and their gender in many languages, a common solution in the literature is to equip the root or the stem with a gender diacritic, which should determine the gender of the formations in which the relevant root appears. This strategy can be found in approaches developed both outside DM (Alexiadou and Müller 2008) and inside the DM framework (Alcântara 2003, 2010). Empirically, however, treating gender as a root property is very problematic, since cases in which the very same root surfaces with more than one gender are not hard to find and this is unexpected if gender is a characteristic of the root itself.

(1) Brazilian Portuguese
a. *o poeta*/ *a poeta*
the.M poet/ the.F poet
'the poet'
b. *o chefe*/ *a chefe*
the.M boss/ the.F boss
'the boss'

(2) Brazilian Portuguese
a. √menin – *a menina*/ *o menino*
√girl the.F girl/ the.M boy
'the girl'/ 'the boy'
b. √gat – *a gata*/ *o gato*
√cat the.F cat(M)/ the.M cat(M)
'the female cat' 'the male cat'

[1] Arad (2005) claims that roots are not atomic concepts. The non-decompositionality of roots is relevant to the theoretical model as a distinctive factor between roots and formal features. It may be possible that the roots are, in some sense, decomposed, provided that the relevant processes take place in different domains than those decomposing formal features. Otherwise, there would be no distinction between roots and formal features. In other words, roots are atomic elements for the system, which manipulates atoms, but this does not prevent them from being constituted by protons and electrons and there might be a subsystem that manipulates these ontologies.

In the DM framework, assuming that roots have gender features also raises theoretical complications. As pointed out by Acquaviva (2009), equipping the root with a feature that gives clues about the categorial formations in which the relevant root may appear ultimately means that these roots are not completely devoid of category, contrary to what is proposed by DM.

In the face of this impasse, some authors have been proposing that gender information is not on the root itself, but on the element that turns this root into a noun, namely the categorizer *n*. In this view, the relation between the root and the flavors of *n* is responsible for licensing the roots with respect to the gender features (Acquaviva 2009, Kramer 2012). In this kind of approach, post-syntactic licensing conditions specify which roots may occur with which gender features. The prediction of approaches that rely on licensing conditions is that any incompatibility between what the relevant condition states and the gender that surfaces in the syntactic structure would result in a non-convergent morphosyntactic structure. However, this prediction is not empirically supported by Brazilian Portuguese data, henceforth BP.

In BP it is possible that the expected gender is incompatible with the gender feature present in the syntactic structure and this does not lead to ungrammaticality.

(3)

a. *A* ***garrafa*** *está na minha casa*.
the.F bottle(F) is in my.F house(F).
'The bottle is in my house.' or 'A girl whose nickname is 'bottle' is in my house.'

b. ***O*** ***garrafa*** *está na minha casa*.
the.M bottle(F) is in my.F house(F).
'*The bottle is in my house.'
'A guy whose nickname is 'bottle' is in my house.'

(4)

a. *A* ***bola*** *está na minha casa*.
the. F ball(F) is in my.F house(F).
'The ball is in my house.' or 'A girl whose nickname is 'ball' is in my house.'

b. ***O*** ***bola*** *está na minha casa*.
the.M ball(F) is in my.F house(F).
'*The ball is in my house.'
'A guy whose nickname is 'ball' is in my house.'

In (3b) and (4b) there is a clear mismatch between the gender of the determiner and the gender of the noun. However, (3b) and (4b) are perfectly interpretable in a context in which 'bottle' and 'ball' are related to animate entities in the world. The grammaticality of these sentences is totally unexpected under approaches that either equip the root/stem with gender features or rely on licensing conditions.

Once there actually is the possibility that the computational system generates structures with gender incompatibility, it makes sense to assume that the value of the gender feature on the noun is irrelevant to syntax and to morphology. In this sense, we claim that gender licensing should be treated as an epiphenomenon of the Encyclopedic interpretation.

In our approach, gender information is interpreted as sets in the Encyclopedia, the list that stores the speaker's non-linguistic knowledge. In BP, for example, the Encyclopedia may be composed by two different sets: one with feminine entities and another one with masculine entities. Whenever a structural association between the root and the gender features is sent to the Encyclopedia, there is a checking operation which verifies if the relevant entity is

included in the correspondent gender set. If the inclusion is not verified, that is, once there is incompatibility between the gender features generated in the syntactic structure and the gender features expected at the Encyclopedia, this association is considered to be false, leading to a violation of the Grice's Maxim of Quality (Grice 1989). This violation triggers a semantic rescue operation similar to, for example, the one triggered in the interpretation of metaphors or idiomatic expressions. A common consequence linked to gender mismatch in BP is to confer animacy to the relevant noun, which, by its turn, shares some properties with the semantics of the root.

An important point to highlight is that our analysis does not rely on other mechanisms than the ones traditionally assumed in the DM framework. Our proposal offers a simple and uniform explanation for gender mismatch, metaphors and idiomatic expressions. Besides, our proposal provides a straightforward answer for the expected association between roots and gender features. These associations are the result of the proper Encyclopedic organization that results from the speaker's world knowledge.

2. On gender and the feature checking approach

Is this section we discuss some proposals which treat gender as a feature that has to be submitted to a checking system. This checking operation was proposed to occur through Agree (Alexiadou 2004) or through licensing conditions (Kramer 2012).

Alexiadou (2004) claims that the gender feature is independent from inflection class, presented by some languages, as Spanish and Greek, for example. The proposal is that the class feature is an inherent property of noun stems. When it comes to gender, however, some noun stems are inherently specified for gender, while others acquire gender by rule. In the same sense, Alexiadou (2004) does not consider gender to be a functional projection, in opposition to number inflection.

Kramer (2012), analyzing data from Amharic, a Semitic language, develops an analysis of gender based on two central elements: (i) the division between natural gender and grammatical gender and (ii) the licensing conditions. The hypothesis is that gender is an *n* feature and that the feature specification of the categorizer varies in type (interpretable vs. non-interpretable) and value (feminine vs. masculine). In this sense, natural gender is considered to be interpretable, whereas grammatical gender is considered to be uninterpretable. The inventory of *n* is the following:

(5) Types of *n*

a. n i [+FEM] female natural gender } Interpretable

b. n i [-FEM] male natural gender }

c. n no natural gender or natural gender unknown

d. n u [+FEM] feminine grammatical gender Uninterpretable

(Adapted from Kramer 2012: 10)

The categorizers in (5a-b) present a correlation between gender and sex and are interpretable. The categorizer in (4d) expresses grammatical gender and it is considered to be uninterpretable. The *n* in (4c) is the *default*, and since the masculine gender is the default in Amharic whenever the other categorizers to be inserted are not specified enough, the masculine is going to surface. In this sense, there is no necessity to specify an *n* with masculine grammatical gender (u [-FEM]), the masculine being the *default*.

The central question is then how to make the right *n* surface with the right root. To solve this problem, Kramer (2012) relies on Acquaviva (2009) and proposes that licensing conditions are necessary to effect the pairing between roots and the different kinds of *n*. The licensing conditions are post-syntactic indications that determine which roots are compatible with which gender values. It is important to remark that the association between the roots and the insertion contexts leads to the problem that the very same root may appear with more than one gender in the languages. This is almost the same problem which is found in approaches that specify the root with a gender diacritic. Besides that, the central problem with the licensing conditions approach is an empirical one: it predicts that the incompatibility between the gender specified by the relevant condition and the gender generated by the syntactic structure should result in an ungrammatical morphosyntactic structure. BP data show, however, that no gender value might be à priori specified in the formal linguistic component, since any noun in BP may be paired with either feminine or masculine. This gender switching has semantic consequences, but what we want to emphasize is that the result is definitely grammatical.

(6)

a. *A bola chegou*.
the.F ball(F) arrived.
'The ball arrived' or 'A girl whose nickname is 'ball' arrived.'

b. *O bola chegou*.
the.M ball(F) arrived.
'A guy whose nickname is 'ball' arrived.'

c. *A garrafa chegou.*
the.F bottle(F) arrived
'The bottle arrived.' or 'A girl whose nickname is 'bottle' arrived.'

d. *O garrafa chegou*.
the.M bottle(F) arrived
'A guy whose nickname is 'bottle' arrived.'

In the sentences (6b) and (6d) there is a mismatch between the gender that is expected to be specified in a possible licensing condition and the gender of the determiner. However, these sentences are easily interpreted and the noun is related to animate entities in the world. In this sense *a bola* - with the feminine determiner - and *o bola* - with the masculine determiner - share properties like 'being round', for example. In this sense, the interpretation that 'somebody fat has arrived' is easily associated with the sentence (6b). The same applies to *a garrafa* – with the feminine determiner – and *o garrafa* – with the masculine determiner. They also share properties, like 'being related to drink', and the interpretation that 'somebody who drinks a lot has arrived' is easily linked to (6d). It is important to emphasize that the relevant nouns in the sentences (6a) and (6c) may also have the interpretation of animate entities. This means that the process that turns non-animate into animate nouns is not exclusive to the cases of gender mismatch.

The gender incompatibility above discussed is a general one in BP: any noun of the language may have its expected gender switched, provided that the relevant noun is interpreted as an animate entity. This phenomenon, however, is unexpected under the approach that relies on licensing conditions.

Interestingly the grammaticality of the data in (6b) and (6d) contrasts with the ungrammaticality in (7c-d) below, where there is an incompatibility of gender agreement between the determiner and the adjective.

(7)

a. *A bola é redonda*.
the.F ball(F) is round.F
'The ball is round' or 'A girl whose nickname is 'ball' is round.'

b. *O bola é redondo*.
the.M ball(F) is round.M
'The ball is round' or 'A guy whose nickname is 'ball' is round.'

c. **A bola é redondo*.
the.F ball(F) is round.M

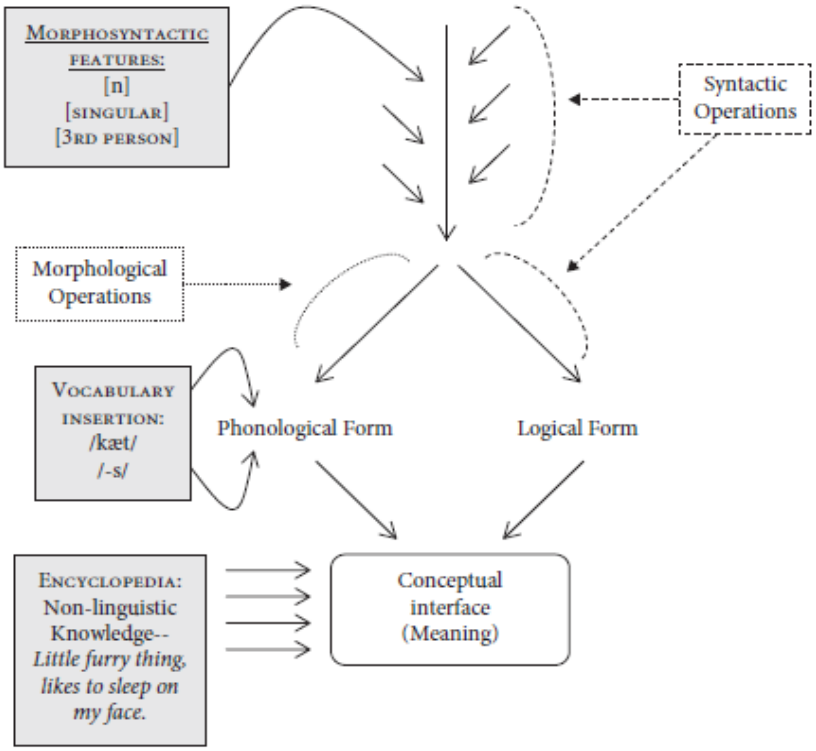
d. **O bola é redonda*.
the.M ball(M) is round.F

If it is possible for the computational system to generate structures with gender incompatibility, then the value of the gender feature needs to be irrelevant for syntax and for morphology. In this sense, we propose that the gender licensing may, in fact, be treated as an epiphenomenon of the Encyclopedic interpretation.

3. On the encyclopedic knowledge

In this section, we intend to characterize the non-linguistic knowledge that speakers of a language possess. In the DM framework, this knowledge is placed in a list known as the Encyclopedia, which interfaces both with the Phonological Form (PF) and with the Logical Form (LF). To illustrate that, we assume the architecture of grammar as it is postulated by DM.

Figure 1: Architecture of Grammar (Siddiqi 2009: 14)



Considering that DM is a non-lexicalist theory, in other words, a theory that advocates against the existence of a generative Lexicon (see Halle and Marantz 1993), then the properties

formerly attributed to the Lexicon have to be distributed to the above Architecture of Grammar.

The DM architecture is composed of three lists. List 1 is the list of morphosyntactic features and it contains the building blocks that feed the syntactic derivation. The morphosyntactic features are of two types: grammatical features (as number, person, tense and category, for example) and acategorial roots .

The morphosyntactic features in List 1 are abstract in the sense that they are devoid of phonological content. Phonology is only going to be inserted post-syntactically through a morphological operation known as Vocabulary Insertion. At this point List 2, also called the Vocabulary, is activated. This list contains the Vocabulary Items (henceforth VI), which are phonological rules that link the phonological content to the bundles of features located at the terminal nodes.

The third list is the Encyclopedia, whose content is the target of this work. This list contains the contextual special meanings attributed to roots and expressions and the world knowledge of the speaker. According to Harley and Noyer (2000), the Encyclopedia associates phonological expressions with meanings. The encyclopedic knowledge can interfere in the grammaticality of sentences. This is exactly the point that we explore in the next subsection, based mainly on Harley and Noyer (2000), one of the few works which explores the functioning of the Encyclopedia.

3.1. The encyclopedic knowledge and the structure of sentence

Harley and Noyer (2000) propose that the formal properties of the VIs determine their distribution in the sentence. These properties are intended to replace both the thematic roles and the mechanisms of selection. Thus, these formal properties of VIs determine if an expression is grammatically well-formed. Nevertheless the encyclopedic properties may influence the speaker's judgment on the proper use of certain expressions.

To illustrate this fact, the authors use the sentence 'John's growth of tomatoes', stating that its anomaly does not come from its syntactic structure or from the formal properties of VI 'grow', but it results from the encyclopedic knowledge itself. The central point of the argumentation is that the Encyclopedia assures that growing is a spontaneous activity (caused internally, according to Levin and Rappaport Hovav 1995), and, in this sense, the subject of the nominalization of 'grow' is not pragmatically constructed as an agent. Therefore, the authors attribute this kind of anomaly to the combination of the encyclopedic knowledge with the semantic type associated with certain syntactic structures.

Besides nominalizations, the authors use other evidence to show how the ill-formedness of an expression could be related not to its formal properties, but instead to pragmatic factors attributed to encyclopedic knowledge.

According to these authors, it is the syntactic structure that leads a particular verb to be interpreted as transitive or intransitive. For example, consider the sentences below:

(8)
a. *The sun melted the snow*.
b. *The snow*$_i$ *melted* t_i.

In a lexicalist theory, one would say that the lexicon hosts two different verbs MELT (an intransitive one and a transitive one). Each verb 'melt' would be assigned specific thematic roles and, therefore, would project distinct syntactic structures. In this sense, the lexicon is responsible both for creating verbs and for relating them. In the DM framework, on the other hand, in the absence of a lexicon, it is argued that there is a single VI MELT. The interpretation

of 'melt' as a transitive or as an intransitive verb depends on the syntactic structure into which it is inserted.

This ultimately means that the structure in (8a) forces an interpretation in which the sun is doing something and the snow is undergoing this event. Harley and Noyer (2000) call this aspect of the meaning of a sentence its *structural semantics*.

However, the authors make it clear that a VI cannot be licensed in any structure. Thus, what, in fact, could cause the ill-formedness of a sentence? We will look at the sentences below to illustrate this question:

(9)
a. *Chris thought the book to Martha*.
b. *The bridge exploded the engineers*.
c. *The red under did not five lunch*.
d. *James put yesterday*.

The ditransitive structure in (9a) has a canonical interpretation: the subject (Chris) is an agent, the direct object (the book) is the theme and the indirect object (to Martha) is the target. Thus, although a verb such as 'to think' does not usually appear in this type of ditransitive structure, it is still possible to attribute an interpretation to the sentence. In this sense, the authors claim that the interpretation is subject to a process of *structural coercion* of the meaning of the verb 'think'. In (9b), the interpretation that must be given is that the bridge is causing the exploding (a thing bridges do not normally do), while the engineers who are shattered by the explosion.

The sentences in (9c) and (9d) differ from those in (9a) and (9b). So, (9c) is only interpretable if 'the red' was something capable of being the subject of the sentence and 'five' was something capable of being a verb, but this is clearly not the case.

In this way, what Harley and Noyer (2000) have proposed is a theory of licensing that ensures the grammatical conditions under which the VIs are inserted into syntactic structures. In this theory, the sentences in (9c) and (9d) are marked by the grammar as ill-formed, i.e. ungrammatical (*), and non-interpretable under any circumstances, because the VI 'under', 'five' and 'put' are not properly licensed. The underlying syntactic structures of these sentences, however, are well-formed, since they are the same structures that ordinarily occur in sentences such as: 'the tall man did not eat lunch' or 'James swam yesterday'. In contrast, the sentences in (9a) and (9b) are not ill-formed, but they are pragmatically anomalous.

The central conclusion is that there is a difference between sentences which are ungrammatical for structural reasons (because their VI are not licensable) and those which are rejected due to the speakers' world-knowledge. If this reasoning is on the right track, it is possible to say that the sentences *O bola está na minha casa* 'The.M ball(F) is in my.F house(F)' and *O garrafa chegou* 'The.M bottle(F) arrived' are not syntactically ill-formed sentences, since all their VIs are perfectly licensable and since the structure in which these items are licensed is the very same structure which licenses a sentence as *O João está na minha casa* 'The.M John(M) is in my house', for example. The mismatch, which causes a new interpretation of the sentence, is the result of a reanalysis based on world knowledge.

In the next section, we will see how this encyclopedic knowledge is important for the licensing of sentences like (3b) and (3d), and we will discuss what information is actually listed in the Encyclopedia.

4. What is inside the Encyclopedia?

The most basic formulation of the Encyclopedia (see Marantz 1997) is that it consists of a list of roots, which in certain specific syntactic contexts show non-compositional readings. This means that the Encyclopedia limits itself to a list of exceptions, of "lexicalized" meanings. That is what we can call a Restrictive Encyclopedia. However, Harley and Noyer's (2000) proposal requires an Encyclopedia that also has systematic and compositional meanings of a language. Hence it is necessary to assume that the Encyclopedia relates roots to the speakers' world knowledge. This is, thus, a Generalist Encyclopedia contrasting with the previous basic formulation.

We assume that this concept of Encyclopedia brings more coherent consequences within the Distributed Morphology framework. A Generalist Encyclopedia provides a straightforward account for mismatches such as those of argument structure and gender. This section sketches what we call the Generalist Encyclopedia and how it can explain gender mismatches.

The most common conception of the Encyclopedia is that it is a list just as the Vocabulary Items list: a correspondence between formal features and phonological features. The example below is the default plural rule in Portuguese:

(10) [+pl] → /s/

In the case of the Encyclopedia, the list would be quite similar, except for the fact that it relates the outputs of the Syntactic derivation to special meanings.

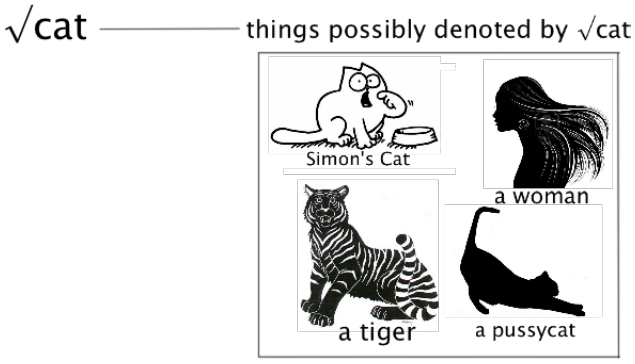
(11)	"bucket"	→	'a container'
	"kick the bucket"	→	'to die'
	"cat"	→	'a fuzzy animal'
	"raining cats and dogs"	→	'raining too much'

This approach is, nevertheless, too simplistic and it doesn't allow us to visualize all the features of a list responsible for relating derivational output and meaning. We propose a structured list account for the Encyclopedia. Such a list is organized in terms of concepts and sets, which are referred to by roots and grammatical features. A concept can be a member of an infinite number of sets, making the Encyclopedia an open list representing the world knowledge of the speaker (or interfacing with it).

