FIRST PHASE SEMANTICS

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1 ABSTRACT

Everything else being equal, the procedural principles of interpretational composition should abide by the morphosyntactic structure that is provided to the conceptual intentional interface, in its totality and without exception. To equip the theory of mapping and interpretation with stipulations that would 'skip' or ignore nodes would mean ridding that theory of the principle-based power of explanation it is presumably designed to provide. It seems an undesirable consequence to me to end up with a theory in which most morphemes are void of meaning or some kind of contribution to meaning. A foundational lexical structure, *qua* First Phase, containing an acategorial root and a categorising head, has not received a principled analysis which would not pull cheap tricks and attempt to assign denotation, or at least non-void denotational properties, to the categorial (n, v) formatives and the acategorial loci of lexical meaning (roots). This paper sketches a programme for doing exactly that: semantics at Phase One of the morphosyntactic derivation.

2 INTRODUCTION

When it comes to lexical categories, semantics and syntax have been predominantly, if not entirely and exclusively, concerned with the thematic structures that those categories associate with. Strip them off of their argument structure, and nouns verbs appear to mean the same thing.

(1)   a. $\lambda x \in \mathcal{D}_e[\lambda y \in \mathcal{D}_e[\text{TRANSITIVE-VERB}(x)(y)]]$
       b. $[\text{TRANSITIVE-VERB}\qquad]$
       c. $[\qquad\text{VERB}\qquad]$

(2)   a. $\lambda x \in \mathcal{D}_e[\text{COMMON-NOUN}(x)]$
       b. $[\text{COMMON-NOUN}\qquad]$
       c. $[\qquad\text{NOUN}\qquad]$

This observation of lexical identity goes back to, at least, Dowty's (1989) who claims that nouns and verbs only differ in their argument structure properties. Consider a verb like 'give':

(3)   (Dowty, 1989, 72n2–3)

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	spatial			temporal		
	object	:	**substance**	::	**event**	:	**process**
semantics	$[+\text{ATM}]$	:	$[-\text{ATM}]$	::	$[+\text{ATM}]$	:	$[-\text{ATM}]$
categorisation	$[-\text{ATM}]$	:	$[+\text{ARB}]$	::	$[-\text{ARB}]$	:	$[+\text{ARB}]$

TABLE 1: Wellwood et al.'s (2018) title analogy between spatial and temporal distinctions using two criteria: the non/atomic ($\pm$ATM) and non/arbitrary ($\pm$ARB) dimension.

      a.   GIVE(x, y, z)

      b. $\{(predicate$ GIVE$), (agent\ x), (theme\ y), (goal\ z)\}$

As " [t]he question of the exact relationship between thematic roles and 'the rest of' lexical meaning has received little further discussion in the thematic roles literature," (Dowty, 1989, 75–76), I adopt here a less conservative and apparently a more controversial position by focussing solely on the lexical component of minimal categories, assuming that thematic roles are not inherent to the mininmal meaning of 'verb', 'noun', or 'adjective' and are determined elsewhere – a view, in fact, advocated by Dowty (1989) himself. In this regard, I am only concerned with the predicate element in (3-b) or the lexical components informally drawn out in (1-c) and (2-c).

    This chapter concerns itself with the question What, then, is the meaning of a thematically stripped lexical category?. Under the standard account (Heim & Kratzer 1998 and essentially the entire generative/formal semantic tradition, with nearly no exception that I am aware of), the meaning of a 'giraffe' is void of any explicit semantic analogue that would mirror the morphosyntactic nominality of a 'giraffe'. One might consider the fact that the restriction to $\mathcal{D}_e$ is nominal, but it is not (at least not by design). More clearly, perhaps, this can be seen with verbs: the meaning of *sleeps* is standardly the one which only treats the verb as a unary predicate, referring in its logical form to single argument position that needs saturating, and does not say anything about the 'stuff' the verb is made of. What is meant here by 'stuff' are some extensional/intensional elements which, once syntactically realised as a full well-behaved verb with inflectional appendages, designate its temporal or event-denoting atoms (proto-acts or temporalless atoms, as I will suggest).