In terms of Architecture of The Grammar, the Encyclopedia is associated with LF and the interface of the Syntactic Derivation with the Conceptual/Intentional module of the mind[2]. It is crucial in this sense that the formalism used to refer to the Encyclopedia is compatible with that used to deal with interpretation phenomena of the derivational output. Two characteristics are important: the first one is that roots and some grammatical features constitute sets within the Encyclopedia containing all the concepts referred to by them.

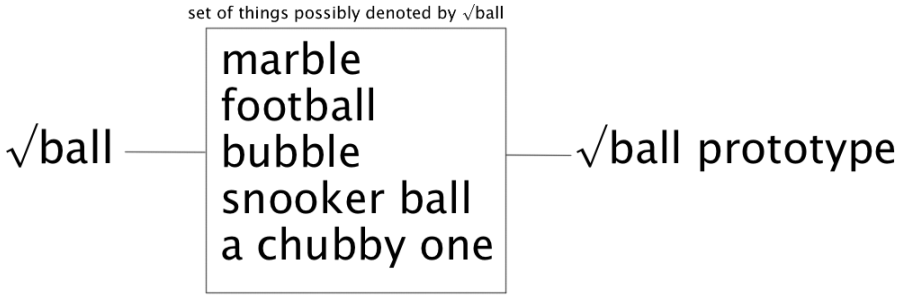
[2] Although we don't take into account this discussion, it may be important to mention that some authors also relate the Encyclopedia to PF, besides LF.

Figure 2: A root denotes a set of concepts



The second one is that the denotation of a set corresponds automatically to the denotation of a prototype: an abstraction of all the members of that set. Hence, if the Computational System derives a structure containing only one root, and this derivation is convergent, for the Encyclopedia this structure does not denote one concept member of the set correspondent to the root: it denotes an abstraction of all the concepts which constitute the set they belong to.

Figure 3: Denotation of a single root is the denotation of its prototype



Following such a mechanism, the more information is brought to the Encyclopedia by the derivation, the more specific should be the denotation.

As mentioned earlier, some grammatical features can be relevant to the structuring of Encyclopedic Knowledge. We believe gender, at least in Brazilian Portuguese, to be one of them. In the language, gender information cannot be considered relevant only for inflection purposes, in contrast to declinations or verbal conjugation patterns. Besides the phenomena presented in this paper, the relevance of gender to semantic interpretation is also seen in phenomena of referential dependence of DPs (Reinhart and Reuland, 1993; Menuzzi 1999), enriching the debate on syntactic restrictions of anaphors.

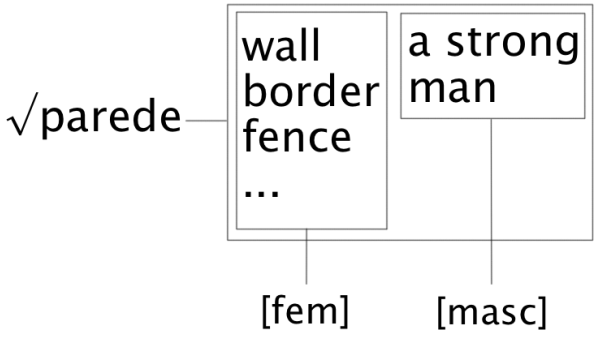
Let us assume that Portuguese speaker's Encyclopedia has two large sets represented by the grammatical features [M] (masculine gender) and [F] (feminine gender). All the concepts of Brazilian Portuguese are members of one of these two concepts, and the speaker learns that from clues given by the language's grammar. We can say, then, that these features can act in a set of roots to specify the denotation. See below:

(12)

a. *Eu vi o Jonas conversando com a parede*.
   I saw Jonas talking to the.F wall(F).
b. *Eu vi o Jonas conversando com o parede*.
   I saw Jonas talking to the.M wall(F).

Both sentences are grammatical and it is possible to say that the word *parede* 'wall' represents the same root in both cases. However, it is more probable that *parede*, in the first case, refers to the wall literally while in the second case, it refers to a human person that is so called because of showing some properties in common with the literal wall. This distribution of meanings can be represented in the Encyclopedia in the following way:

Figure 4: The meaning of √parede



As we can observe, the "Encyclopedic entries" are, actually, the sets to which roots and grammatical features refer. If the derivation provides a structure which is interpreted as the conjunction between the root √parede and the feature [F], the Encyclopedia will map the intersection of the sets √parede and [F]. On the other hand, if the derivation provides √parede and [M], the intersection between √parede and [M] will be mapped and this will necessarily correspond to a more specific, metaphoric interpretation.

Considering that the Encyclopedia is an open inventory list, it is possible for new concepts to be added at any moment or even to be created through ***structural coercion***, from the simply convergence of certain syntactic structure. In the cases of gender ***mismatch*** a frequent effect is the denotation of a personified entity. We believe this to be an epiphenomenon of the Gricean Maxim of Relevance (see Grice 1989). If an element occurs with a different gender feature than the expected one, it should be because this gender difference is relevant. In a language like Portuguese, in which grammatical gender is related somehow with sex, the personified interpretation is the most probable.

5. Final Considerations

This paper investigated, from within the Distributed Morphology framework, the licensing of roots with respect to gender information: a crucial problem to the model. We based our discussion in Brazilian Portuguese pairs such as *a bola* 'the.F ball(F)'/ *o bola* 'the.M ball(F)' in which the mismatch between root and gender does not lead to ungrammaticality, but confers animacy to the noun. Therefore we pointed out the inadequacy of post-syntactic licencing conditions proposed in the literature (cf. Acquaviva 2009, Kramer 2012), which predicts ungrammaticality to the mismatch between root and gender: clearly not the case for Brazilian Portuguese. As an alternative, we propose that gender information should be accounted for as sets within the Encyclopedia. Thus, whenever a structural association between root and gender feature is sent to the Encyclopedia it should undergo an operation verifying whether the referred entity is included in the correspondent set. When it is not included (a gender mismatch), a semantic rescue operation, of the same nature as metaphors and idiomatic interpretations, is triggered. Gender licensing is, therefore, taken as an epiphenomenon of Encyclopedic interpretation.

Two consequences of the present proposal are crucial. The first one is that gender features are constituted as labels to two large Encyclopedic sets. This means that roots do not present

an inherent gender feature that must somehow be checked for means of structural convergence. In this case, the second consequence is that nouns do not need to bear gender features. Maybe only determiners and adjectives bear them, with an agreement relation between one another. In this case, a noun may only have its interpretation specified in terms of gender when it comes together with a determiner or adjective.

The main advantage of this account is that it does not rely on extra mechanisms besides those already traditionally assumed with the Distributed Morphology framework. In this sense, our proposal provides a simple and uniform explanation for the incompatible relations between gender and root, metaphors and idiomatic expressions.

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Idiomatic verb-clitic constructions: lexicalization and productivity

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1. Introduction

The Idiomatic Verb-Clitic Construction (IVCC) is a special verbal complex found in Italian, as well as other Romance languages, that consists of a verb plus one or more pronominal clitics and displays a very specialized or totally idiomatic meaning. These constructions are known as *verbi procomplementari* 'pro-complement verbs' in the Italian lexicographic tradition (De Mauro 1999, GRADIT) and have received little attention until very recently (see Viviani 2006 and Russi 2008, 2011). The following examples contain Italian IVCCs based on the verb *prendere* 'to take' (1).

(1) Italian
a. *prender-**se-la***
take.INF-SI[1]-CL.3.SG.F.OBJ.ACC
'to become upset, to take offence'
b. *prender-**le***
take.INF-CL.3.PL.F.OBJ.ACC
'to be beaten'
c. *prender-**ci***
take.INF-CL.LOC
'to make the right choice, to guess/get it right'

Sometimes, the V+CL complex is part of a larger multiword expression, or complex predicate, as illustrated in (2).

(2) Italian
a. *metter-**ce-la*** *tutta*
put.INF-CL.LOC-CL.3.SG.F.OBJ.ACC all.F
'to try one's best'
b. *prender-**ci*** *gusto*
take.INF-CL.LOC taste
'to get to like something, to enjoy something'
c. *dar-**se-la*** *a* *gambe*
give.INF-SI-CL.3.SG.F.OBJ.ACC to legs
'to run away (very quickly)'

IVCCs are also found in other Romance languages, such as Catalan and Spanish, as illustrated in (3)-(4). Espinal (2009), whose paper is based precisely on these languages, speaks of *inherent clitics* (or *i-clitics*).

[1] We use SI as an abbreviation for the polyfunctional pronominal clitic *si* in Italian (see Section 2.2).

(3) Catalan (adapted from Espinal 2009: 1222)
*ballar-**la***
take.INF-CL.3.SG.F.OBJ.ACC
'to suffer'

(4) Spanish (adapted from Espinal 2009: 1224)

pasar	***lo***	*bien*
pass.INF	CL.3.SG.NTR.ACC	well

'to have a good time'

IVCCs in Romance languages are somehow similar to idioms that present the neuter weak pronoun *it* in English. Some of them are even equivalent to Italian IVCCs, as illustrated in (5).

(5)

	English		Italian	
a.	*give **it** a rest*	→	*far-**la***	*finita*
			make.INF-CL.3.SG.F.OBJ.ACC	ended.SG.F
			*smetter-**la***	
			stop.INF-CL.3.SG.F.OBJ.ACC	
			*finir-**la***	
			end.INF-CL.3.SG.F.OBJ.ACC	
b.	*take **it** easy*	→	*prender-**se-la***	*comoda*[2]
			take-SI-CL.3.SG.F.OBJ.ACC	comfortable
c.	*make **it***	→	*far-**ce-la***	
			make-CL-LOC-CL.3.SG.F.OBJ.ACC	

2. Italian IVCCs: what's special about them?

Italian IVCCs display an array of special semantic (Section 2.1) and morphosyntactic (Section 2.2) properties, as also noticed by Russi (2008) and Espinal (2009).

2.1 Semantic properties

Semantically speaking, the clitic is not a true anaphoric pronoun that refers to some other element in the discourse, but an element that is incorporated into the V and has a semantic impact on it. This impact may be different in both *strength* and *nature*.

As for strength, the IVCC and the clitic-less V may be more or less related semantically. In other words, the impact of the clitic goes from mild (6a) to fair (6b-c) to radical (6d), thus forming either fairly interpretable expressions (*encoding idioms* à la Makkai 1972) or totally idiomatic expressions (*decoding idioms*).

(6)

a.	*smettere*	>	*smetter-**la***
	stop.INF		stop.INF-CL.3.SG.F.OBJ.ACC
	'to stop'		'to stop (especially doing something annoying), to give it a rest'
b.	*sentire*	>	*sentir-**se-la***
	feel.INF		feel.INF-SI-CL.3.SG.F.OBJ.ACC
	'to feel'		'to feel like doing something (difficult/unpleasant)'

[2] This is just one of the many possible translations of *take it easy* into Italian.

c. *sentire* > *sentir-**se-lo***
feel.INF feel.INF-SI-CL.3.SG.M.OBJ.ACC
'to feel' 'to have a premonition about something'
d. *correre* > *correr-**ce-ne***
run.INF run.INF-CL.LOC-CL.GEN
'to run' 'there to be a great difference'

As for nature, the impact of the clitic may be either more lexical or more grammatical. A lexical kind of impact is exemplified by (7a), where the V+CL complex simply acquires a new, idiomatic meaning. In (7b-c), instead, the impact of the clitic is more grammatical, since the IVCC is close in meaning to the base V, but the clitic brings about new nuances. Russi (2008: 180-193) proposes that *la* in (7b) be analyzed as a subjectivity and *possibly* an aspectual marker, whereas *ci* in (7c) as a stativity and intransitive marker (Russi 2008: 169).

(7)
a. *stare* > *star-**ci***
stay.INF stay.INF-CL.LOC
'to stay' 'to agree to do something, be condescending'
b. *finire* > *finir-**la***
end.INF end.INF-CL.3.SG.F.OBJ.ACC
'to end' 'to stop (espcially doing something annoying), to give it a rest'
c. *vedere* > *veder-**ci***
see.INF see.CL.LOC
'to see' 'to be able to see'

2.2 Morphosyntactic properties

As regards their position within the verbal complex, inherent clitics behave as normal clitic pronouns,[3] as illustrated in (8)-(9). However, IVCCs are peculiar in more than one sense.

(8)
a. *prender-**le*** [infinitival form]
take.INF-CL.3.PL.F.OBJ.ACC
'to be beaten'
b. ***le** prendo* [finite form]
CL.3.PL.F.OBJ.ACC take.1.SG
'I'm beaten'

(9)
a. *prender-**se-la*** (**prender-la-si*) [clitic cluster order]
take.INF-SI-CL.3.SG.F.OBJ.ACC
'to become upset, to take offence'
b. *esser-**se-la** presa* (**prender-la-si*) [clitic climbing]
be.INF-SI-CL.3.SG.F.OBJ.ACC taken.F
'to have become upset, to have taken offence'

[3] Cf. Cordin & Calabrese (1988: 589), quoted in Schwarze & Cimaglia (2010), for for restrictions on clitic clusters in Italian.

First of all, the range of clitics used in IVCCs is rather limited compared to the full set of existing Italian clitics and clitic combinations. Indeed, only 6 pronominal clitics (including *si*) are used (Russi 2008; Jezek 2011), out of a total of 13 possibilities (Schwarze & Cimaglia 2010: Tab.1):

(10)

a.	***ci***	→	locative
b.	***la / le / lo***	→	accusative object (F.SG, F.PL, M.SG respectively)
c.	***ne***	→	genitive/partitive
d.	***si***	→	polyfunctional clitic pronoun and grammatical marker (see below)

Moreover, only 6 clitic clusters[4] are attested:[5]

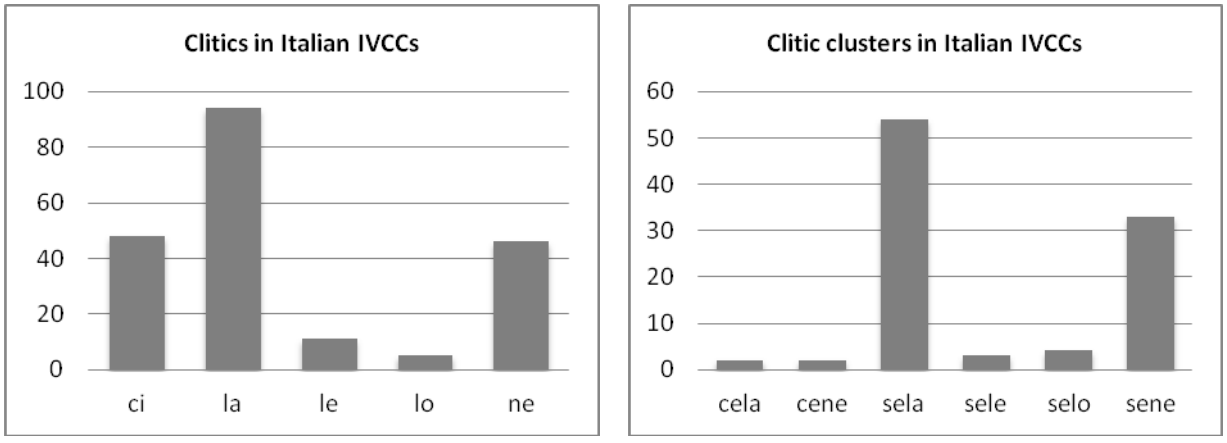
(11)
a. ***cela*** (ci+la), ***cene*** (ci+ne)
b. ***sela*** (si+la), ***sele*** (si+le), ***selo*** (si+lo), ***sene*** (si+ne)

The precise role of *si* in IVCCs is not always easy to single out, given its many functions, e.g.: reflexive, reciprocal, impersonal, passivizing, aspectual, middle (cf. Jezek 2003, 2005). For instance, (12) clearly contains a reciprocal *si*, but the role of *si* is not clear in more idiomatic cases like (9) above.

(12) *dar-**se**-le*
dare-RECP-CL.3.PL.F.OBJ.ACC
'to beat each other, to fight'

Apart from formal restrictions, we also have quantitative differences in usage among clitics and clitic clusters, which are illustrated in Figure 1. The data are elaborated from a database of approximately 200 (non-multiword) IVCCs that I collected from different sources (previous literature, dictionaries, corpora and my own intuition).

Figure 1: A quantitative sketch of clitics and clitic clusters in Italian IVCCs.



As shown in Figure 1, *la* (CL.3.SG.F.OBJ.ACC) is the most common clitic found in IVCCs, followed by *ci* (CL.LOC) and *ne* (CL.GEN), whereas *le* (CL.3.PL.F.OBJ.ACC) and *lo*

[4] But see also *dar-**glie**-la su* (give.INF-CL.3.SG.M.DAT-CL.3.SG.F.ACC su) 'to give up'.
[5] In clitic clusters, *ci* and *si* appear in their allomorphic variants *ce* and *se*, respectively.

(CL.3.SG.M.OBJ.ACC) apparently have a marginal role. As for clusters, *sela* and *sene* are by far the most frequent.
Another special morphosyntactic feature of IVCCs is that inherent clitics are fixed. If we change the clitic, the IVCC (see e.g. (13a)) vanishes and we obtain a different construct, viz. either another IVCC (13b) or a "regular" clitic construction where the clitic is an anaphoric pronoun (13c).

(13)
a. *prender-**le***
take.INF-CL.3.PL.F.OBJ.ACC
'to be beaten'
b. *prender-**ci***
take.INF-CL.LOC
'to make the right choice, to get it right'
c. *prender-**la***
take.INF-CL.3.SG.F.OBJ.ACC
'I take her (*to be beaten)'

Finally, inherent clitics are *mostly* obligatorily realized, i.e. in most cases they cannot be just dropped if we want to retain the same semantics (see (14)).

(14) *prender-**le*** vs. *prendere*
take.INF-CL.3.PL.F.OBJ.ACC take.INF
'to be beaten' 'to take (*to be beaten)'

Russi (2008: 180ff.) claims that in some IVCCs the clitic is not strictly obligatory (grammaticalized), because under certain circumstances we can drop it and end up with a grammatical sentence: see e.g. *finirla* vs. *finire* (7b) and *smetterla* vs. *smettere* (6a). Indeed, the meaning of the clitic-less V in these cases is very similar to the meaning of the IVCC (as Russi 2008: 180ff. claims, *la* acts as a sort of a subjectivity marker here), thus dropping the clitic may have no dramatic consequences on the semantics of the sentence in the "right" context, like (15):

(15)
a. *Devi smettere di fumare*
'You must quit smoking'
b. *Devi smetter**la** di fumare*
'You must stop smoking / with all this smoking'

However, even in these cases the clitic is not really optional, because it cannot be dropped *arbitrarily*, i.e. the two versions are not interchangeable in any context. See for instance (16a) and the agrammaticality of the clitic-less version (16b), or the different entailments of sentences (17a) and (17b): (17a) is an objective, neutral statement, whereas (17b) generally entails some kind of subjective disapproval about the fact that Sara doesn't want to stop working.

(16)
a. *È ora di finir**la** con questa storia*
'It's time to put an end to this stuff / I've had enough of this stuff'
b. **È ora di finire con questa storia*

(17)
a. *Sara non vuole smettere di lavorare*
'Sara doesn't want to stop working'
b. *Sara non vuole smetterla di lavorare*
'Sara doesn't want to stop working (but she should!)'

To sum up, IVCCs have a regular morphosyntactic behavior, but are morphologically restricted and have an unpredictable meaning. Even when the semantics of the IVCC is close to that of the base V, it's not predictable on the basis of its form. So, we are dealing with a case of morphosyntax-semantics mismatch.