    Such questions have pre-theoretical, or differently theoretically inclined, precursors in work by Bach (1986) and Wellwood et al. (2018), for instance. I reproduce in Tab. 1 Wellwood et al.'s (2018) title analogy between spatial and temporal distinctions using two criteria: non/atomic ($\pm$ATM) and non/arbitrary ($\pm$ARB) Table 1 seems to report a metaphysical or an ontological system, which Bach (1986, 15) cautions against since "[i]t is not part of linguistics to decide whether all matter is atomic or all happenings are reducible to little granules of process", questions that he calls, in any case, "basically incoherent", which Wellwood et al. (2018) also acknowledge. This analogy may

rather be reflective of "an artifact of our language or conceptualizations of the world". For questions that deal with such philosophically laden topics, Bach warns that linguists should stay well away from pursuing 'the cognitive construal' (Wellwood et al., 2018, 186, fn. 1) as "probably here too our strictly semantic theories should remain silent." (Bach, 1986, 15) This paper does not aim to break this silence, but rather explore the theoretically desirable consequences of, or conditions on, the one aspect of analogy reported by these previous authors but, critically, in terms that may shed light on the derivational precursors of notions of 'objects' and 'events', which are not themselves atomic in terms of modern morphosyntax, but may instead be decomposed into more primitive components. The aim of this chapter is to meditate on the meaning of those components and remain appropriately silent on other matters that fall outside the scope of formal linguistics proper. For readers that may be disinclined to this endeavour, this chapter may also be read as a non-trivial exercise on how our increased knowledge on the matter (combining modern theoretical insight from Distributed Morphology, for instance) might give clues as to how we might approach the problem of core lexical meaning in a productive way.

Type-theoretic reasoning can be seen as the most systematic treatment of formal-semantic compositional objects that are input by the narrow syntactic module of grammar. And while we know much about First-Phase syntax (Ramchand, 2008), it still remains unclear, and this is probably due to the fact that Formal Semantics has not caught up with Distributed Morphology, or vice versa, is the set of formal semantic primitives that are at play at the point of merger of a lexical category (assuming there is something semantic to be said about that), *qua* composition, of a phasal categoriser, i.e. either n or v, with a root (which I label $\sqrt{x}$ or $\sqrt{\text{RT}}$).

With the advent of decompositional schools of morphology, such as Distributed Morphology (Halle & Marantz, 1994; Embick & Noyer, 1999, 2001; Embick, 2010), the demarcation of syntax and morphology, and the very notion of word and word boundary got blunted, and nearly eliminated. Formal semantics, however, has lagged behind such advances although it too necessarily relies on a precise morpho-syntactic structures it takes as its own compositional objects of enquiry. Szabolcsi (2010, 189n1) was among the first to state that "compositional analysis cannot stop at the word level". (I return to this in §2.2; see also Mitrović 2021 for background and discussion pertaining to the functional vocabulary and cross-linguistic semantics.)

I start with the assumption that the world level minimally and necessarily corresponds to the First Phase, in the sense developed and adopted by Roberts (2010) and those he cite. Given below is a list of technical and conceptual assumptions I make and follow, all of which should be non-controversial within the Distributed Morphology framework of research specifically, and generative morpho-syntax more generally.

(4)   Morpho-syntactic assumptions:

    a. A lexicon contains Roots and features.[1]

    b. At least one subset of features of categorial kind and is a doubleton set of features $[n]$ and $[v]$ forming nouns and verbs, resp., out of roots.

    c. Roots are the locus of lexical meaning (without denoting directly), categorial features are not.

    d. Roots do not take complements. They do not have formal features and, therefore, do not project. (qua *The naked roots view*, in terms of Ramchand 2008, 11)

    e. Roots are morphosyntactically invisible insofar as their categorial status goes. Visibility is provided by the notion of Label that not only enables the derivational procedure but ensures interface legibility Chomsky (2013).

    f. Categorisers 'make' roots visible by virtue of categorising.[2]

We embed these questions under a wider, and more controversial, meditation concerned with the homeomorphism between category-theoretic and type-theoretic functions.

What follows from (4-e) is that an unlabelled object is semantically illegible. If categorial features are the locus of labellability procedures, then categorial labels should be semantic in part, insofar as legibility is concerned.

(5)   categorial labels : syntax :: type : semantics

    a. Therefore, if Roots are morphosyntactically invisible, then they are semantically illegible.

    b. If (in)visibility is predicated on categorial feature labelling procedures, and Roots are void of categorial features, then Roots are void of (visible/legible) type.