3. Previous analyses and present issues

Espinal (2009) – whose analysis is mainly based on Spanish and Catalan – claims that inherent clitics are "arguments, whose binding-theoretic status is that of free variables incorporated into the verb stem" (Espinal 2009: 1257) and which denote "abstract semantic objects". The mismatch is explained by saying that the constructions are regularly derived in the syntax, and then the clitic incorporates into the V at LF, thus saturating the argument of the V and giving rise to a complex predicate with a non-compositional semantics.

Russi (2008) – who carries out a descriptive, more diachronically oriented analysis of Italian IVCCs – claims that their emergence is the result of both grammaticalization (since the clitic becomes an obligatory marker, although not all IVCCs have reached a full stage of grammaticalization) and lexicalization (since the union of V+CL becomes a complex predicate with an idiomatic meaning). Russi (2008, 2011) also claims that the morphosyntactic status of inherent clitics (clitic vs. affix, inflectional vs. derivational) is all but clear, and that in fact inherent clitics seem to form a category of their own. Finally, Russi (2011: 400) states that "it should be desirable to determine how (or if) current theoretical frameworks are able to account for the phenomenon of incorporated clitics […], especially without taking into consideration a diachronic dimension" (2011: 400).

In Section 4 I will address precisely this question: which kind of morphological theory would be suitable to account for the the synchronic and diachronic behavior of IVCCs?

In Section 5, instead, I will investigate in more detail another question: are IVCCs just a "dead" area of the Italian lexicon, or are they "alive" to any extent? In other words: is there any trace of productivity in the IVCC domain?

4. A constructionist account of IVCCs

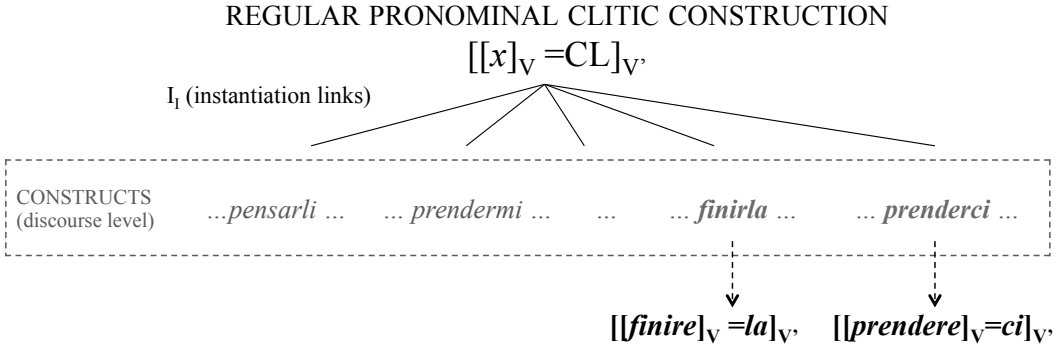
Most facts about IVCCs can find a suitable explanation by adopting a theory that: i) allows in principle for mismatches between form and meaning; ii) accounts for both regularities and idiosyncrasies; iii) fruitfully integrates synchrony and diachrony, formalization and usage. I propose that one such model is Construction Morphology (CxM; Booij 2010), which is framed within the more general theory of Construction Grammar (CxG; Hoffmann & Trousdale 2013).

As is well-known, in a constructionist perspective morphology and syntax are not independent, sequential components. The basic unit of analysis is the construction, i.e. a conventionalized association of a form and a meaning that may have different degrees of schematicity and complexity. Two basic mechanisms are used to form new expressions: instantiation, i.e. the creation of more specific instances from more general constructions, and unification, i.e the merging of two or more constructions together. Constructions are

organized into a hierarchical lexicon and may be connected to one another via inheritance links of different sorts. The mechanism of default inheritance accommodates both regular and idiosyncratic facts, including form-meaning mismatches. Hybrid morphosyntactic status is therefore an expected, possible output, rather than an exception. Despite having a formalizing vocation, CxM is sensitive to (and equipped to account for) usage and diachronic facts, along the lines of CxG.

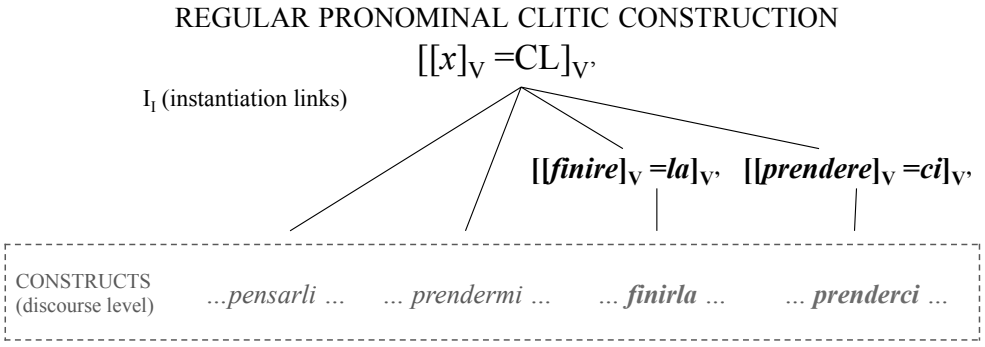
Let us see how some of the IVCC facts can be analyzed within the framework of CxM. Figure 2 describes the diachrony of IVCCs: some instances (constructs) that originate from the regular clitic construction (e.g. *finirla* 'to give it a rest' and *prenderci* 'to guess it right') become more and more entrenched and acquire new meanings, by virtue of their occurrence in specific contexts (cf. Russi 2008). As a consequence, new constructions are created and stored in the constructicon.

Figure 2: Diachronic picture for IVCCs.



These new constructions (see Figure 3) are lexically fully specified (i.e., the components are fixed) and semantically idiomatic, thus overriding the function of the regular pronominal clitic construction. At the same time, they retain some link to the regular pronominal clitic construction, thus inheriting its morphosyntactic properties (remember that IVCC have a regular morphosyntactic behavior).

Figure 3: Synchronic picture for IVCCs



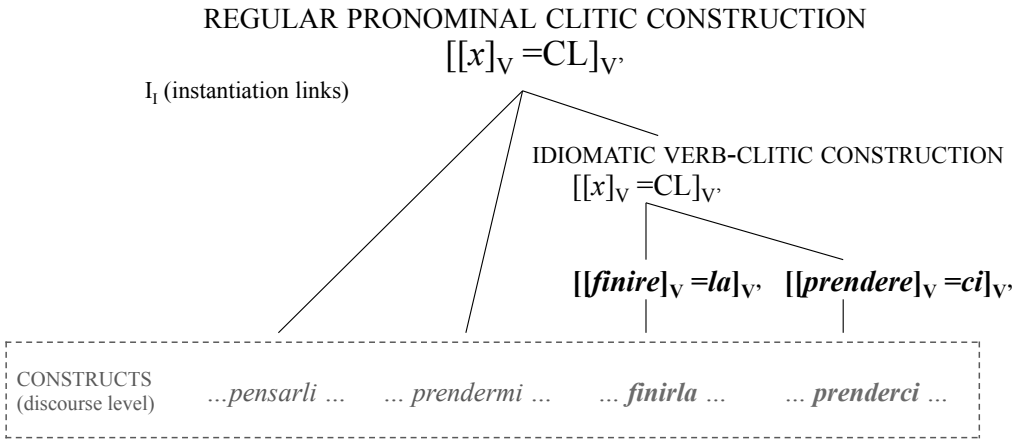
We therefore obtain a mismatch, like the one illustrated in Figure 4.

Figure 4: Mismatch between form and meaning in IVCCs.

REGULAR PRONOMINAL CLITIC CONSTRUCTION			IDIOMATIC VERB-CLITIC CONSTRUCTIONS	
Form	$[[x]_{Vk} =CL_i]_V$,	→	**Form**	$[[prendere]_V =ci]_V$,
Meaning	$< PRED_k (Arg\|Adj)_i >$	↛	**Meaning**	< to guess it right>

An alternative synchronic analysis of IVCCs is given in Figure 5. The difference with Figure 3 lies in the positing of an intermediate abstract IVCC between the regular pronominal clitic construction and the single lexically specified IVCCs. This solution has the advantage of generalizing over the several instances of IVCCs existing in Italian. However, the generalization is pretty loose: the clitics have different roles and functions in the various IVCCs, which normally have a history of their own (but see Section 5). Therefore, the only information we can inscribe into the abstract IVCC is that the clitic is not anaphoric and the meaning is non-compositional. In other words, the abstract IVCC, if posited, should not be taken as a template for the formation of new IVCCs, but as a static generalization.

Figure 5: Alternative synchronic picture for IVCCs: positing an abstract IVCC



In conclusion of this section, two other cases are discussed: IVCCs with *si* (cf. (11)-(12), Section 2.2) and IVCCs within multiword expressions (cf. (2), Section 1).

As for the former, cases like (12), where we have a synchronically identifiable *si* within an IVCC, could be analyzed as cases of unification between the *si* construction (in this case, the reciprocal *si* construction) and the regular pronominal clitic construction, whose output is then lexicalized. Inheriting from the reciprocal *si* construction, too, guarantees that the semantic contribution of *si* is correctly interpreted within the IVCC. This analysis obviously does not apply to cases where the contribution of *si* within the IVCC is not synchronically recognizable.

As for the latter case, the fact that IVCCs frequently occur within larger multiword expressions is not unexpected in a constructionist perspective. Since morphology and syntax are not independent, sequential components, but levels of analysis that closely interact with each other, multiword expressions are expected to occur, alongside morphological words. Therefore, complex predicates are lexical constructions with their own properties and argument structure, just like non-multiword verbs, and as such they are equally eligible to develop into an IVCC.

5. From lexicalization to productivity

At first sight, there are no signs of true productivity in the domain of IVCCs, which seem to be the result of unpredictable diachronic processes. We can only find traces of analogy. For instance, in several cases, IVCCs with different bases and same clitic (18) or same base and different clitics (19) have the very same meaning. This seems to hint that some IVCCs are created along the lines of already existing ones via analogy.

(18)

a.	*finir-**la***	vs.	*smetter-**la***
	end.INF-CL.3.SG.F.OBJ.ACC		stop.INF-CL.3.SG.F.OBJ.ACC
	'to stop, to give it a rest'		
b.	*impiegar-**ci***	vs.	*metter-**ci***
	employ-CL.LOC		put-CL.LOC
	'to take (time to do something)'		

(19)

a.	*cercar-se-**la***	vs.	*cercar-se-**le***
	search-SI-CL.3.SG.F.OBJ.ACC		search-SI-CL.3.PL.F.OBJ.ACC
	'to deserve something, to ask for it'		
b.	*azzeccar-**la***	vs.	*azzeccar-**ci***
	guess_right-CL.3.SG.F.OBJ.ACC		guess_right-CL.LOC
	'to get it right'		

Take for instance the *finirla* vs. *smetterla* couple. As Russi (2008: 180ff.) notes, whereas *finire* 'to end' and *smettere* 'to stop' are not complete synonyms (20), *finirla* and *smetterla* actually are (21).

(20)

a.	*finire un libro*	vs.	**smettere un libro*
	'to finish a book'		
b.	*finire di fumare*	vs.	*smettere di fumare*
	'to finish smoking (*to quit smoking)'		'to finish / quit smoking'

(21)

a.	*finiscila!*	=	*smettila!*
	'Stop it! / Give it a break!'		
b.	*finiscila di parlare!*	=	*smettila di parlare!*
	'Stop that talking!'		

If we check when these items were coined (cf. GRADIT), we find out that *finirla* dates back to the 16th c., whereas *smetterla* is much more recent (19th c.). Therefore, it is reasonable to hypothesize that *smetterla* was coined by analogy with *finirla*.

However, there is one case in which things seems to have taken a different course.

5.1 A case study: *andarsene*

One of the most frequent clitic clusters in IVCCs is *sene* (cf. Figure 1), formed by *si* (in its allomorphic shape *se*) and the genitive/partitive clitic *ne*. One of the most often cited

examples of lexicalized IVCCs with *sene* is *andarsene*, which is very frequent in contemporary Italian and whose meaning is usually that in (22):

(22)
a. *andar-**se-ne***
go.INF-SI-CL.GEN
'to go away, to leave'
b. […] *salutò e se ne andò*
'He said goodbye and left'

In this case we should probably speak of *sene* as an inseparable clitic cluster, since **andarsi* would be agrammatical in contemporary Italian and *andarne* is an IVCC with a completely different meaning ('be at stake').[6]

At the same time, *andarsene* may also have a different use, which is definitely more marginal and usually requires an adverbial. See the examples in (23):[7]

(23)
a. *avendo un paio di ore libere, **me ne sono andata** a spasso sotto una pioggia fitta e insistente*
'having a couple of free hours, I went walking around [somehow emotionally involved] under a heavy and persistent rain'
b. […] ***se ne andava** in giro con il sorriso stampato sulle labbra*
'(she) was going around [somehow emotionally involved] with a smile fixed on her face'

In these cases, there is no "away" semantics. Rather, *sene* has a sort of "emphatic" function, which results in the subject (or some other participant in the event or in the enunciation) being somehow affected by the event denoted by the verb. Since the overall effect of *sene* on the verb is not easily translatable, for convenience it will be marked with [+EMPHASIS] / [+E] hereafter.

What is interesting is that, as cursorily noted by Russi (2008) and Masini (2008, 2012), this "emphatic" *sene* seems to occur not only with *andare* 'to go', but also with other motion verbs, such as directed motion verbs (24) and locative/stative verbs (25)-(26).[8]

(24)
a. *uscir-sene* exit.INF-SENE 'to exit, to go out [+EMPHASIS]'
b. *Mentre Sepp, Fritz e Valz **se ne uscivano** piuttosto depressi dalla riunione* […]
'While Sepp, Fritz and Valz left the meeting [+E] in a quite depressing mood…'

(25)
a. *star-sene* exit.INF-SENE 'to stay, to remain [+EMPHASIS]'
b. *La incontravo a colazione e raramente a pranzo e cena, perchè lei **se ne stava** in camera*
'I met her during breakfast and, rarely, dinner and supper, since she would stay [+E] in her room'

[6] However, the presence of *si* might play a covert role here, since its presence triggers the BE auxiliary (*essere*), thus making the whole construction more compatible with telic situations.
[7] All examples hereafter are taken from the *ItTenTen10* web corpus, available on the SketchEngine. Cf. also Section 5.2.
[8] For simplicity, I will use the term "motion verbs" or "verbs of motion" for verbs conveying both motion (e.g. *go*, *come*) and location (e.g. *stay*).

(26)
a. *restar-sene* stay.INF-SENE 'to remain [+EMPHASIS]'
b. *Andava ancora alle feste, ma **se ne restava** in disparte*
'(He) still went to parties, but he would stay [+E] on his own'

For the sake of completeness, all these examples would be grammatical even without *sene*:

(27) (*me ne*) ***sono andata** a spasso sotto una pioggia fitta e insistente*
'I went walking around under a heavy and persistent rain'

(28) *lei* (*se ne*) ***stava*** in camera
'she stayed in her room'

However, the semantics would slightly change: the *sene* event is not presented in an objective, neutral, detached way ([-EMPHASIS]); rather, the subject (or another participant) is somehow affected ([+EMPHASIS]). In (27), for instance, it would be *inappropriate* to use the *sene* variant if the participant were not emotionally involved (which is not entailed by the corresponding example without *sene*, cf. (23a)). Similarly, in (28) it would be *inappropriate* to use the *sene* variant if the participant were staying in her room all day long unwillingly (which, again, is not entailed by the corresponding example without *sene*, cf. (25b)).

5.2 A corpus search for motion verbs with *sene*

In order to confirm the observation that *sene* can in fact be used with verbs of motion (and to what extent), I carried out a corpus search, based on the 3.1 billion tokens web corpus *ItTenTen10*, available on the SketchEngine (www.sketchengine.co.uk).

It turned out that *sene* can be attached to a large array of verbs of motion, albeit their token frequency is pretty low. Clearly, it is a marginal construction, which may even sound awkward to some native speakers, but whose use is undeniably attested. The *sene* construction appears to be compatible with virtually all verbs of motion, namely:

- PATH VERBS OF MOTION: *andare* 'to go'*, venire* 'to come'*, partire* 'to leave'*, arrivare* 'to arrive'*, fuggire* 'to escape'*, tornare* 'to come back'*, ritornare* 'to come back'*, uscire* 'to exit'*, entrare* 'to enter'*, salire* 'to go up, climb'*, scendere* 'to go down, descend'*,* etc.
- MANNER VERBS OF MOTION: *correre* 'to run'*, cadere* 'to fall'*, saltare* 'to jump'*, volare* 'to fly'*, scivolare* 'to slide, slip'*, camminare* 'to walk'*, gironzolare* 'to wander around'*, passeggiare* 'to stroll'*, rotolare* 'to roll', etc.
- LOCATIVE/STATIVE VERBS: *restare* 'to stay'*, stare* 'to stay'*, giacere* 'to lie'*,* etc.
- PHRASAL VERBS with motion/locative meaning (cf. Masini 2005; Iacobini & Masini 2007).

For each category, some examples are given below (cf. (29)-(32)).

(29) PATH VERBS OF MOTION
a. *Addio Bocca di rosa con te **se ne parte** la primavera* (F. De André song)
'Goodbye Bocca di rosa, the spring **leaves** [+E] with you'
b. […] *egli uccise il mostro. Poi **se ne fuggì** con Arianna*
'he killed the monster. Then he **fled** [+E] with Ariadne'
c. *dopo qualche strillo **se ne sale** in camera incazzata nera*
'after some screaming, (she) **went up** [+E] to her room, really pissed off'

d. *Ecco a voi* […] *Logan che **se ne entra** al ristorante con il suo maritino*
'And there you have […] Logan **entering** [+E] the restaurant with her dear husband'
e. *In quel momento **se ne arriva** la baby sitter con i tre pargoli*
'At that point the babysitter **arrives** [+E] with the three kids'
f. *Impostata la velocità di 70 Km/h l'aereo **se ne scende** tranquillo*
'Once a 70 km/h speed has been set, the airplane **goes down** [+E] easily'

(30) MANNER VERBS OF MOTION
a. *tutto il materiale* […] ***se ne rotolava** bel bello di qua e di là*
'all the material […] was **rolling** [+E] here and there'
b. […] *vidi il teppistello **correrse**ne in skateboard lungo la strada*
'[…] I saw the little thug **running** [+E] on a skateboard along the street'
c. *come i denti da latte che **se ne cadono** da soli*
'like milk teeth that **fall out** [+E] spontaneously'
d. *Un ragazzo **se ne passeggia** nel giardino*
'A boy **wanders** [+E] in the garden'
e. […] mentre *l'Uomo Ragno **se ne saltava** da una parte all'altra*
'[…] while Spiderman was **jumping** [+E] from side to side'
f. *Cominciai a invidiare il dottore che* […] ***se ne camminava** nella fresca ombra degli alberi*
'I started envying the doctor who […] was **walking** [+E] in the refreshing shadow of the trees'

(31) LOCATIVE/STATIVE VERBS
a. […] *il celebre scienziato che **se ne giaceva** tutto solo*
'[…] the famous scientist who was **lying** [+E] there all alone'

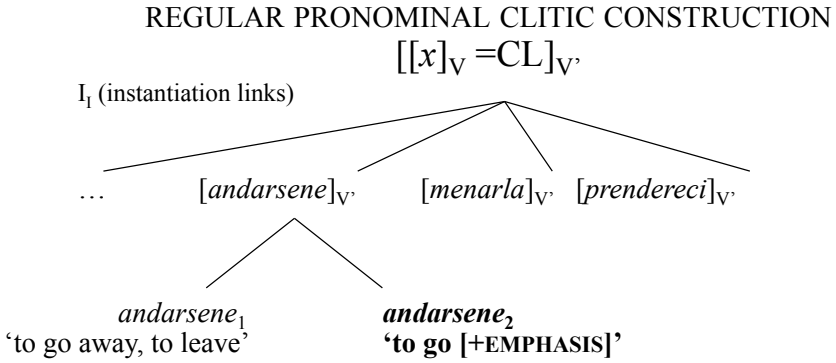
(32) PHRASAL VERBS with motion/locative meaning
a. *Paula si alzava di notte e **se ne scendeva giù** in cucina*
'Paula used to get up at night and **go down** [+E] to the kitchen'
b. *La farfalla, tutta rossa per la vergogna, **se ne volò via***
'The butterfly, crimson with embarrassment, **flew away** [+E]'
c. […] *il mantello caduto a Plasson nella fretta di **correrse**ne via*
'the cape that Plasson dropped while he **ran away** [+E] in a rush'
d. […] *la luna che **se ne viene su***
'the moon that **rises** (lit. comes up) [+E]'

5.3 Constructionalization

The IVCCs with *sene* in Section 5.2 are not encoded in dictionaries and seem to be recent innovations (20th c.), with the exception of the more widely used *sene* verbs: the verb *andarsene* is the oldest attested (1294, cf. GRADIT), followed by *ritornarsene* (17th c., cf. GRADIT) and *tornarsene* (1879, cf. GRADIT).
Therefore, it seems we are dealing with an exemplar-based constructionalization process, namely the emergence of a (semi-specified) construction with some degree of productivity that originates from one or more lexicalized instances (specific IVCCs) with very high token frequency.

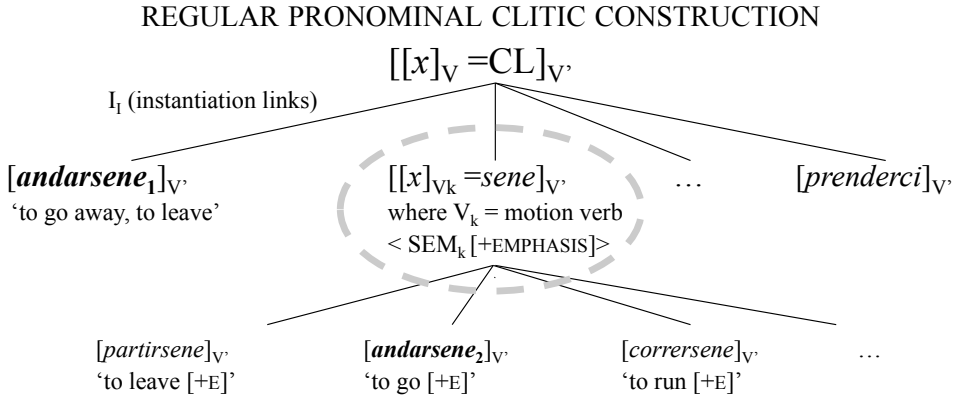
This process is outlined in Figure 6 and Figure 7.

Figure 6: Diachronic picture for the *sene* construction



We first see the instantiation of the lexically specified construction *andarsene*$_2$ 'to go [+EMPHASIS]' (Figure 6): due to the entrenchment of this exemplar, new expressions are created by analogy (e.g. *ritornarsene*, *tornarsene*). Eventually, a new semi-specified construction emerges in the constructicon with the following properties (see Figure 7): a (fixed) *sene* clitic cluster, an open slot for motion verbs, and an emphatic meaning. Since the V slot is open, new fully specified expressions with *sene* are instantiated.

Figure 7: Synchronic picture for the *sene* construction.



The emerging *sene* construction is limited by input constraints. First, only intransitive verbs of motions seem to be allowed. Transitive motion verbs such as *raggiungere* 'to reach' don't occur with *sene*:

(33) *raggiungere* (qualcosa/qualcuno) > ***raggiunger-sene***
'to reach (something/someone)' reach.INF-SENE

Also verbs already containing an inherent *si* such as *arrampicarsi* 'to climb (up)' are excluded, probably due to a formal clash:

(34) *arrampicarsi* > ***arrampicarsi-sene***
'to climb' climb.INF-SI-SENE

5.4 Beyond motion: expanding the *sene* construction

At a closer look, the *sene* construction seems to go beyond the domain of motion/location.

First of all, the emphatic *sene* is also found with motion verbs used *metaphorically*, as shown in (35)-(36), and with some non-motion verbs, as illustrated in (37)-(38).

(35)
a. ***cadere a pezzi*** (lit. fall to pieces) 'to fall to pieces, to crumble away'
b. *E tutto ormai **se ne** cade a pezzi*
'And everything is falling into pieces [+E] by now'

(36)
a. ***volare via*** (lit. fly away) 'to pass quickly'
b. *e così quel breve pomeriggio **se ne** volò via*
'and so that brief afternoon passed quickly [+E]'

(37)
a. ***vivere*** 'to live'
b. *Il cane **se ne** viveva per suo conto*
'The dog would live [+E] on its own'

(38)
a. ***nascere*** 'to be born'
b. […] *Leonard Bernstein, che **se ne** nacque povero in un posto infame*
'Leonard Bernstein, who had been born [+E] poor in a miserable place'

Also, *sene* is found with *stare* 'stay' / *restare* 'stay' / *andare* 'go' when these are not used as motion verbs, but as functional verbs in aspectual periphrases (see (39)-(41)). The *sene* construction is very common with *stare* 'stay' / *restare* 'stay'.

(39)
a. (***re***)***stare*** + ***a*** + $V_{INFINITIVE}$
b. *era il suo giorno libero, poteva benissimo **starsene a dormire***
'that was his day off, he could well keep on sleeping [+E]'

(40)
a. ***andare*** + V_{GERUND}
b. *Un attimo dopo Ellis **se ne andava camminando** nel buio*
'A minute later Ellis would be walking around [+E] in the dark'

(41)
a. ***andare*** + ***a*** + $V_{INFINITIVE}$
b. *nessuno ha voglia di **andarsene a dormire***
'nobody would want to go to sleep [+E]'

The occurrence of *sene* in these aspectual constructions (where it is associated with all sorts of verbs) may contribute / have contributed spreading its use beyond the domain of motion. However, the "intransitivity" constraint still appears to hold.

5.5 A broader picture

What is the function of the *sene* construction within the Italian system? In this last section I would like to explore this question and put forward a first hypothesis.

The semantic job done by *sene* is quite similar to what *si* does in another "emphatic" pronominal verb construction in Italian, namely the so-called Transitive Middle Construction[9] (Fried & Masini 2011; Masini 2008, 2012), where *si* marks the affectedness of the subject. See the following contrasts between *mangiare* and *mangiar**si*** on the one hand (42) and *bere* and *ber**si*** on the other (43):

(42)
a. *Sara mangia un gelato*
'Sara eats an icecream'
b. *Sara **si** mangia un gelato*'
'Sara eats "herself" an icecream' → eat[+EMPHASIS]

(43)
a. *Bevo una birra*
'I drink a beer'
b. ***Mi** bevo una birra*
'I drink "myself" a beer' → drink[+EMPHASIS]

The Middle Transitive *si* is also found in combination (unified) with inherent clitics:

(44) *ber-**se-la***
drink.INF-SI-CL.3.SG.F.OBJ.ACC
'to believe naively that something is true, to "buy" it'

As discussed in Masini (2012), the Middle Transitive Construction admits only prototypically transitive verbs, i.e. transitive verbs used with an Agent subject and an overtly expressed object (the null object alternation is not allowed). Within the limits of this restriction, it is very productive in contemporary (colloquial) Italian.

The *sene* construction shares the emphatic function with the Middle Transitive Construction, which results in an impact on the subject or another participant. However, as we pointed out, the emphatic *sene* only adds up to intransitive verbs, and a limited (albeit possibly increasing) portion of them. Therefore, the *sene* construction could be seen as a sort of Middle *Intransitive* Construction**,** with a more restricted use than the corresponding Middle Transitive Construction at present.

If we accept this hypothesis, then the *sene* construction is quite different from most other IVCCs:

i) unlike the *sene* construction, generally IVCCs are lexically specified and basically unproductive;
ii) unlike the emphatic *sene*, most inherent clitics have a "lexical" impact on the V and are obligatorily realized;
iii) clitics with more "grammatical" meanings (like *la* in *finir-la* 'to give it a rest') are more similar to *sene*, but still different because basically unproductive.

[9] The term *middle* here is used in the sense of Kemmer (1993).

6. Concluding remarks

The case study discussed in this paper illustrates two general points: the crucial interplay between representation and usage in the building of grammar, and the importance of using flexible theoretical tools to capture hybrid situations.

As for the first point, we can see that all the effects of usage on grammar mentioned by Bybee (2006: 719) are illustrated by IVCCs:

i) low levels of repetition lead to conventionalization only (as in prefabs and idioms);
ii) higher levels of repetition can lead to the establishment of a new construction with its own categories;
iii) extreme high frequency leads to the grammaticization of the new construction, the creation of grammatical morphemes, and changes in constituency.

As for the second point, a constructionist view of the language architecture allows to capture and integrate various synchronic and diachronic aspects of IVCCs, most importantly the mismatch between their morphosyntax and their semantics, their emergence from concrete exemplars, and the different degrees of idiosyncrasy/regularity that characterizes the behavior of the various IVCCs. Indeed, at the present stage of development, we have a hybrid situation that includes: IVCCs with a regular behavior but unpredictable semantics that are represented as lexically specified constructions[10]; and a lexically semi-specified construction (called here Middle Intransitive Construction) that displays some degree of productivity and is set apart from other IVCCs. Although it seems flimsy to hypothesize the existence of a maximally abstract IVCC that acts as a template for the formation of new IVCCs, such a construction may still be present in the constructicon as a "closed" construction, namely as a generalization over a closed set of instances.

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[10] Possibly, other concrete IVCCs are in the making but not yet constructionalized. I leave this question for future research.

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Relational adjectives in English and Japanese and the RA vs. PP debate

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1. Introduction[1]

Relational adjectives ("RA" hereafter) constitute one of the representative, highly productive word-formation types in many European languages and have long been a matter of debate for their mismatch between morphology and semantics. Morphologically, RAs are adjectives, but semantically they do not express property. Rather, by modifying a noun, which is their sole or principal syntactic distribution, they express an intrinsic relation between two entities, one denoted by their base noun and the other denoted by the modified noun. As a result, a possibility arises that the combination of an RA and a modified noun competes with other forms of nominal modification. The aim of this paper is to examine the possibility of RA in Japanese in light of the competition debate on RA in European languages (Rainer 2012, 2013; ten Hacken 2013) and show that the definition of RA should be sought in their grammatical and semantic functions as direct modifiers (Sproat and Shih 1988; Cinque 2010) rather than in their adjectival forms.

What constitutes the most important empirical observation is that if we define RAs as above, i.e. derivatives which are morphologically adjectives but semantically denote an entity or a relation, Modern Japanese totally lacks RAs. All of its denominal adjective-deriving suffixes, including *-teki*, the derivational suffix discussed as an RA suffix by Bisetto (2010: sections 3 and 5), form qualitative adjectives (QAs), i.e. words that participate in modification with the *-i* or *-na* inflectional ending (Nishiyama 1999) and express a gradable property or quality of the modified noun. When modifying an action nominal, they do not allow any argument-structure interpretation (cf. *presidential {election/lie}* (Giegerich 2009)). The inflectional ending *-na*, in particular, is an unambiguous marker of the QA-status; *-teki* derivatives always select this inflectional suffix (see section 3.1 for the status of *-na*) (see fn. 18).

Thus, Japanese cannot form RAs with derivational adjectival suffixes. However, if we focus on the function of RAs as direct modifiers (Sproat and Shih 1988; Cinque 2010), we notice that Japanese productively forms this type of modifier by attaching the genitive particle *no* to a noun (Watanabe 2012). For example, material/nationality-denoting modifiers take RA forms in English but "N-*no*" forms in Japanese.[2]

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[2] Like genitive forms in many other languages, the genitive particle *no* is polyfunctional (see, for example, Hiraiwa 2012: 357). We will gloss *no* phonemically as NO because its functional status is the very topic of this paper. Watanabe (2012: 508, fn. 1) does not go into the status of the direct modifier *no*, suggesting it is either a genitive case marker or a linker. In section 3.3, we will propose that it is functioning as a functional postposition (P) in the sense of Baker (2003: Appendix).

(1)

a.	wheaten bread	a’	komugi-no pan wheat-NO bread ‘wheaten bread’
b.	Chinese {vase / cooking}	b’	chuugoku-no {kabin / ryoori} China-NO {vase/ cooking} ‘Chinese vase/cooking’

The following translation pairs show that the correspondence is not limited to material and nationality:

(2)

a.	triangular room	a’	sankaku-no heya triangle-NO room
b.	marine life	b’	umi-no {seikatsu / seibutsu} sea-NO {living state / living thing}

We also notice that the “N-*no*” modifier can overtly mark various semantic relations between two entities, those identified by the RA research (e.g. Levi 1978; Warren 1984), by means of dedicated relational nouns (“RN” below; cf. Adger 2013 for relational nouns), surfacing in the form “N-RN-*no*,” as in (3):

(3)

a. Chuugoku-{siki/ fuu}-no ryoori (cf. 1b’)
China-{style/ type}-NO cooking
‘Chinese-style cooking/ Chinese-type cooking’

b. komugi-{sei/iro}-no pan (cf. 1a’)
wheat-{made/ color}-NO bread
‘wheat-made bread/ wheat-color bread’

c. sankaku-kei-no heya (cf. 2a’)
triangle-form-NO room
‘room of a triangular form’

d. kai-{chuu/joo}-no seikatu[3] (cf. 2b’)
sea-{in/on}-NO living state
‘life inside the sea/ life on (or above) the sea’

The “N-*no*” forms in (1) and (2) can express several relations between two entities, like European RAs, but the “N-RN-*no*” form in (3) selectively mark one particular type of those relations. For example, (1a’, b’) are ambiguous between the formally-marked relations in (3a, b). Thus, we can assume that the *-no* modifier uniformly have the structure in (4) below, the “N-*no*” form having a covert RN. We represent *-no* as P, anticipating the upcoming discussion. The modifier with the covert RN corresponds to RAs derived by “all-purpose” RA suffixes in Europe (Rainer 2013).

(4) [P (no) [RN [Base Noun]]] (P = adposition, RN = relational noun)

Obviously, we cannot capture the cross-linguistic parallelism in (1) and (2) unless we adopt the separation hypothesis (Beard 1995), “an approach to morphology in which there is no

[3] The form *kai* “sea” in the modifier is the bound form of the noun *umi* used in (2b’).

direct connection between the side of morphology that deals with sound and the sides that deal with syntax and semantics" (Aronoff 1994: 8). If we viewed the noun-modifying syntax of RAs and the various semantic relations they express as directly connected to the formal properties of RAs, adjective-deriving suffixes to be specific, there would be no way to account for the "N-*no*" modifiers in Japanese, which are clearly not adjectival from a morphological point of view. Rather, the Japanese data suggest that the syntax and semantics (grammatical and semantic functions) of RAs are shared cross-linguistically; and the point of variation lies in how to realize those functions morphophonologically.

Notice that a similar approach is necessary even within European languages with RAs, in which the nominal modification by RA exhibits paradigmatic relationships to other forms of nominal modification. Bisetto (2010), Rainer (2013), and ten Hacken (2013) show how the occurrence and distribution of RAs in a language are closely (and sometimes intricately) interrelated with other forms of nominal modifiers used in that language. For example, according to Rainer (2013: 20, 23), Spanish uses RAs for the direct-object relation to the head action noun, as in (5a), but PP modifiers for the material ("made-of") relation, as in (5b). In (5b), we gloss the preposition *de* as DE.

(5)
a. producción platera 'silver production' (Rainer 2013: 20)
production silver-REL
b. vaso de plata / *vaso platero 'silver cup' (Rainer 2013: 23)
cup DE silver

Similarly, Szymanek (2010: 218-219) provides the following Polish translations of English N-N compounds to show that in Polish, (i) a noun phrase with an inflected noun modifier (usually in the genitive), (ii) a noun phrase incorporating a prepositional phrase modifier, and (iii) a noun phrase involving an RA modifier compete with one another to realize semantic relations expressed by compounding in English:

(6)
a. *telephone number*
i. numer telefon-u
ii. *numer do telefon-u
iii. *numer telefon-icz-n-y

b. *computer paper*
i. *papier komputer-a
ii. papier do komputer-a
iii. papier komputer-ow-y

c. *toothpaste*
i. *past-a zęb-ów
ii. past-a do zęb-ów
iii. *past-a zęb-ow-a (Szymanek 2010: 218)

As far as these three sets are concerned, they suggest a function-form paradigm in which the "part/whole" relation is expressed by a genitive modifier, while the "intended for" relation is expressed by PP or RA modifiers, with the PP option being a default.

Taking the separation hypothesis, this paper attempts to account for the relationship between RAs in English and "N-*no*" forms in Japanese as a morphophonological variation of

the common functional structure (or the base structure in Beard (1995)) of direct modifiers. As a fundamental explanation of this type of cross-linguistic variation, we will also discuss why Japanese cannot realize the direct modifier in an adjective form. Our proposals can be summarized as follows:

- RAs and the "N-*no*" forms are forms that PP adjuncts (Beard 1995: chapters 10-12) take in direct attributive modification. RA suffixes in European languages are bound realizations of P or P+RN in (4). That is, Japanese agglutinatively marks RN and P in (4), but RA languages have synthetic, suffixal markers for these elements.
- The inventory of derivational morphology in a language correlates with the conflation patterns of its basic vocabulary. Derivational RA suffixes are rich in languages whose basic adjectives do not conflate Pred (Bowers 1993). Japanese adjectives clearly differ from European adjectives in the conflation of Pred (e.g. *aka-i* lit. red-Pred 'be red'). Because canonical adjectives in Japanese inherently comprise Pred, its derivational morphology also produces such predicative adjectives.

Section 2 will survey the syntactic, semantic, and morphological properties of direct modification (section 2.1) and analyze RAs in English in light of those properties (section 2.2). In section 3, we will first demonstrate the morphological difference between Japanese and English non-derived adjectives (section 3.1) and show how and why RAs in English correspond to the *no* forms in Japanese (sections 3.2 and 3.3).

2. RAs in English

2.1. Two types of nominal modification: Indirect and direct modification

One of the recurrent questions about nominal modification is the grammatical status of the modifier and the unit size of the modifier + modifiee combination as a whole. At the phrasal level, the distinction between direct and indirect modification has been widely assumed since Sproat and Shih (1988), while at the word level, modificational compounds or what Scalise and Bisetto (2009) call ATAP compounds ('attributive and appositive' compounds) have been attested in many languages. Thus, the intersective vs. non-intersective interpretational ambiguity exhibited by the adjectival modification in (7) below constitutes the classic piece of evidence for the indirect vs. direct modification distinction at the NP/DP level, while the pairs in (8) are often cited as attesting to phrasal modification vs. compounding modification.

(7)
a. a beautiful dancer
i. 'a dancer who is beautiful'
ii. 'a person characterized by beautiful dancing'
b. an old friend
i. 'a friend who is old'
ii. 'a person characterized by old friendship'

(8)
a. a blàck bóard vs. a bláckbòard
b. a dàrk róom vs. a dárkròom
c. a gréen hóuse vs. a gréenhòuse

The minimal pairs like those given above strongly indicate that the grammatical status of an adjective, whether it functions as a predicative or indirect-modifier adjective, as a non-predicative or direct-modifier adjective, or as a compound constituent, depends on the adjective's hierarchical closeness to the modified noun, i.e., which position it occupies in the NP (DP)-internal syntactic structure. Crucially, (7) and (8) show that one and the same adjective can function as a predicative, non-predicative, or compound-constituent modifier, which means that the tripartite status distinction is not an inherent property specified for each adjectival item but a property emergent from the adjective's relative closeness to the head noun. In this paper, we focus on the relationship between indirect and direct modifiers, referring readers to Nagano (2013: section 4) for the relationship between these phrasal modifiers and modificational compounds.

The syntactic difference between the two uses of each adjective in (7a, b) becomes evident once we compare their word-order flexibility. The intersective reading is not affected by moving the adjective to a higher prenominal position, as in (9a), or to the postnominal position, as in (9b).