The formal context and notion in which (5) is intended to be understood is that of isomorphism, which I adopt from Partee et al. (1990):

(6)   **Isomoprhism**.   (Partee et al., 1990, 204, Def. 8.9)

An *isomoprhism* between two such systems is in a one-to-one correspondence between their elements and a one-to-one correspondence between their operations and relations which satisfies the following conditions:

    a. If a relation R' holds between two elements of A, the corresponding relation R' holds between the corresponding elements of B; if R does not hold between two elements of A, R' does not hold between the corresponding elements of B.

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1 See Embick (2021) and those he cites for details and further discussion.

2 Ramchand (2008) talks about 'ergative roots', which conceptually contradicts th]sd e (naked roots) system I have adopted, since roots lexialisable elements, and since ergativity is not a lexical feature, ergative roots are as admissible in the system as 1 + 1 = 3 is admissible in arithmetic. This is not meant as a conceptual argumentation against Ramchand (2008), but rather a clarification regarding the terminological as well as conceptual notions underlying the version of the generative system I am assuming.

b. Whenever corresponding operations are performed on corresponding elements, the results are corresponding elements.

My idea, as it stands in its pre-pubescent form here, is to axiomatise type-theory morpho-syntactically as being the formative factor in the determination of categorial status. One motivation for this is the recent work by Mitrović & Sauerland (2016) suggeests that the typological facts concerning conjunction systems, for instance, may be exhaustively captured type-theoretically. On a less empirical level, the type-theoretic intuition of denotata should enable us to press forward with a categorial theory that incorporates types more explicitly – and vice versa, as I argue in this chapter.[3]

While couched in these grand ideas, we explore here the relation of category-bearing, or morpho-syntactic visibility, and type-wise denotation. The first and possibly ultimate question I pose is: What is the type of a root? Before addressing such questions, let me introduce in §2.1 Property theory and Microsemantics in §2.2 as a way to implement it.

2.1 PROPERTY THEORY

The property theory for natural language which I follow and adopt here is essentially that of Chierchia (1984); Chierchia & Turner (1988) which I now briefly summarise in terms of its conceptual structure. The technical aspects are postponed until §4.

The construction of a property theory seems to be the most central task of semantics since the operation of predication, a signature mechanical process is semantics, is essentially nothing but attribution of a property to an individual. As Chierchia (1984, 1) notes, Montogovian semantics (Montague, 1970a, b, 1973) relies on two subcomponents:

a. a possible-world analysis and
b. the theory of simple types.

According to the first, properties are functions from possible words into extensions (sets of characteristic functions of sets). The second subcomponent allows us to generalise the theory of properties in a paradox-free way (Appendix B in Russell 1903, Russell 1908). As Chierchia (1984, 21) states,

> There are a number of grammatical phenomena whereby predicative expressions of English (VPs, [Common Nouns] CNs, Adj[ective]s, etc.) are turned into noun-like items, i.e. items that purport to have singular references like proper nouns do. In a type-theoretic semantics properties have to be ranked on the basis of the 'level'

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3 Semantic-type- and syntactic-category-theory are on a par in independent empirical domains. The Rizzian views on movement to criterial positions which license labelling can, in this way, be analysed as overt means or repairing type-mismatches. Accordingly, it may seem reasonable to consider that unlabellable sets are type-incompatible, and if vice versa holds also, then the Narrow-Syntax/Logical-Module interface is more glass-like.

of their arguments (i.e. according to whether they apply to urele-
ments, properties of urelements, properties of properties of ure-
lements, etc.). So properties of basic elements and properties of
(nominalized) properties will have to be different entities. This
seems counterintuitive. Furthermore it has undesirable effects
on the overall organization of a grammar (both in the semantics
and in the syntax), which are totally unsupported from an em-
pirical point of view. We are led to conclude that type theory pro-
vided and unsatisfactory basis for a linguistically adequate no-
tion of property [...].

The aim of this paper is to adopt and adapt such a property theory in or-
der to dub the interpretationally compositional aspects of categorisation,
i.e. the first-phase, in a way that is theoretically (technically and concep-
tually) directly translatable from and to decompositional morphosyntactic
view such as Distributed Morphology.