(9)

a. a beautiful, enchanting dancer
   an old stingy friend

b. a dancer especially beautiful today
   a friend old for her age

On the other hand, the non-intersective reading is not available in these adjectival configurations; *an old stingy friend* in (9a), for example, cannot refer to a stingy person characterized by old friendship or a person characterized by old stingy friendship. Direct modifier adjectives are governed by rigid word-order restrictions. First, the direct modifier occurs closer to the head noun than the indirect modifier. According to Cinque (2010: 22), a cross-linguistic generative study of the syntax of adjectives, the two types of adjectives occur in the following relative orderings with respect to D (Determiner) and the head noun in Germanic and Romance languages:

(10)

a. Germanic languages
   D > indirect-modifier > direct-modifier > Noun > indirect modifier

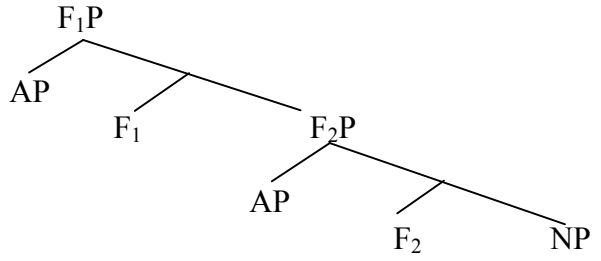
b. Romance languages
   D > direct-modifier > Noun > direct-modifier > indirect-modifier

Next, direct modifiers can be stacked, but according to Scott (2002), their ordering needs to follow the following semantics-based hierarchical order with respect to the head noun (Scott 2002:114):

(11) *Hierarchy of attributive adjectives*
Subjective comment > ?evidential > size > length > height > speed > ?depth > width > weight > temperature > ?wetness > age > shape > color > nationality/origin > material

Cinque (2010: 37-41) proposes to capture this ordering restriction by positing semantically defined adjunct positions in the NP structure, as follows:

(12)

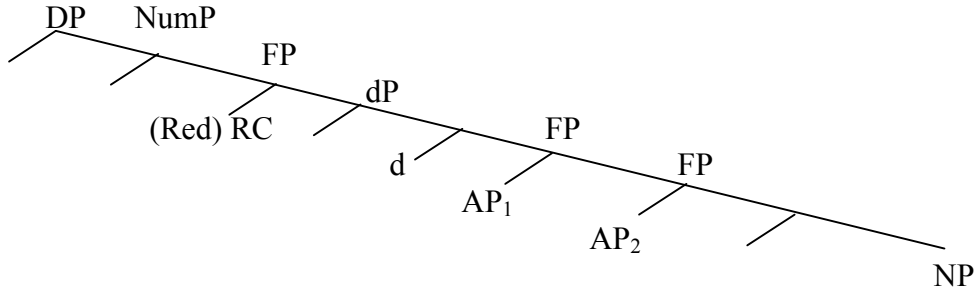


Because each adjunct site accommodates only one direct modifier, this syntactic structure can account for both the relative ordering among direct modifiers given in (11) and the fact that the same semantic type of direct modifier cannot be iterated. Thus, when an identical prenominal modifier occurs twice, as in (13) below, the modification is interpreted either as the repetition of an indirect modifier or as the combination of indirect and direct modifiers. Interpreting both occurrences as direct/non-predicative type is usually not possible.

(13)
a. a criminal criminal lawyer
b. a beautiful beautiful dancer
c. I missed the Thursday Thursday lecture ((13c) from Cinque 2010: 26)

The above discussion makes it clear that predicative and non-predicative uses of canonical, morphologically simple adjectives derive from their syntactic or hierarchical positioning; the former use is licensed in the outer domain in the DP, whereas the latter use is licensed in the inner domain in the DP, positions closer to the head noun. Technically, we will capture this difference by adopting the mainstream view that indirect modifiers are reduced relative clauses, while direct modifiers directly merge with the head noun. According to Cinque (2010: 33-34), the two DP domains are demarcated by a small indefinite dP, as depicted below (Cinque 2010: 34):

(14)



A relative clause (RC), full or reduced, merges above the indefinite d head; and this head functions as the head of the relative clause itself. On the other hand, the direct modification structure in (12) comes below the d head. Cinque claims that the positional difference with respect to the d head can also account for the series of semantic differences between indirect and direct modification (Cinque 2010: chapter 2), the differences which Bolinger (1967) reduces to the difference between Reference modification (i.e. AP modifying the reference of the NP) and Referent modification (i.e. AP modifying the referent of the NP):

> If we think of d as assigning some referential import (though not the uniquely individuating referential import of the higher D, which marks the (maximal) intersection of the set contributed by dP and the set contributed by the relative clause), it is evident that direct modification adjectives, which are below d, modify something that is still predicative in nature, while (full and) reduced relative clauses, which are higher than d, modify something that already has some referential status (Cinque 2010: 34).

Under this view, indirect modification leads to intersective interpretations such as (7a/b i) because it attributes a property to the head noun as a referential argument, whereas direct modification leads to non-intersective interpretations such as (7a/b ii) because it further specifies the kind denoted by the head noun; it names a specific subclass of the kind denoted by the head noun.[4]

We have seen the syntactic and semantic properties of direct modification based on Cinque (2010). In addition, Baker (2003: section 4.2) points out that direct modification exhibits the following morphosyntactic properties:

(15)

a. Syntactic category of the modifier: The syntactic category of a direct modifier is A.
b. Agreement between the modifier and the modifiee: Overt or covert agreement between the modifier and the modified noun is necessary to the existence of direct modification, functioning as a sort of glue between them.
c. Syntactic size of the modifier: A direct modifier has a small structure (cf. Sadler and Aronld 1994). A direct modifier is similar to an incorporated head in that they are "both very small pieces of syntax, typically consisting of only a single X^0" (Baker 2003: 274).

In order to make sense of this cluster of grammatical properties, we need to make a crucial divergence from Cinque (2010) concerning the presence of a functional head between the direct modifier and the modified noun. (12) and (14) show that Cinque assumes its presence.[5] In this paper, however, we follow Baker's (2003: section 4.2.2) view that direct modification is closely related to the nature of the syntactic category A as a defective category. Baker claims that the syntactic defectivity enables adjectives to directly merge with the head noun, with no functional structure mediating the relation (as an instance of Bare Phrase Structure) and suggests that the modifier-modifiee agreement is necessary, as stated in (15b), as a morphological support for the direct Merge relationship.

Under this view, the modifier-modifiee agreement is a morphological compensation for the lack of any functional structure in-between (see also Emonds 2000: 309, fn. 29). Being a defective syntactic category, adjectives can share the same phi-features as the head noun.[6] This feature-sharing licenses the direct merge relationship between the adjective and the head noun. In addition, in order to properly inherit the phi-features of the head noun, the modifier must be not only A in category but also small in size. That is, direct modifiers assume an incorporated head size in order to properly agree with the head noun; if the modifier had its own syntactic dependents such as arguments and adjuncts (see e.g. (9b)) or its own phi-

[4] In other words, direct modification is a type of kind modification (cf. Gehrke 2012; Snyder 2012). See Snyder (2012: 85) for the semantic definition of kind.

[5] Cinque does not specify the type of the functional head, though. See Rubin (2003) for the difficulty of identifying the category label of the supposed functional head for adjunction.

[6] See Anderson (1992: section 5.1) for the distinction between modifier-head agreement and predicate-argument agreement. While the latter type of agreement can be construed as feature-copying, the former type is "the passing of feature specifications within the structure of phrasal categories" (Anderson 1992: 111), so that the identity of features obtains between the modifier and modifiee phrases.

features, it could not inherit the feature specifications of the modified head. Moreover, the significance of modifier-modifiee agreement motivates the reference modification property of direct modifiers discussed above; sharing the phi-features of the head noun, adjectives can provide purely semantic labels necessary for the subclassification (or further specification) of the kind concept denoted by the head noun.

The licensing of direct modification by modifier-head agreement rather than by a functional head is confirmed by the following formal alternation that transitive adjectives exhibit in indirect and direct modification:

(16)
a. a country (which is) rich in oil
a' an oil-rich country / *a rich in oil country
b. people (who are) proud of their houses
b' house-proud people / *proud of house(s) people
c. a child (who is) prone to accidents
c' an accident-prone child / *a prone to accident(s) child
d. troops (that are) weary of wars
d' war-weary troops / *weary of war(s) troops

Transitive adjectives take a compounded A^0 form in the direct modifier position, as in (16a'-d'), because they must agree with the head NP in that position.[7] If their internal arguments are projected as PPs, as in the right-side forms in (16a'-d'), it obliterates the feature inheritance from the head NP, hence the ungrammaticality of these forms. By compounding the internal argument, transitive adjectives can occur adjacent to the head NP. Also significant for the feature inheritance is the fact that the Number distinction of their internal arguments is lost in compounded form; as in (16b'-d'), even count nouns occur in the default singular form. The same factor underlies the A^0 vs. AP alternation based on adjectives taking a measure phrase in (17) below, and the A^0 vs. VP alternation based on stative (or passive) verbs in (18) below ((17) and (18) from Nagano (2013: 117)):

(17)
a. a girl who is {ten years old / *ten-year-old}
a' a {ten-year-old / *ten-years-old} girl
b. a pole that is {three feet long / *three-foot-long}
b' a {three-foot-long / *three-feet-long} pole

(18)
a. packages that {look suspicious / *are suspicious-looking}
a' suspicious-looking packages
b. a company that is {based in Britain / * British-based}
b' a British-based company

The prenominal modifiers in (17a',b') and (18a',b'), which are all attributive-only compounded adjectives, exhibit forms fit for agreement with the head NP. For instance, the measure noun occurs in the default form in (17a',b'), and the toponymic noun occurs in the adjectival form in (18b').

[7] See Marchand (1969: 84) and Yumoto (2009) for further examples of this type of compounds. We do not discuss whether this compounding belongs to incorporation or not.

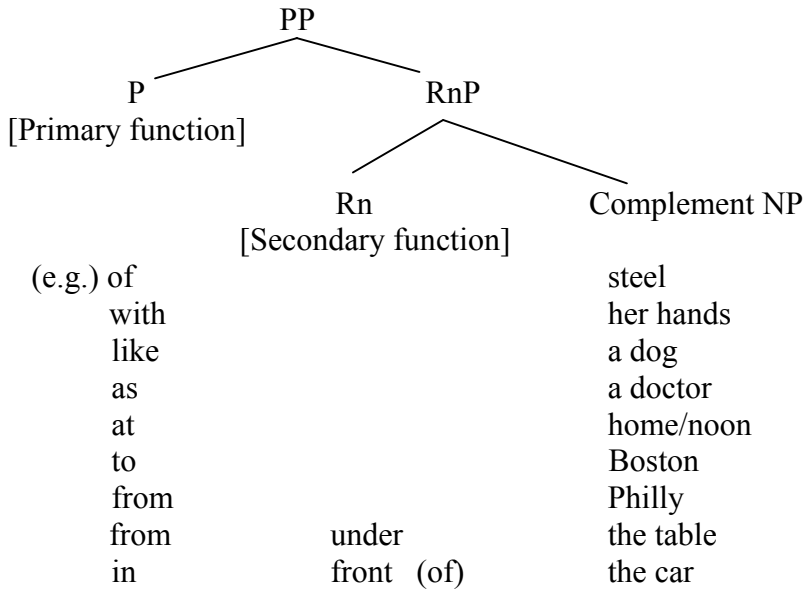
2.2. RA and PP as denominal direct and indirect modification

In the previous section, we have seen that canonical non-derived adjectives in English possess predicative and non-predicative usages due to the dual source of syntactic nominal modification: relative clause modification and direct merge modification. We have also seen that this syntactic distinction corresponds to the formal AP (or stative VP) vs. A^0 distinction due to the agreement condition on direct merge modification. As long as one and the same adjective exhibits the two usages based on its syntactic contexts, the distinction can be seen as a kind of inflection, contextual inflection in particular (Booij 1996).[8]

These facts provide a new perspective on non-canonical, denominal adjectives called RAs. The A^0 size and the limited syntactic occurrence of RAs suggest that RAs are direct-modifier forms of certain adjunct functions which take distinct phrasal forms in indirect modification. In their attempts to integrate Case systems and P (adpositions), Beard (1995: chapters 10-12) and Emonds (1985: 223-237 and 2000: section 7.4) propose a consistent treatment of two types of indirect modifier forms attested across languages: so-called semantic Case-marked NPs and adjectival/adverbial PPs. In particular, Beard (1995: 253) claims that "Case is present only to mark grammatical functions, where the means of marking may be affixational or adpositional".[9] Based on this view, we propose that the grammatical functions formally marked by semantic Case affixes or PPs in indirect modification are formally marked by A^0-forming morphology in direct modification, including compounded adjectives such as those we saw in (16a'-d'), (17a',b') and (18a',b') and RAs. In our view, RAs do not have a predicative usage because they are word-forms that adjunct PP structures take in direct modification; in the predicative, relative clause context, the same structures take full PP manifestations.

Following Beard (1995: 280), we assume that semantic Case functions correspond to PP base structures, in which the relationships between primary functions (i.e. obligatory nominal grammatical functions), secondary functions (i.e. optional nominal grammatical functions) and Case-bearing NPs are represented hierarchically:

(19)



[8] Indeed, Cinque (2010: Appendix) shows that inflection-rich languages formally distinguish canonical adjectives in direct and indirect modification.

[9] See Beard (1995: Appendix A) for the list of all the grammatical functions attested in Indo-European Case systems.

As formulated as the Grammatical Function Criterion (Beard 1995: 268), all NPs must bear one primary grammatical function; and NPs with a primary function may bear one additional secondary function. Semantically, secondary functions provide further specifications to primary functions. Morphosyntactically, Beard's (1995: section 10.4) empirical data show that the distinction between primary and secondary nominal functions is a case of the widely attested bipartition of functional categories into "purely" functional ones and "semi-lexical" ones (Emonds 1985, Corver and van Riemsdijk 2001, Corver 2008, among others).[10] Most tellingly, primary functions can be zero-marked (cf. fn. 14), whereas secondary functions need overt marking. Thus, in the spatial adjunct domain, primary functions such as Location and Goal may be zero-marked, as in (20a) below, but secondary functions such as Inession and Subession must be marked overtly, as indicated in (20b).

(20)
a. She stayed home. He went home.
b. The ball rolled from *(under) the table.

In order to capture this difference, we use the label "Rn" (relational noun) for the syntactic position accommodating secondary functions; the Rn head is a generalized version of the Axial Part head Svenonius (2006, 2010) posits for spatial PPs. The semi-lexicality of the relational noun *front* in (19) is demonstrated by the following contrast (Svenonius 2006: 49-50):

(21)
a. There were kangaroos in {front / *fronts} of the cars.
b. There were kangaroos in the {front / fronts} of the cars.

Compared to *front*, *under* is closer to a purely functional P in directly taking its complement, but its lexical character can be detected in allowing the following NP usage (Baker 2003: 304-305, fn.1):

(22)
a. Under the elm is a nice place for a picnic.
b. I prefer under the maple.

In indirect modification, the base adjunct structure in (19) can be realized as a PP and/or as a Case-marked NP,[11] but direct modification requires its A^0 realization due to the agreement requirement discussed in (15b). This is made possible by conflating or incorporating the complement NP up to the P head in the structure (19). The conflation and incorporation result in representations like (23) and (24), respectively:

(23) Conflation in (19) leads to:
a. [NOUN + Primary function]
b. [[NOUN + Secondary function] + Primary function]

[10] Tănase-Dogaru (2011) surveys diagnostic criteria for semi-lexicality.
[11] We use the conjunction "and/or" here because the number of Case functions and the number of morphological exponents are not necessarily the same. As the structure (19) shows, Case functions that define adjuncts are maximally two, but "the maximum number of Case endings and/or Ps in a PP is the maximum number allowed by the MS component to mark two functions; this seems to be about four" (Beard 1995: 272). See also the discussion and data in Nikolaeva and Spencer (n.d.).

(24) Incorporation in (19) leads to:
a. [P [Noun]]
b. [P [RN-Noun]]

We do not go into the details of the distinction between conflation and incorporation (see, for example, Baker 2003: section 2.9 and 167-169). What is important here is that the base adjunct structure in (19) can give rise to syntacticosemantc representations for A^0 realizations through the widely-attested processes of conflation and incorporation. Beard and Volpe (2005), for example, utilizes a function-conflation process similar to (23) in order to derive the agent nominal *baker* from the same base structure as the indirect modification *a person who bakes*. In our case, the output syntactic category A comes from the P head, which is the AP-forming (or adjunct-introducing) functional category as discussed in Beard (1995: chapter 12) and Baker (2003: 324-325).[12] (23a) and (24a) represent cases when the base structure does not have a secondary function, while (23b) and (24b) come from cases when it does.

The following data show that English employs conflation for the A^0 realization of the base structure (19) ((25) and (26) from Nagano 2013: 123):

(25)

a.	*presidential* plane/election/lie	a’	plane/election/lie *of the president*
b.	*cellular* structure	b’	structure *of cells*
c.	*dental* disease	c’	disease *of teeth*
d.	*woolen* fabrics	d’	fabrics *of wool*
e.	*bearded* man	e’	man *with beard*
f.	*southern* exposure	f’	exposure *to the south*
g.	*Belgian* law	g’	law *of Belgium*

(26)

a.	*preadverbial* expression *pre-Chaucerian* literature	a’	expression *in front of an adverb* literature *before Chaucer*
b.	*postnominal* adjective	b’	adjective *after a noun*
c.	*intra-organismal* and	c’	struggle *within and between organisms* *interorganismal* struggle
d.	*sub-Saharan* Africa	d’	Africa *below the Sahara*
e.	*suprasegmental* phonemes	e’	phonemes *above segments*
f.	*a trans-global* expedition	f’	expedition *across the globe*

The RAs in (25a-g) are forms realizing the conflated representation in (23a); the underlined suffixes are realizations of Primary functions. The parasynthetic RAs in (26a-f) are forms realizing the conflated representation in (23b); the underlined suffixes realize Primary functions, while Secondary functions are realized by the spatio-temporal prefixes, bound forms of the relational nouns used in the corresponding indirect-modifier PPs (see Nagano 2013: section 3 for details). In the pairs in (26a/a’), for example, the suffix *-al* and the adposition *in* realize the same primary function of Location, while the prefix *pre-* and the relational noun *front* realize the same secondary function of Anteriority.[13]

[12] As an important ingredient of his semantic Case analysis, Beard (1995: chapter 12) advances the Defective Adjective Hypothesis, according to which PPs are a subclass of APs.

[13] In the PPs in (26b’-f’), the primary and secondary functions are fusionally marked by the prepositions. That is, underlying relational nouns for secondary functions (e.g. *after* in 26b’) are conflated into the P head in (19).

Because the primary function can be marked covertly,[14] the modifier-head combinations in (27) and (28) below can also be viewed as direct modifications realizing (23a,b), respectively.

(27)
a. *steel* bridge, *corduroy* suit, *duck* soup, *gold* medal, *iron* rod, *rubber* boots, *wood* floor
b. *autumn* leaves, *September* morning, *summer* palace, *Arab* policies/philosophy, *garage* door, *library* curtains, the *New Zealand* economy, *Tiffany* lamp, *US* ambassador

(28)
a. *pre-Easter* season, *pre-railroad* world, *post-lunch* coffee, *anti-tank* gun, *anti-trade* wind, *cross-border* traffic, *inter-island* steamer, *interstate* affairs, *pro-tariff* reform, *sub-bottom* echo, *subsurface* waters, *superstandard* risk, *trans-earth* orbit, *trans-world* airline
b. *after-dinner* mint, *before-tax* book profits, *between-class* break, *off-campus* extension courses, *on-base* military club, *on-board* modem, an *underground* passage

The primary function in (27a) is Material, which is overtly marked by an RA suffix in (25d). The primary functions zero-marked in (27b) and (28a,b) are Location and Temporal. The following additional example shows that even Possession function, which is usually marked by the RA suffix *-ed* as in (25e) and (29b), can be zero-marked in English:

(29)
a. In the other corner was the aforesaid *three-corner* table adorned with a fat, red velvet pin-cushion hard enough to turn the point of the most adventurous pin. (From *Anne of Green Gables* by Lucy Maud Montgomery (1908)).
b. a three-cornered table

The secondary functions in (26) and (28) are further specifications of the Location or Temporal primary functions, but the following data indicate that the preposition *of*, which realizes primary functions such as Possession, Measure, and Partitivity, can also take relational nouns to specify its secondary (sub-classificatory) functions (Schwarzschild 2006: 106):

(30)
a. an Iranian 16th century brass *boat-shaped* vessel (Feist 2012: 116),
her tawny, *almond-shaped* eyes (BNC), an *onion-shaped* dome
b. a *medium-sized* city, a *life-size* dinosaur, an *economy-size* package, a *pocket-size* dictionary, a *middle-size* bank, *bite-size* fried chicken
c. a *four-color* photograph, granular phosphatic limestone and *dove-colored* limestone, a *green*/*peach color* scheme, the thin *coffee-colored* dress (BNC)
d. a *three-foot* pole (cf. a *three-foot-long* pole), 5 *pound* paper

In sum, we have shown that RAs are direct-modifier realizations of the adjunct base structure in (19). RAs do not occur in indirect modification because in this syntactic context, the same structure is realized in PP forms. The prenominal positioning of RAs follows from the word-order property in (10a), while their kind-specifying semantics (McNally and Boleda 2004)

[14] The zero-marking of P in (19) may depend on the morphological typology of the language at issue. English is well known for its tolerance for zero derivation, and the zero-marking of the P head, the AP-deriving category, is also tolerated (especially when P = *of*, *at*, or *to*) (see e.g. Collins 2007). As we will see in the next section, Japanese does not allow the zero-marking of P.

belongs to Reference modification, the non-intersective, classificatory interpretation that section 2.1 attributed to the hierarchical relationship between the direct modifier and the indefinite d head.