2.2 MICROSEMANTICS

The morphosyntactic enterprise has moved toward blurring the lines that
are traditionally associated with the notion of 'word' and 'word boundaries'.
Three research programmes are relevant in this respect. The first is the en-
terprise of Distributed Morphology (DM), as galvanised by Halle & Marantz
(1993) and culminating in state-of-the art work such as Arregi & Nevins (2012)
who devote a monograph to analysing the internal structure of a couple
of auxiliary verbs in Basque and, in doing so, answer some more theoret-
ical questions about the nature of Spellout and the structure of grammar.
The second is work by Kayne (2005) who has been independently postulat-
ing silent elements in syntax for decades, with great success. The third is
the decompositional programme of Nanosyntax (Starke, 2009) which treats
syntactic terminals as corresponding to submorphemic elements. For our
purposes, all latter approaches may be considered methodologically and con-
ceptually on a par and, in tandem, constitute a body of strong motivations,
both theoretical and empirical in nature, against the atomicity of 'word-
hood' in general.

In this programmatic respect, this paper is aligned with the methodolog-
ical promise of such decompositional analyses, as independently motivated
and developed in Mitrović (2021) (not for the lexical domain of content words,
but rather for the functional domain of logical words). As an example of this,
take Kayne (2005, Chap. 4) who considers the seemingly locative *there* in En-
glish to not in fact be intrinsically locative. Rather, the locative flavour of
there is acquired in structural presence of an unpronounced nominal head
PLACE, itself the locus of locativity. Such (sub-) morphemic dissection into
conspicuous and soundless constituents of a seemingly simplex word is far
more than fanciful generative gymnastics. Firstly, this not only assimilates

the cases of locative and non-locative incarnations of *there*, but also natu-
ralises the very diachronic relationship between the contemporarily locative
and archaically non-locative semantics of *there*. By allowing for the preposi-
tion to be unpronounced in such cases, we can bring directly into the fold
the evidently non-locative uses in French and Italian of the apparently and
seemingly locative clitics *y* and *ci*.

So what are the ramifications for semantics? Mitrović (2021) states a Mi-
crosemantic Principle, based on Szabolcsi (2010, 189) which describes the
microsemantic programme.

(7)   **The Microsemantic Principle**
       Compositional analysis cannot stop at the word level. (Since there is
       no word-level boundary.)

Everything else being equal, interpretational composition should abide
by the morphosyntactic structure that is provided to the conceptual inten-
tional interface. To equip our theory with stipulations that would 'skip'
nodes or ignore nodes would mean ridding that theory of the principle-based
power of explanation it is designed to provide. Naturally, one can pull a
cheap trick to salvage this and adopt a view according to which most nodes
in a complex structure are vacuous. It seems an undesirable consequence to
me to end up with a theory in which most morphemes are void of meaning
or some kind of contribution to meaning.

Thus far, formal semantic theory has not taken into consideration the re-
sults from decompositional morphosyntax, such as DM. Let me, then, now
turn to sketching how this may or could be done, turning to the question
whether morphosyntactic should be read off in its totality by the conceptual-
intentional interface.

2.2.1 ON THE PARTIALITY/TOTALITY OF STRUCTURE READING

While seemingly trivial, the amount of structure being read off at the in-
terpretational component of the grammar is a matter of debate. Either we
assume that not all elements within a syntactic structure are necessary, rel-
evant, or even visible for the interpretation of that structure (8-a), or we con-
sider it necessarily true that all objects in a syntactic structure (S) receive an
interpretation S', as per (8-b).

(8)   a. $S \rightarrow S'$
       b. $S \rightarrow S'$

The first approach to this question (8-a) can be dubbed the partiality the-
ory, and the second (8-b) the totality theory of mapping. This section argues
against the partiality and in favour of a totality view of the architecture. I
believe here, at least on philosophical grounds, that the seemingly univer-
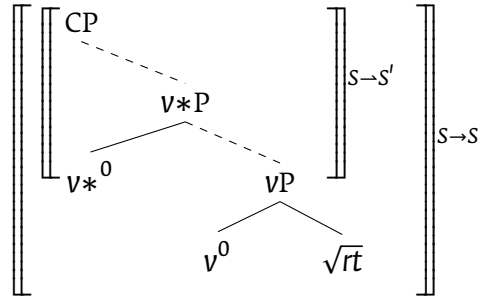sal desideratum of a theory of the syntax-to-semantics mapping is a total

FIGURE 1: The scope of definedness of $[\![\,\cdot\,]\!]$ under a total $(S \to S')$ and a partial $(S \to S')$ view of syntax-semantics mapping.

function (in category-theoretic terms, syntax and semantic are inverse categories under this view).