3. The *no* modifiers in Japanese

The aim of this section is to confirm the analysis of English RAs in section 2 from a cross-linguistic point of view. We have claimed that RAs should be viewed not as lexemic members of an independent subclass of the category A but as grammatical word-forms that adjunct PPs take in direct modification contexts. This view is strongly supported by the total lack of RAs in Japanese; in this language, direct modifiers are formed not by an adjectival suffix but by a nominal Case morpheme, as mentioned in section 1. If RAs were lexemic word-formations, their preponderance in European languages in contrast to their total absence in Japanese would remain a puzzle. However, if RAs are word-forms, their presence and absence in a language are a matter of morphological typology. Because different languages use different morphological realization patterns for common grammatical functions, it is plausible that Japanese morphologically realizes the adjunct PP base structure (19) in a distinct way from English and other RA languages. Below, we will show that the choice of the *no* forms (instead of RA forms) for the realization of direct modifiers is closely related to the morphology of Japanese adjectives.

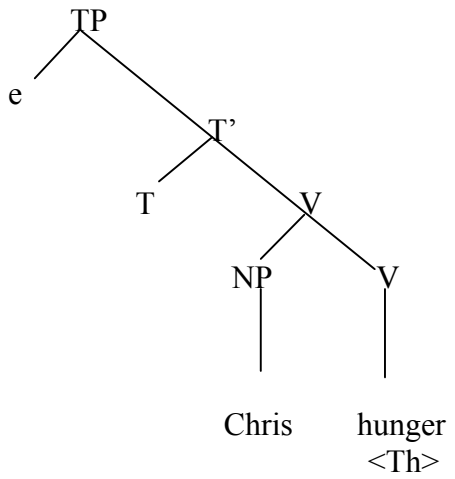
3.1. Morphology of Japanese adjectives in predication and its correlation to indirect vs. direct modification

The syntactic category of A is well known for exhibiting a typological partition into two morphological types in the predicative function: verb-like adjectives and non-verb-like adjectives in Dixon's (2004) terms (see also Stassen 1997, 2009: 140-141). Verb-like adjectives behave like intransitive verbs in allowing the predicative use by themselves, without a copular verb. Non-verb-like adjectives, on the other hand, behave like predicate nominals in needing an independent copula to occur in the predicative function. In Baker's (2003) theory of lexical categories, this typological difference can be described as a difference of the realization pattern of the function Pred (Bowers 1993). In this theory, verbs can take a subject and thus function as predicates by themselves, while adjectives and nouns cannot take a subject and hence need the support of Pred to introduce a subject and function as predicates (see Baker 2003: chapter 2). Thus, the verbal predication in (31a) is given a structure like (32a), whereas the non-verbal (adjectival and nominal) predication in (31b,c) is given a structure like (32b). Crucially, the structures in (32a,b) show Baker's view that the category V is equivalent to the composite category Pred+A(P); verbs realize Pred and A in one-word forms. English canonical adjectives, on the other hand, need the copular verb *be* (or copulas such as *as* in small clauses) as a morphological bearer of Pred. As indicated in (31b,c), they cannot morphologically realize Pred in and of themselves, just as nouns cannot ((31) and (32) from Baker 2003: 35).

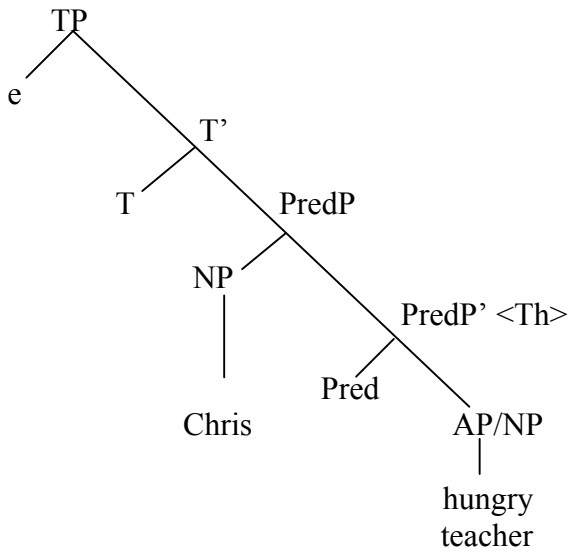
(31)
a. Chris hungers.
b. Chris *(is) hungry.
c. Chris *(is) a teacher.

(32)

a.



b.



If English canonical adjectives, which belong to the "non-verb-like" type, correspond to A(P) in (32b), then, verb-like adjectives should be morphological realizations of the composite category Pred+A; in this case, Pred in (32b) is fusionally realized on the lexical category A. What is crucial here is the fact that Japanese canonical adjectives, which characteristically have the non-past *-i* ending, belong to the latter type. As indicated below, they can take a subject like verbs and do not need the copular verb *de-aru* or its contracted form *da*.

(33) Canonical adjectives

a. yama-ga takai
mountain-NOM high.PRES
'The mountain is high.'

b. yama-ga takakatta
mountain-NOM high.PAST
'The mountain was high.'
(Nishiyama 1999: 183)

(34) Intransitive verbs

a. John-ga karuk-u warau
John-NOM light-ADV laugh.PRES
'John laughs lightly.'

b. John-ga karuk-u waratta
John-NOM light-ADV laugh.PAST
'John laughed lightly.'

If the structure in (32b) underlies the adjectival predication in (33), the adjectives within should correspond to the composite category Pred+A, hence their parallelism to the intransitive verbs in (34). In fact, Nishiyama (1999, 2005) confirms the Pred status of the root-final morpheme *k* of canonical adjectives, which manifests itself overtly in all of their inflectional forms except the present-tense form (33a); as underscored, *k* occurs in the past form in (33b) and also in the predicative-adverb forms in (34a, b). In the Fukuoka dialect, the Pred morpheme *k* appears in all the word forms including the present-tense form:[15]

(35) Canonical adjectives in the Fukuoka dialect

a. yama-ga takaka
mountain-NOM high.PRES
'The mountain is high.'

b. yama-ga takakatta
mountain-NOM high.PAST
'The mountain was high.'

[15] The Fukuoka dialect is spoken in northern parts of the Kyushu region in Japan. One of the present authors is a native speaker of this dialect.

In brief, Japanese canonical adjectives morphologically differ from English canonical adjectives in realizing not only A but also Pred.

Furthermore, as discussed by Kageyama (1993), the predicative copula (Pred copula) *de* (Nishiyama 1999) exhibits distinct morphological properties in so-called nominal adjectives (36) and predicate nominals (37).

(36) Nominal adjectives

a. hon-ga kiree-de-aru
book-NOM pretty-PRED-PRES
'The book is pretty.'

b. hon-ga kiree-de-atta
book-NOM pretty-PRED-PAST
'The book was pretty.'

(37) Predicate nominal

a. John-ga sensee-de-aru
John-NOM teacher-PRED-PRES
'John is a teacher.'

b. John-ga sensee-de-atta
John-NOM teacher-PRED-PAST
'John was a teacher.'

At the first sight, nominal adjectives look like English canonical adjectives, exhibiting the same syntagmatic pattern as nouns. Yet, Kageyama (1993) and Shimada (2004: chapter 5) argue that the Pred copula *de* constitutes an inflectional ending with respect to its lexical host in (36) but does not in (37). As the following data indicates, *kiree-de* in (36) exhibits lexical integrity while *sensee-de* in (37) does not:

(38)

a. hon-ga kiree *(de) tana-ga gooka-de-aru
book-NOM pretty-(PRED) shelf-NOM gorgeous-PRED-PRES
'The book is pretty and the shelf is gorgeous.'

b. John-ga sensee (de) Tom-ga seito-de-aru
John-NOM teacher-(PRED) Tom-NOM student-PRED-PRES
'John is a teacher and Tom is a student.'

Significantly, independent evidence shows that nominal adjectives form a natural class with canonical adjectives rather than with predicate nominals. For example, Nishiyama (1999: section 1) points out the contrastive possibilities of the abstract noun deriving *sa*-suffixation and the *soo* ('seem') complementation between canonical and nominal adjectives on one hand and predicate nominals on the other. As a stronger piece of evidence for the categorial identity between canonical and nominal adjectives, the Fukuoka dialect uses not *de* but *k* for the realization of Pred in nominal adjectives:

(39) Nominal Adjectives in the Fukuoka dialect

a. hon-ga kiree-k-a
book-NOM pretty-PRED-PRES
'The book is pretty.'

b. hon-ga kiree-k-atta
book-NOM pretty-PRED-PAST
'The book was pretty.'

Thus, given the categorial identity of canonical and nominal adjectives,[16] it seems to be safe to conclude that Japanese adjectives morphologically conflate A and Pred.

[16] See also Baker (2003: section 4.6.1) for arguments against the view that Japanese has two kinds of adjectives (e.g. Backhouse 2004).

Now turning to nominal modification, we propose that the morphological property of Japanese adjectives discussed above is closely related to the long-standing observation that direct modification is difficult with Japanese adjectives. First, Sproat and Shih (1988, 1991), Morita (2010), and Watanabe (2012) show that they do not follow the ordering restriction in (11) in modifying nouns. As the data below show, canonical adjectives, which modify a noun in the same form as their present-tense *i*-ending form (see (33a)), and nominal adjectives, which take the *na* ending instead of *de* (see (36a,b)) in nominal modification, occur in a free syntactic order irrespective of their semantic classes. Compare the adjectival ordering in (40a, b) with the one in the English translation (Sproat and Shih 1991:582):

(40)

a. chiisana shikakui ie
small square house
'small square house'

b. shikakui chiisana ie
square small house
'small square house'

Next, Hoshi (2002: section 6.1) points out that Japanese adjectives lack the semantic ambiguity that English adjectives can exhibit in nominal modification. Thus, the ambiguity of *a beautiful dancer* discussed in (7a) does not obtain in the Japanese translation; the Japanese translation of this phrase can be interpreted only intersectively (Hoshi 2002: 15):

(41) Kanozyo-wa utsukushi-i dansaa-da
she-TOP beautiful dancer be
'She is a dancer who is beautiful.'
= someone who is beautiful and who is a dancer (= intersective)
= ?*someone who dances beautifully and who is a dancer (= non-intersective)

According to Hoshi, the not-completely-unacceptable status of the non-intersective interpretation comes from the independent fact that Japanese allows for zero pronominals.[17]

Thirdly, Morita (2010) shows that both canonical and nominal adjectives are gradable adjectives. They accept modification by degree adverbs such as *motto* 'more,' *totemo* 'very,' and *kanari* 'fairly,' which is shown for canonical adjectives by her data in (42) and for nominal adjectives by her data in (43). Notice that Morita explicitly indicates the existence of the *k* morpheme in the canonical adjective modifiers in (42). Also, these data show that the non-gradable modifiers, which cannot be modified by the degree adverbs, all take the *no*-ending form (Morita 2010: 110-111):[18]

---

[17] Thus, according to Hoshi (2002: 16-17), the modifier in (41) has the following relative-clause structure with the zero pronominal:

(i) Kanozyo-wa [*e* utsukushi-i] dansaa-da
she-TOP beautiful dancer-PRED

In his view, the very subtle ambiguity arises because the zero pronominal can be interpreted as the counterpart of either of the two overt relative subjects in (iia, b).

(ii)

a. Kanozyo-wa [yooshi-ga utsukushi-i] dansaa-da.
she-TOP figure-NOM beautiful dancer-PRED
= someone whose figure is beautiful and is a dancer

b. Kanozyo-wa [odori-ga utsukushi-i] dansaa-da.
she-TOP dance-NOM beautiful dancer-pred
= someone whose dance is beautiful and is a dancer

[18] The QA status of the *na* form is clearly shown by toponymic modification:

(42)
a. totemo {maru(k)-i/*maru-no} teeburu
very round round table
'a very round table'
b. totemo {shikaku(k)-i /*shikaku-no} teeburu
very square square table
'a very square table'

(43)
a. motto {wazuka-na / *wazuka-no} okane
more a little-NA a little-NO money
'lesser amount of money'
b. kanari {koosiki-na / *kooshiki-no} kaigi
fairly formal-NA formal-NO conference
'a fairly formal conference'

Based on these facts, we assume that Japanese adjectives (both canonical and nominal adjectives) modify nouns as indirect modifiers (i.e. relative clauses), adjoined to the DP-internal domain above the small d head in (14). We claim that this syntactic restriction to indirect modification is a consequence of these adjectives morphologically conflating Pred, for the direct Merge between A(P) and N(P) without the mediation of Pred is the very definition of direct modification (see section 2.1). One might worry about the *de-na* ending alternation exhibited by nominal adjectives. The allomorphic relationship between *de* and *na*, i.e. the fact that *na* is an allomorph of the Pred copula *de*, is confirmed by the inflection of nominal adjectives in the Fukuoka dialect. As shown below, nominal adjectives take *k* for Pred not only in predication but also in modification (see also (39) for predication):

(44) Modification and predication by nominal adjective in the Fukuoka dialect
a. kiree-k-a hon
pretty-PRED-PRES book
'a pretty book'
b. hon-ga kiree-k-a
book-NOM pretty-PRED-PRES
'The book is pretty.'

On the other hand, direct modifiers, i.e. modifiers that are directly merged with the head noun in the DP-internal domain below the small d head, take the *no* ending, as indicated by (1), (2), (42), and (43). Thus, our hypothesis about nominal modification in Japanese is that canonical and nominal adjectives are always indirect modifiers, while direct modifiers always take the

---

(i)
a. Tsukuba-na omise
Tsukuba-NA shop
'a shop that reminds one of Tsukuba'
b. Tsukuba-no omise
Tsukuba-NO shop
'a shop in Tsukuba'

Based on the toponym *Tsukuba*, the name of the largest academic town in Japan, the modifier in (ia) denotes properties characteristic of people in academia and their ways of living (e.g. "practical", "not fashionable", "economical", "geeky"); hence, it can be modified by a degree adverb. The shop in (ia) does not have to be in Tsukuba. In contrast, the *no*-modifier in (ib) denotes a location, so that the shop in (ib) has to be in Tsukuba. Incidentally, the modifier in (ia) can be augmented by the suffix *-teki* (e.g. *Tsukuba-teki-na omise*), expressing the same meanings. This is a piece of evidence on which we argue against Bisetto's (2010) analysis of *-teki* as an RA suffix.

no form.[19]This is in line with Morita's (2011) morphology-based analysis of nominal modifiers in Japanese. In the next section, we will confirm the proposed formal property of Japanese direct modifiers by looking at how the direct modifiers in English, both canonical adjectives and RAs, are translated into Japanese; what we will see presently is the use of *no* modifiers (and modificational compounds) rather than canonical and nominal adjectives.

3.2. Comparison to English direct modifiers

Let us start with the translation data of English attributive-only adjectives:

(45)

a.	an alleged miracle	a'	mayutsuba(-mono)-no kiseki fake(-thing)-NO miracle
b.	a fake pistol	b'	nise(-mono)-no pisutoru fake(-thing)-NO pistol
c.	a total stranger	c'	aka-no tanin red-NO stranger
d.	the mere child	d'	hon-no kodomo mere-NO child
e.	the sole/only survivor	e'	yuiitsu-no seozonsha sole-NO survivor
f.	sheer delight	f'	mattaku-no yorokobi complete-NO delight
g.	a junior/senior bureaucrat	g'	kakyuu-no/jyookyuu-no yakunin junior-NO/senior-NO bureaucrat
h.	a stricken deer	h'	teoi-no shika wounded-NO deer
i.	a drunken brawl	i'	sake-no ue-no kenka alcohol-no over-NO brawl

In these data, attributive-only or unambiguously direct-modifier adjectives in English are translated into Japanese by *no*-form modifiers. In some cases, not only the *no*-form modification but also modificational compounding can be employed. In the following pairs, the second translation exhibit the one-word form [bound modifier + free or bound nominal].

(46)

a.	the uppermost floor	a'	ichiban ue-no kai / saijoo-kai most above-NO floor uppermost-floor
b.	the former mayor one time-NO mayor	b'	mae-no sichoo / zen-sichoo former-mayor

[19] We do not go into the details of the remaining possibility, i.e. the *no* form used for indirect modification, as in the following example (Shimada 2004: 124):

(i) [gakusei-ga asu fuzai-no] kenkyuushitsu
student-NOM tomorrow absent-NO laboratory
'a lab from which students will be absent tomorrow'

For the non-predicative use of canonical and nominal adjectives such as the one in (ii) below, see section 3.2 and Hoshi (2002: section 5):

(ii) furui yuujin
old friend
'an old friend'

c. late Prof. Smith

c' onakunari-no sumisu kyoojyu /
deceased-NO Smith professor
ko-sumisu kyoojyu
deceased-Smith professor

It is very difficult to find Japanese adjectives that could replace the modifier forms in (45a'-i') and (46a'-c').

Next, cases of ambiguous adjectival modification in English, such as (7a, b), are formally disambiguated in Japanese via the distinction between adjectival modifiers and *no*-modifiers. In (41), we saw that the ambiguity of *a beautiful dancer* does not obtain in the Japanese adjectival translation form. Similarly, when we translate the English ambiguous phrases in (47a, b) by adjectival modifiers, as in (47a') and (47b'), their non-intersective readings disappear. In contrast, if we use *no*-modifiers as in (47a'') and (47b''), only those readings remain. The Japanese NP in (47a''), for example, refers to a dog which is characterized by a small dog-size, i.e. a small-size dog.

(47)

a. *a small dog*

a' chiisai inu
small dog

a'' ko-gata-no inu
small-size-NO dog

b. *a safe driver*

b' anzen-na/buji-na untenshu
safe driver

b'' anzen-daiichi-no untenshu
safety-first-NO driver

The ambiguity of the adjective *old* (e.g. (7b)) is also formally disambiguated:

(48)

a. *an old friend*

a' nenpai-no/ toshiyori-no yuujin
aged-NO friend

a'' furui yuujin / furuku-kara-no yuujin
old friend/ old.time-from-NO friend

b. *old wine*

b' furui wain
old wine

b'' nendai-mono-no wain
age-thing-NO wine

c. *(Britain's) old families*

c'

c'' (igirisu-no) kyuuka /furuku-kara-no kakei
Britin-gen old.family/old.time-from-NO family

Notably, (48a'') indicates that not only *no*-forms but also adjectival forms can be used for the non-intersective readings of (48a). Yamakido (2000) claims that the adjectival modification *furui yuujin* 'an old friend' in (48a'') constitutes a strong piece of evidence against the traditional (and also our) view that Japanese adjectives are barred from direct modification. Although we do not go into the question of why *furui* can be exceptionally used in the direct modification, we need to notice that the Japanese adjective *furui* 'old' is antonymous to *atarashii* 'new' but not to *wakai* 'young,' so that the predicative sentence **Kono yuujin-wa furui* 'This friend is old' is totally out. In other words, the AP + NP in (48a'') is not ambiguous like the English counterpart in (48a); the 'not young' sense of *old* corresponds to the *no*-forms *nenpai-no* and *toshiyori-no* 'aged,' as shown in (48a'). When the head noun brings forth the 'not new' sense of *old*, as in (48b), the intersective reading is translated by the adjectival form, as in (48b'), and the non-intersective reading by the *no*-form, as in (48b''). When the English *old* phrase is unambiguously a direct modification, as in (48c), we do not have adjectival translation, so (48c') is left open. In a nutshell, the data in (48) also show that

Japanese adjectives differ from English adjectives in formally disambiguating direct and indirect modification.

Finally, section 2.2 showed that RAs in English are direct modifiers. Using data such as (1), cited again as (49) below, Watanabe (2012) shows that material and nationality RAs correspond to *no*-modifiers in Japanese:

(49)

a.	wheaten bread	a’	komugi-no pan wheat-NO bread ‘wheaten bread’
b.	Chinese {vase / cooking}	b’	chuugoku-no {kabin / ryoori} China-NO {vase / cooking} ‘Chinese vase/cooking’

The following translation pairs in (50) show that the correspondence is not limited to material and nationality. RAs of shape (50a), weather (50b), body part (50c), location (50d-g), time (50h), and status (50i,j) also correspond to *no*-modifiers.

(50)

a.	triangular room	a’	sankaku-no heya triangle-NO room
b.	rainy season	b’	ame-no kisetsu rain-NO season
c.	bearded man (cf. 25e)	c’	hige-no otoko beard-NO man
d.	marine life	d’	umi-no {seikatsu / seibutsu} sea-NO {living state / living thing}
e.	local wine	e’	jimoto-no wain home-NO wine
f.	the dream of global peace	f’	sekai(-no) heiwa-no yume world(-NO) peace-NO dream
g.	prenominal adjectives (cf. 26a)	g’	{meisi(-no) mae-no/ meishizen-i-no} keiyooshi noun(-gen) front-NO/ noun-front-NO adjective
h.	pre-Chaucerian literature (cf. 26a)	h’	choosaa izen-no bungaku Chauser before-NO literature
i.	vice-presidential caliber	i’	fuku-daitooryoo-no utsuwa vice-president-NO caliber
j.	her presidential term	j’	kanojyo-no daitooryoo-no ninki her-gen president-NO term

Let us check the direct-modifier status of these *no*-modifiers, starting with the syntactic ordering restriction. Watanabe (2012) confirms the direct modifier status of material and nationality no-modifiers like (49a’,b’) by their relative ordering to adjectival modifiers. Compare the following data with the free ordering of multiple-adjectival modification in (40) (Watanabe 2012: 507):

(51)

a.	chiisana ki-no hashi small wood-GEN bridge ‘small wooden bridge’	a’	??ki-no chiisana hashi wood- GEN small bridge

b. chiisana chuugoku-no kabin
small China-GEN vase
'small Chinese vase'

b' ??chuugoku-no chiisana kabin
China-GEN small vase

Most of the Japanese phrases in (45), (46), and (50) do not allow the insertion of an adjective or a Possessor-denoting genitive noun between the *no*-modifiers and the head nouns, as follows:

(52)

a. chiisana nise-no pisutoru
small fake-NO pistol

a' ??nise-no chiisana pisutoru (cf. 45b')
fake-NO small pistol

b. takai jimoto-no wain
expensive home-NO wine

b' ??jimoto-no takai wain (cf. 50e')
home-NO expensive wine

However, we notice that when the host of *no* is headed by a semi-lexical, relational noun, with the complex internal structure [modifier/complement+relational noun], the *no*-modifier allows for the intrusion of an adjectival modifier:

(53)

a. kuroi nise-mono-no pisutoru
black fake-thing-NO pistol
'a black fake pistol'

a' nise-mono-no kuroi pisutoru (cf. 45b')
fake-thing-NO black pistol

b. idaina furuku-kara-no kakei
great old.time-from-NO family
'a great old family'

b' furuku-kara-no idaina kakei (cf. 48c'')
old.time-from-NO great family

c. marui nendai-mono-no chiizu
round age-thing-NO cheese
'round old cheese'

c' nendai-mono-no marui chiizu (cf. 48b'')
age-thing-NO round cheese

The *no*-modifiers in these examples differ from those in (51) and (52) in their internal morphosyntactic complexity; the hosts of *no* in (51) and (52) are purely lexemic nouns, while *no* in (53) attaches to multi-word complexes headed by semi-lexical relational nouns. The contrast between (52a) and (53a) makes this point clear; as we saw in (45b'), the adjective *fake* corresponds to the *no*-modifiers with and without the light noun *mono* 'thing,' *nise-mono-no* and *nise-no*. The latter form observes the ordering restriction, but the former form does not. Below, we will use the term "complex *no*-modifier" to refer to *no*-modifiers based on the headed internal structure [lexeme+overt relational noun].[20]

Curiously, *no*-modifiers of this type differ from the simple type in allowing the predicative use:

(54)

a. kono pisutoru-wa nise-mono-da
This pistol-TOP fake-thing-PRED
'This pistol is a fake one.'

b. *kono pisutoru-wa nise-da.
this pistol-TOP fake-PRED
'This pistol is a fake one.'

[20] This type excludes *no*-modifier whose hosts are morphologically complex lexemes formed by bound elements, such as *komugi-no* in (49a) and *chuugoku-no* in (49b).

We need to hasten to add, however, that from the viewpoints of semantics and degree modification, the *no*-modifiers observed in this section, whether complex or simplex, qualify as direct modifiers.[21] Semantically, they name specific subtypes of the kinds denoted by the modifiee nouns. For example, the formal difference between the modifiers in (47a') and (47a'') clearly corresponds to the semantic distinction between referent vs. reference modification although both of the modifiers can occur in the predicative usage:

(55)
a. kono inu-wa chiisai. (cf. 47a')
this dog-TOP small-PRES
'This dog is small.'
b. kono inu-wa kogatada. (cf. 47a'')
this dog-TOP small-size-PRED.PRES
'This dog is a small-size dog.'

The direct-modifier status of the no-modifier with RN *kogata-no* is also suggested by the fact that unlike the canonical adjective *chiisai* (or the nominal adjective *chiisana*), it cannot be modified by a degree adverb:

(56)
a. motto chiisa-na/-i inu
more small dog
'a smaller dog'
b. *motto kogata-no inu
more small-size-NO dog

For the gradability difference between adjectives and *no*-modifiers, see also the data in (42) and (43).

Although we have no explanation for the ordering property of the complex *no*-modifiers in (53), their predicative usage (54a) can be seen as a kind-specifying type of predication discussed by McNally and Boleda (2004). According to these authors, RAs in European languages are kind-specifying adjectives, and as long as this interpretation is explicit, with the subject denoting a kind rather than an ordinary individual, RAs can be used predicatively. They provide the following Catalan example (McNally and Boleda 2004: 189):

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

The predicative usage of RAs is restricted because they select kind-denoting subjects, as predicates such as *be extinct* and *exist* (e.g., *This kind of dog is extinct.*/**Fido is extinct.*). Based on this finding about RAs, we tentatively propose that the complex *no*-modifiers allow for the predicative usage, as in (54a) and (55b), because the overt relational noun guarantees the kind-specification interpretation.[22]

[21] The complex modifier *furuku-kara-no* in (48a'') and (48c''), however, allows for degree modification.

[22] In Japanese linguistics, the kind-specifying predication is called property-description and distinguished from the event-description type of predication (Kageyama 2006, 2009). Significantly, the syntactic frames for property description utilize the same semi-lexical relational nouns as we observe in the complex *no*-modifiers. Witness the use of the light noun *mono* (and the pronoun *no*) in the following sentence:
(i) Inu toiu-{**no**/**mono**}-wa kamu **mono**-da

In sum, this section has shown that direct modifiers in English consistently correspond to *no*-modifiers in Japanese. Formally, the *no*-modifiers come in simplex and complex types, depending on whether the host of *no* has a semi-lexical relational noun or not. They qualify as direct modifiers in light of their kind-specifying semantics, lack of gradability, syntactic closeness to the head noun, and potential to participate in kind-denoting predication, with the last two properties showing a variation between the two formal types.

3.3. The *no*-modifier as the incorporated form of the adjunct PP structure

In section 2.2, we argued that the adjunct base structure in (19) is morphologically realized as PPs and/or NPs with semantic Case affixes in indirect modification but as RAs in direct modification. Specifically, RAs are morphological realizations of the representation in (23). RA languages, including English, have the morphological resources for this option, i.e. A-deriving affixes, to spell out (23) because their non-derived adjectives belong to the non-verb-like type discussed in section 3.1; they do not morphologically conflate Pred. Our present assumption, which is tacitly assumed in the literature, is that word-formation and inflection in a language cannot produce lexemes or word-forms of the type absent from its non-derived basic vocabulary. To put it simply, English can produce adjectives that does not conflate Pred (i.e. RAs) because their canonical adjectives do not conflate Pred.

Under the same assumption, if Japanese canonical adjectives always conflate Pred (section 3.1), this language should not have morphological resources that give rise to adjectives that do not conflate Pred. In our view, this is why Japanese totally lacks RAs (or morphological affixes that realize (23) as RAs); and it is also the reason why Japanese opts for the incorporation path in (24), cited below again as (58), to produce direct modifiers.

(58) Incorporation in (19) leads to:
a. [P [Noun]] e.g. (49a') *komugi-no* (*pan*)
b. [P [RN-Noun]] e.g. (47a'') *ko-gata-no* (*inu*)

It is clear that the simple *no*-modifier corresponds to (58a) while the complex *no*-modifier to (58b), with *no* being the exponent of P, the adjunct-introducing category. To use the base structure in (19), *no* realizes a primary function while relational nouns (e.g. *kata* 'size') realize a secondary function; and Noun and RN are incorporated into the functional head P.

One may notice that the relational nouns of the complex *no*-modifiers we have seen in section 3.2 do not necessarily combine with a noun as suggested by the inner bracket of (58b); the *no*-modifier in (47a''), for example, has the internal structure [[[ko]$_{\text{A stem}}$+[kata] $_{\text{RN}}$]no]. A similar observation holds true of some of the English direct modifiers in (30) (e.g. *a middle-size bank*). First, although we cannot go into details, we assume that the complement of the Rn head in (19) is an instance of Rheme (Ramchand 2008) and hence its syntactic category is not limited to NP or DP (see Ramchand 2008: chapter 2).[23]

Second, we do have a number of examples in which the complex *no*-modifier has a nominal complement, exhibiting the exact manifestation of the internal structure in (58b). In fact, as mentioned in section 1 (see (3)), simple *no*-modifiers with the internal structure in (58a) can be expanded by the insertion of a relational noun, which yields complex *no*-modifiers with the internal structure in (58b). For example, the simple *no*-modifiers in (49) and (50) can be turned into the complex type by relational nouns that specify the semantic relationship between the modifier noun and the modified noun:

Dog called-thing-TOP bite thing-PRED
'Dogs bite.'

[23] See also Adger (2013) for the syntactic status of the complement of relational nouns.

(59)

a. Chuugoku-{siki/ fuu}-no ryoori (cf. 49b')
China-{style/ type}-NO cooking
'Chinese-style cooking/ Chinese-type cooking'

b. komugi-{sei/iro}-no pan (cf. 49a')
wheat-{made/ color}-NO bread
'wheat-made bread/ wheat-color bread'

c. sankaku-kei-no heya (cf. 50a')
triangle-form-NO room
'a triangular-form room'

d. kai-{chuu/joo}-no seikatu (cf. 50d')
sea-{in/on}-NO living state
'life inside the sea/ life on (or above) the sea'

e. jimoto-san-no biiru (cf. 50e')
home-grown-NO beer
'locally brewed beer'

f. sekai-kibo-no heiwa-no yume (cf. 50f')
world-scale-NO peace-NO dream
'the dream of world-wide peace'

g. fuku-daitooryoo-toshite-no utsuwa (cf. 50i')
vice-president-as-NO caliber
'(one's) caliber as a vice-president'

h. kanojyo-no daitooryoo-toshite-no ninki (cf. 50j')
her-gen president-as-NO term
'her term as a president'

As these data suggest, Japanese is rich in relational nouns that can be used for the secondary function realization, i.e. the Rn head in (19). Witness the following non-exhaustive list of the Rn formatives:

(60) Representative RNs used in the *no*-modifier:

a. **Material**: *sei* 'made by,' *iri* 'added'
b. **Origin**: *sei* 'made in,' *kei* 'descended from,' *shussin* 'coming from,' *umare* 'born in'
c. **Shape/Size**: *kei* 'shape,' *kata/gata* 'shape, size'
d. **Taste**: *aji*/ *mi* 'taste,' *fuumi* 'taste'
e. **Type**: *sei* 'type, nature,' *gata* 'type,' *kei* 'type'
f. **State**: *joo* 'state,' *jootai* 'state,' *sugata* 'wearing'
g. **Belonging**: *kumi* 'group,' *ha* 'group, school,' *shugi* 'ism,' *syozoku* 'belonging to'
h. **Similarity**: *fuu* 'like,' *ryuu* 'like, in the style of'
i. **Possession/Ingredient**: *tsuki* 'with,' *mochi* 'with,' *iri* 'added'
j. **Purpose/Target**: *yoo* 'for,' *muke* 'meant for,' *senyoo* 'exclusively for'
k. **Location**: *mae*/ *zen* 'front,' *shita/ ka* 'under,' *naka* 'in, inside,' *ue/ joo* 'on, above,' *chuu* 'inside,' *kan* 'between,' *iki* 'bound for,' *hatsu* 'departing from,' *muki* 'toward, faced to,' *kake* 'hanged on'[24]
l. **Time**: *mae* 'before,' *go* 'after,' *chuu* 'during'
m. **Status/Profession**: *jin* 'nationality,' *shi* 'specialist,' *fu* 'female,' *kan* 'official,' *ko* 'worker,' jo 'female,' *toshite* 'as'
n. **Level**: *kyuu* 'level,' *reberu* 'level,' *do* 'degree,' *i* 'level'

[24] This class of Rn formatives are discussed under the term Axial Part in Svenonius (2006, 2010).

The semi-lexical nature of the formatives in (60) is indicated by their morphological boundness; most of them need a host to attach to.

Our analysis of *no*-modifiers as word-forms based on the base structure (19) is confirmed by the fact that inalienable possession nominals and simple event nominals can be used as the Rn formatives (Shimada 2004: chapter 5). Ogawa (2001) observes that relational nouns constitute a natural class with inalienable possession nouns and simple event nominals in morphosyntactic contexts independent of direct modification. (61) exemplifies inalienable possession nominals realizing secondary functions, while (62) exemplifies the realization by simple event nominals (see also Yumoto 2009 for the latter type):

(61)
a. choo-hatsu-no gakusei
long-hair-NO student
'a long-haired student'
b. chika-ba-no hoteru
near-place-NO hotel
'a nearby hotel'

(62)
a. ishi-zukuri-no ie
stone-make-NO house
'a stone-made house'
b. kata-yude-no tamago
hard-boil-NO egg
'a hard-boiled egg'

Crucially, the nominalizations used in (62a, b), V-to-N conversions (e.g. *tsukuru* 'to make' > *tsukuri* '(a) make, making,' *yuderu* 'to boil' > *yude* '(a) boil, boiling'), belong to the simple event nominalization (Sugioka 2011; see also Tagawa 2013 for this type of nominalization).

Lastly, let us close this section by presenting evidence for the process of incorporation itself. First, all the complex *no*-modifiers have indirect-modifier counterparts; similarly to the correspondences in (25) and (26), the base adjunct structure in (19) has phrasal and morphological realizations, as follows:

(63)

a.	sankaku-kei-no heya triangle-form-NO room 'a triangular room'	(cf. 59c)	a'	sankaku-no katachi-no heya triangle-NO form-NO room 'a room of a triangular form'
b.	choo-hatsu-no gakusei long-hair-NO student 'a long-haired student'	(cf. 61a)	b'	nagai kami-no gakusei long hair-NO student 'a student with long hair'
c.	ishi-zukuri-no ie stone-make-NO house 'a stone-made house'	(cf. 62a)	c'	ishi-no tsukuri-no ie stone-NO make-NO house 'a house made of stone'

The direct modifiers in (63a-c) are formed by incorporating the complement and the relational noun in (63a'-c') successively into the uppermost *no*. Notice that this process is accompanied by morphophonological alternation (i.e. allomorphic alternation) of the incorporated elements; for example, in (63a/a'), the free Rn formative *katachi* alternates with its bound form *kei*, while in (63b/b'), the complement adjective *nagai* alternates with its suppletive

bound form *choo*. The free-bound allomorphy occurs due to the XP vs. X^0 difference between indirect and direct modifiers (section 2.2), so that similar changes can be observed in English pairs of direct and indirect modifiers as well (see (26)).

Next, *no*-modifiers exhibit general properties of the incorporating patterns (Dahl 2004: chapter 10; see also Baker 2003: section 4.6.3). We have already seen that *no*-modifiers denote permanent, classificatory properties and that the incorporated complement and relational noun form a single morphological word occurring in their bound forms. Additionally, the incorporated nominal complements cannot take a D element, cannot be modified by an indirect modifier,[25] or cannot take the plural marker *-tachi*, as the following data for simple *no*-modifiers (64) and complex *no*-modifiers (65) indicate:

(64)
a. kono ki-no tsukue
this wood-NO desk
'this wooden desk,' # 'a desk made of this wood'
b. *oji-no-sumu Chuugoku-no kabin
uncle-Nom-live China-NO vase
'a vase made in China, where my uncle lives'
c. {kodomo/*kodomotachi}-no hon
{child/*children}-NO book
In the sense 'a children's book'

(65)
a. ookii ichigo-iri-no keeki
large strawberry-RN ('added')-NO cake
#? 'cake with large strawberries,' 'strawberry cake which is large'
b. genkina ko-mochi-no otokotachi
high-spirited child-RN ('with')-NO men
'men with a high-spirited child or children,'
'high-spirited men with a child or children'
c. {kodomo/*kodomotachi}-yoo-no hon
{child/*children}-RN ('for')-NO book
'a book written for children'

4. Concluding remarks

This paper has shown that RAs in English are a type of direct modifiers and their syntactic, morphological, and semantic properties can be better understood in light of the distinction of two types of nominal modification: direct and indirect modification. Specifically, adopting the

[25] The possibility of expanding the incorporated nominal complement by direct modifiers cannot be addressed in this paper (see Nikolaeva and Spencer (n.d.)). For example, comparison between (65a,b) with the following data speaks for the expansion possibility:
(i)
a' ko-gata-no ichigo-iri-no keeki
small-size(-NO) strawberry-RN('added')-NO cake
'cake with small strawberries', 'strawberry cake which is small'
b' sannin-no ko-mochi-no otokotachi
three-RN ('person')-NO child-RN ('with')-NO men
'men with three children', 'three men with a child or children'
This fact might raise certain complications for our assumption that (63 a'-c') represent indirect modification. We leave this issue for further research.

separation hypothesis, we have proposed that the base adjunct structure is realized as PPs in indirect modification while as RAs in direct modification. In the sense that this formal alternation is forced by syntactic contexts of modifiers, RA formation is closer to inflection than to lexeme formation.

Our separationist approach to RAs in English has been supported by the fact that Japanese uses a distinct form, the incorporated PP form, to realize the same base structure in direct modification. Japanese opts for this path of realization because RA forms, or adjectives without Pred, run afoul of the morphological typology of non-derived canonical adjectives in this language.

What we have seen in this paper is a cross-linguistic competition of two morphological realizational processes: incorporation and affixation. For the realization of PP-based direct modifiers, English opts for affixation while Japanese opts for incorporation. Because this option is crucially dependent on the grammar of each particular language, it is quite natural that the realizational competition is observed within one language. Notably, Rainer's (2013) data, (5a,b) in particular, indicate that Spanish uses both affixation and incorporation for PP-based direct modifiers; in some cases, this language uses (23) like English to yield RAs, but in other cases, it uses (24) like Japanese to give rise to the N+P+N direct modification.[26] Why does Spanish differ from English and Japanese in the availability of the two realization processes? If our analysis is on the right track, the answer to this question should be sought in morphosyntax, and we tentatively suggest that one factor comes from word-order properties of direct modification. Specifically, Spanish differs from English and Japanese in the flexibility of the order between direct modifiers and modified nouns. As we saw in (10a, b), direct modifiers in Romance languages occur both prenominally and postnominally, while direct modifiers in English occur only prenominally. In Japanese, both indirect and direct modifiers occur only prenominally. Although both RAs (5a) and incorporated PPs (5b) occur postnominally in Spanish, word order is one of the defining syntactic properties of direct modification and therefore, its variation is worth exploring as a possible factor underlying the morphological variation between the languages at issue. Finally, as for the question of how Spanish distribute the two realization processes in each instance of PP-based direct modification, a very careful scrutiny of various aspects of Spanish grammar is the central task.[27]

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[26] See Moyna (2011: chapter 1) for the incorporation analysis of the N+P+N construction in Spanish. Also, Fradin (2009) and Masini (2009) for parallel modification constructions in French and Italian, respectively.

[27] One can find an in-depth exercise along this line in Feist (2012) for direct modification in English.

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Semantic rivalry between affixes: the case of Portuguese nominalisers

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1. Introduction

In Portuguese there are different suffixes that permit us to construct event deverbal nouns. Those affixes may adjoin the same verbal base. Examples of this are presented in table 1:

Table 1: Different deverbal nouns from the same verb

Base verb	EDN in *-mento*	EDN in *-da*	EDN in *-ção*	EDN in *-dela*	EDN in *-dura*
tosquiar 'to shear'	*tosquiamento*	*tosquiada*	*tosquiação*	*tosquiadela*	*tosquiadura*
moer 'to mill'	*moimento*	*moída*	*moição*	*moidela*	*moedura*

Albeit deriving event nouns, the meanings of the derivatives of these suffixes are slightly different. We intend to contribute to the understanding of the mechanisms that are involved in affix semantic rivalry, specifically to the knowledge of the semantic features of the verbal base that are sensitive to the semantics of each affix.

2. Affix selection: the 'all or nothing' hypothesis

Fábregas (2010) has proposed that in Spanish the selection of the different nominalising suffixes depends on the semantic features of the internal argument of the base verb. According to Fábregas, verbs of change of state with a rheme path object originate nominals with the suffix *-da/-do*, but not with the suffix *-miento*. Contrarily, verbs of change of state with an undergoer choose the suffix *-miento* and not *-da/-do*.

Table 2: Verbs with undergoer and verbs with rheme path objects with deverbal nouns with *-da* and *-mento*

Verbs with undergoers	**Deverbal nouns with *-da***	**Deverbal nouns with *-mento***
processor 'to process'	*processada* 'event of processing'	*processamento* 'event of processing'
pensar 'to think'	*pensada* 'event of thinking'	*pensamento* 'event of thinking'
aquecer 'to heat'	*aquecida* 'event of heating'	*aquecimento* 'event of heating'
esfriar 'to cool'	*esfriada* 'event of cooling'	*esfriamento* 'event of cooling'
engordar 'to fatten'	*engordada* 'event of fattening'	*engordamento* 'event of fattening'

Verbs with rheme path objects	**Deverbal nouns with *-da***	**Deverbal nouns with *-mento***
bronzear 'to tan'	*bronzeada* 'event of tanning'	*bronzeamento* 'event of tanning'
envernizar 'to varnish'	*envernizada* 'event of varnishing'	*envernizamento* 'event of varnishing'
descascar 'to peel'	*descascada* 'event of peeling'	*descascasmento* 'event of peeling'
descer 'to pull down; to lower'	*descida* 'event of pulling down; lowering; descent'	*descimento* 'event of pulling down; event of lowering; descent'

The analysis of Portuguese data does not corroborate Fábregas' hypothesis. As Portuguese data evidence, affix selection is not sensitive to the distinction between rheme path objects and undergoers. In fact, both verbs may be bases of nouns with the suffixes *-da* and *-mento*, as exemplified in table 2.

What we would like to question are those perspectives that consider affix selection as a question of blockage that operates in an 'all or nothing mode', that is, if a verb has a certain feature, the verb blocks the adjunction of a certain affix and requires the adjunction of another one. The examples in tables 1 and 2 arouse doubts concerning the 'all or nothing mode' conception of how suffix selection operates. It is intriguing that the same verb goes under the affixation of so many suffixes that operate in the same word-formation rule. Should not affix rivalry provide for the blockage of synonyms?

3. Affix selection: Our proposal

Instead of considering an 'all or nothing mode', we propose the notion of compatibility between the semantic features of the suffix and those of the verb (Rodrigues 2008, 2009, 2012; Rodrigues & Rio-Torto 2013).

We consider that the suffix contains semantic features. The verbal base also has semantic features related to the event and to the lexical semantic structure of the verb. The semantic feature will coindex with the semantic feature of the verb that is more compatible with its own feature. The conception of coindexation that we adopt is not the same that is presented in Lieber (2004). In Lieber (2004), coindexation operates with semantic and syntactic features. Our proposal eliminates syntactic features and focuses on semantic ones. Coindexation is a semantic operation required in word-formation processes such as affixation and compounding (Rodrigues & Rio-Torto 2013). In the case of affixation, coindexation is responsible for the adjunction of suffixes to the base, on the level of semantic structures operating in those formations. Coindexation works with semantic compatibility between the affix and the base.

Semantic features of the affixes are observable in a non-direct way, in the derivative. We have to compare event deverbal nouns that share the same base with each other, such as the ones presented in table 1. We also have to compare deverbal nouns from different bases but with the same affix with each other, as the ones presented in table 2.

These two ways of comparison had led to the following statements (Rodrigues 2008; Rodrigues & Rio-Torto 2013):

a. *-da* has as semantic features [+sudden event; +point of arrival];
b. *-mento* has as semantic feature [+process].

3.1 Semantic coindexation

The coindexation mechanism is described now. Remember that *-da* has as semantic features [+sudden event; +point of arrival]. If there is a verb whose event structure has a point of arrival, then the semantic feature of *-da* will coindex with this feature of the base, forming a deverbal noun whose meaning will be 'sudden event focused on the point of arrival'. The suffix, because of its own semantic feature(s), highlights the feature of the verb it coindexes with.

Regarding the suffix *-mento*, this one has as semantic feature [+process]. This feature contains the sub-features [+durative], being minimally compatible with the feature [point of arrival]. Subsequently, the semantic feature [+ process] of the suffix *-mento* will coindex with the feature [+durative] of the base.

This means that the base may contain both features [durative] and [point of arrival]. However, due to this mechanism of coindexation, which works in a semantic compatibility mode, the same verb may select both *-da* and *-mento*. The first affix will capture the point of the arrival of the event implied in the base and the second affix will capture the process implied in the base.

Table 3 and 4 contain a representation of the mechanism (for details of the symbols notation see Rodrigues 2008).

Table 3: Mechanism of coindexation of the feature of the suffix *-mento* with the features of the base

		Features of the verb			Features of the affix *-mento*	
verb	**Deverbal deverbal noun**	durative	point of arrival	telic	process	point of arrival
tosquiar 'to shear'	*tosquiamento*	$E^{e,s}$	E	$E^{e,s}$	S^{s}	

Table 4: Mechanism of coindexation of the feature of the suffix *-da* with the features of the base

		Features of the verb			Features of the affix *-da*	
verb	**Deverbal noun**	durative	point of arrival	telic	process	point of arrival
tosquiar 'to shear'	*tosquiada*	E	$E^{e,s}$	$E^{e,s}$		S^{s}

3.2 Affix as rivals?

Due to the different semantic features involved in each formation, the suffixes in those situations are not acting as rivals. In fact, the derivatives, although both meaning 'event', have different semantic nuances. Indeed, *tosquiada* means a quick event, whilst *tosquiamento* means the course of the process in itself (examples 1-4):

(1)
a. Vamos proceder ao tosquiamento do rebanho.
'We will proceed to the shearing of the flock.'
b. *Estamos a assistir ao tosquiamento do rebanho há mais de duas horas*.
'We are attending the shearing of the flock since two hours ago'.

(2)
a. *Vamos proceder à tosquiada do rebanho.
*'We will proceed to the shearing of the flock.'

b. **Estamos a assistir à tosquiada do rebanho há mais de duas horas.*
*'We are attending the shearing of the flock since two hours ago.'

(3) Vamos dar uma tosquiada ao rebanho.
'We will give a shearing to the flock.'

(4) *Vamos dar um tosquiamento ao rebanho.
*'We will give a shearing to the flock.'

Examples (1-2) show that event deverbal nouns with *-mento* are compatible with a durative reading implied in the construction *estar a assistir a* 'to be attending sth' and *ir proceder* 'to go to proceed to'. Deverbal nouns with *-da* are not compatible with those constructions. Examples (3-4) demonstrate that *-da* may occur with the light verb *dar* 'to give', which does not happen with suffixes with *-mento*.

4. Conclusions

Unless there are other orders of constraints, in terms of semantic operations in word formation, it is not possible to state that only a certain kind of verbs will select a certain affix, since many affixes occur with the same base. This is possible because affixes have semantic features. These semantic features are semantically compatible or not with each one of the aspect features of the verb. The semantic feature of the affix will coindex with the semantic feature of the verb that is most compatible with itself. Because of this there may be a verb with different event deverbal nouns. Each one has semantic nuances that result from the specific features used in coindexation. Those semantic differences are observable in utterances that contain aspect constructions.

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The meaning of Italian VN compounds in a diachronic perspective: the development of a word-formation rule and its semantic instruction

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1. Introduction: the premises and the aim of the study[1]

The VN compounding (of the type *portalettere*) in Italian (and, in general, in the Romance languages, cf. Gather 2001, Bauer 2010, among many others) is a well-studied and well-described phenomenon. However, recent research has shown that at least two questions are worth being further developed. First, it is the quantitative aspect of the productivity and of the overall distribution of the VN compounds in large – synchronic – corpora (see Ricca 2010). Second, it is the diachronic development of the pattern in question that has come to the foreground (see Moyna 2011 for Spanish).

The aim of this paper is to combine both aspects and to offer a *partial corpus-based diachronic picture* covering the period that goes from the 16th to the 19th century, based on selected data drawn from the LIZ 4.0; and, at the same time, a *partial dictionary-based diachronic description* of the pattern covering, in a complementary way, the same period, based on four editions of the *Vocabolario degli Accademici della Crusca* (ranging from 1612 to 1738) and on the dictionary *il Tommaseo* (2004) by Niccolò Tommaseo and Bernardo Bellini (1857-1879) (for a history of the Italian lexicography see Marazzini 2009).

This study is supposed to show that VN compounding, though being always *available*, has become more *profitable* – in the sense of Corbin's (1987:177) distinction between *disponibilité* and *rentabilité* – only over the period under investigation. It will also be shown that VN compounding has always been endowed with the same semantic instruction inherent in the word-formation rule (WFR), exhibiting thus all the known semantic outputs to be described below.

2. VN compounds in present-day Italian

As is well known, VN compounding is a well-settled productive pattern in present-day Italian (see, e.g., Tollemache 1945; Scalise 1994: 134-136; Bisetto 2004: 45-47; Radimský 2006: 95-101; Scalise & Bisetto 2008: 133-135; Dardano 2009: 190-198; Ricca 2010, among others).

The pattern consists in a combination of a verbal base with a noun which is usually its internal argument: *portalettere* 'postman', *guardaboschi* 'forester', *lavapiatti* 'dishwasher', *contagiri* 'tachometer', etc. (e.g., Scalise 1994: 134). However, not every imaginable verbal base is found in the attested compounds; the restrictions, as summarised by Ricca (2010: 243-246), seem to be phonological (preference for bisyllabic bases), morphological (avoidance of verbs with *-isc-*), syntactic (limitation to transitive / agentive verb bases), and probably also semantic, as the number of really productive verbal bases is rather low. In fact, corpus-based

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and dictionary-based studies (Ricca 2010, 2005; Radimský 2006; Gather 2001) show that productive leading bases (Ricca 2010: 247) are mainly *porta-* 'bring', *salva-* 'save', *mangia-* 'eat', *acchiappa-* 'take', *ammazza-* 'kill', *copri-* 'cover', *taglia-* 'cut', *para-* 'block', *spacca* 'break' and *trita-* 'grind'.

Semantically, these compounds may be *agents, instruments, events, locations* (the last two being marginal), but they can also function as adjectival modifiers (qualifying/relational). Also, it was assumed that there was a primary meaning – that of agent – from which the other meanings could be diacronically derived, but recent research (see, especially, Moyna 2011, for Spanish) suggests that all semantic outputs tend to coexist since the early attestations.

3. VN compounds in diachrony

Interestingly, VN compounding in Romance is not a pattern with a stable diachronic productivity. In fact, as Moyna (2011: 206) puts it, its "beginnings are modest, less robust than those of many other compounding patterns, (...)."

Moyna (2011: 206) demonstrates that a real quantitative spread of the pattern can be traced back to as late as the 19th century: 70% of all VN compounds are attested precisely from the 19th century onwards.

In order to obtain a similar picture for Italian, the data from the 16th to the 19th century will be presented on a limited (but sufficiently representative) sample of 15 leading bases: *porta-* 'bring', *copri-* 'cover', *salva-* 'save', *lava-* 'wash', *conta-* 'count', *para-* 'block', *passa-* 'pass', *reggi-* 'bear', *rompi-* 'break', *apri-* 'open', *batti-* 'beat', *guarda-* 'watch', *mangia-* 'eat', *ammazza-* 'kill', *spacca* 'break', *taglia-* 'cut'.

4. Lexicographic data

The lexicographic evidence drawn from the major historical dictionaries shows clearly that the representation of the VN compounding is really weak; the overall number of lemmas (containing only the 15 leading bases introduced above) is captured in Table 1.

Table 1: VN compounds attested in historical dictionaries.

Dictionary	Period	Lemmas
Vocabolario degli Accademici della Crusca (1st edition)	1612	11
Vocabolario degli Accademici della Crusca (2nd edition)	1623	11
Vocabolario degli Accademici della Crusca (3rd edition)	1691	16
Vocabolario degli Accademici della Crusca (4th edition)	1729-1738	27
il Tommaseo	1857-1879	160

In the first two editions of *La Crusca*, the pattern is really marginal: there are only two bases (*batti-* 'beat', *guarda-* 'watch') which exhibit more than one formation; besides, they cannot really qualify for core formations (e.g., *batticuore* 'palpitations'); moreover, some VN compounds are even not given a separate lemma being used only inside of the definition (e.g., *parasole* turns up only as a synonym for the lemma *solecchio* 'sunshade').

In the 3rd and 4th editions, the newly entered compounds are mainly those with *porta-* 'bring' and *guarda-* 'watch' (*portamantello* 'clothes rack', *guardadonna* 'midwife'). It is only in the major 19th century dictionary *il Tommaseo* that a significant number of lemmas can be found; nevertheless, out of 160 compounds, 85 are covered by just three leading bases (28 *porta-* 'bring', 30 *guarda-* 'watch', 27 *mangia-* 'eat').

5. Corpus data

As far as the corpus data are concerned, it is important to note that they are drawn from a sample of Italian texts LIZ 4.0 (*Letteratura Italiana Zanichelli*, 2001). The selected texts, covering the time span under investigation (and divided into centuries according to the traditional periodization), represent the core of what is usually referred to as *italiano letterario.*[2]

However, the corpus data – within the subcorpora corresponding to the four centuries – are not directly comparable: the 16th and 19th century subcorpora do reveal an increasing tendency (they are roughly of the same size); the 17th and 18th century subcorpora are not sufficiently large but contain nevertheless some interesting examples to be discussed below. The overall situation is captured in Table 2.

Table 2: VN compounds attested across four subcorpora based on LIZ 4.0.

Period/subcorpus	Corpus size in tokens	Number of texts	Number of types
16th century	10 459 937	221	45
17th century	3 028 291	49	15
18th century	4 600 141	237	18
19th century	10 285 433	217	91

Qualitatively, the corpus situation is much similar to the lexicographic one. In the 16th century, the most nouns are those with *porta-* 'bring', *guarda-* 'watch' and *mangia-* 'eat' (e.g. *portanovelle* 'news-reporter', *guardadonna* 'midwife', *mangiaguadagni* 'profit-eater').

The 17th and 18th centuries (due to the reduced size of the corpus) register, on the whole, only those nouns already encountered. Still, some new formations (what is more, in the adjectival function) do turn up here (e.g. *guardacoste* 'coastguard'in the expression *vascello da guerra guardacoste* 'coastguard warship').

In the 19th century, the expansion concerns, as expected, mainly the leading bases *porta-* 'bring', *guarda-* 'watch', *mangia-* 'eat' (these three covering 43 formations out of 91), but also *para-* 'block' (there are some neologisms in Leopardi's *Zibaldone* along with the author's interesting comment on the pattern).

6. Meaning distribution in diachrony and the semantics of the WFR

The diachronic data, though limited qualitatively and quantitavely, permit us to answer some of the questions already alluded to.

First, there is the question of the semantic outputs. Are all earlier formations agents (with the typical disparaging connotation)? The answer is clearly no, as there are some instrument nouns from the very beginning: beside *lavamano* 'washstand', *guardaroba* 'wardrobe' and *salvadanaio* 'moneybox', attested as *salvadenaro* even from as early as the 14th century, we find for example *parasole* 'sunshade' (16th cent.), *guardastelle* (for *telescopio* 'telescope'). There are some locations as well: *battifolle* 'belfry', *battifreddo* 'defending tower', though these are presumably not formed directly by a WFR (*battifreddo* being remodelled on French *beffroi* 'belfry'). Finally, there are also some event nouns, though they are very rare (in line with Ricca's claim 2010: 251): *batticuore* 'heartbeat', *battibecco* 'squabble' (nouns surviving

[2] The textual database LIZ 4.0 contains also texts that cannot be considered representative of the literary language (which was to become the basis of the national language after the unification after 1861). The individual subcorpora have been created on the basis of precise criteria, see Štichauer (forthc.).

well into the present-day Italian), *lavacapo* 'brain-washing' (cf. for similar conclusions on Spanish Moyna 2011: 210-211).

Second, the important question of the output category (raised recently by Ricca 2005; 2010) can be answered only to a modest extent, as the corpus data from the 18th and 19th centuries show only one sure example: "(...) e ce lo mandò a bordo il vascello da guerra guardacoste, che sta sempre ancorato a quattro miglia di distanza." ('and it was sent to us on board of a coast-guard warship which is always anchored at the distance of four miles'), (Algarotti, *Viaggi di Russia*, 1764). It is true that *il Tommaseo-Bellini* registers several formations as nouns/adjectives (e.g. *mangiacarne* 'meat-eater'), but the adjectival function is hardly found in the corpora (so it can be concluded that it is probably a recent tendency yet to be investigated thoroughly).

Third, can any more precise diacronic tendencies (within the general quantitative increase) be established? Indeed, within the class of the most frequent leading bases (*porta-*, *mangia-*), it is the instrument meaning that emerges.

Finally, the question of the semantic instruction inherent in the WFR that creates VN compounds can only be reformulated as follows. The diachronic data suggest that whatever definition of the WFR one wishes to adopt (Aronoff 1976; Corbin 1987), it should be sufficiently general and should, as Ricca (2010: 254) puts it, "(...) leave the output category unspecified and basically context-dependent."

7. Conclusions

If we leave aside the precise formulation of the WFR in question, at least two conclusions can be drawn. First, the diachronic data presented so far confirm the view according to which all semantic types have always been present (being thus, in a way or another, inherent in the WFR). Second, the fact that instruments tend to prevail over the past two centuries (a fact to be ascribed to extralinguistic reality) suggests that this semantic output exploits the WFR, increasing thus the *profitability* of the always *available* word-formation pattern.

In this sense, the increasing productivity of the VN compounding is not to be taken as a phenomenon rooted in a deep structural change in the word-formation patterns, but should be considered instead as a *fortuitous exploitation* of an already present morphological procedure.

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