Let me start by laying out, what seem to me completely reasonable and logically tractable, conditions on an (explanatorily) adequate properties of the model of syntax-semantics mapping. A theoretical analysis must meet (9) in order to be adequate at a level we are pursuing:

(9)   Conditions on Explanatory Adequacy of the Syntax-Semantics Mapping:

   a.   A model of mapping is adequately explanatory if the map is total
   b.   A map is total if for every terminal syntactic object x there exists a corresponding interpretation x

Non-totality is possible in at least two ways: it may be achieved by assuming that not all terminal objects x receive an interpretation; or by positing that the interpretation function is undefined for some class of terminal objects y, for which there is no interpreted logical form y. I will consider both such views to amount to the same thing. It appears to me equivalent to compare the amount of structure being read to the partiality/totality of the reading function defined for that structure, hence the derivational onset, *qua* type-encoding and interpreting the lexical layer at the first phase, is point contention, as per Fig. 1. It is, however, undesirable to operate on such assumptions, at least in absence of any empirical motivation.

The default constellation of the syntax-semantics mapping theory obligates all elements in a syntactic structure to bear a lexical entry which enters into compositional meaning computation. An alternative, a very recently explicated theory, supposes a partial mapping between the built and the interpreted structure. This school of thought is generally embodied by the recent unpublished work by Omer Preminger, which I summarise only briefly and do not contest in any greater detail due to its unpublished status. My arguments here are centred predominantly around the conceptual nature of such an approach. As just implied, the goal of this section to fortify the view that the said mapping is total and not arbitrarily partial, so that we may, conceptually adequately, pursue a version of compositional semantics

(8-b), or at least the principles and properties of one, that pertain to the level of the first-merge, or first-phase.

The partial mapping theory supposes that the interpretational function is not defined for all elements in a syntactic structure. The idea that the syntactic structures S are partially interpreted as S' has recently been advocated by Preminger (2021). While unpublished, his idea has been circulated at various prominent venues, hence it should be noted here and explicated in some cursory form.[4] In short, Preminger (2021) argues that the interpretation function does not apply to all terminals in the syntactic structure. The question, "What does the word/morpheme w mean?" is not a coherent question, strictly speaking, for Preminger (2021). My primary argument against such a view is a logical one: a theory that supposes arbitrary limitations on a function is logically and conceptually weaker than a theory that is void of such an assumption. Algebraically, a non-restricted function is stronger, therefore, than one whose domain is restricted (in this case, the restriction is the relevant syntactic/interpretational structural size). What is more, even if technical solutions, such as identity-functional denotation, are adopted, such technicalia cannot salvage the first-merge/first-phase composition in which no element of an otherwise contentful composite is able to inherit any structurally provided denotata.

The last (kind of) argument I involve against the partiality approach and in favour of the totaltiy approach is empirical: this paper ultimately aims to demonstrate how the bicategorial nature and the presumably core categorial signature of adjectives may be derived interpretationally. This argument, and the overall theory thus, is parasitic on a non-void semantic contribution of the categorial head, supposing a non-ontological and purely linguistic notion of categorial interpretation.

In laying out such a program for an inherently interpretable (in the semantic, not just minimalist-syntactic sense) category-forming and -defining head, I will proceed to distilling a theory of category-interpretation in three, or two and a half, steps. Firstly, I will adopt and not too drastically adapt the sort-theoretic approach of Chierchia & Turner (1988) — ver. 1. Secondly, I adapt the view by positing a 'default' setting or filer, which will detect and allow elements of type e to be of sufficient 'granularity' to act as extensional denotata for nominal meanings, supposing that the 'elsewhere' condition which bans other e-element of 'insufficient granularity' is what forms the denotation set of the 'stuff' of which verbs are made — ver. 2. With our (empirically) primary goal in mind, namely to derive the categorial meaning of adjectives (things denoting both sorts/nominal things and scales/degrees, to put bluntly), such notion of filtering and defaulting leads me to entertain a possibly more appropriate sorting mechanism relying on a modification view, which allows e-elements in $\mathcal{D}_e$ to be modified twice. Hence a

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4   The only available format of Preminger (2021) is in slides, I hence extrapolate the core ideas and the conceptual backbone of the arguments, without delving into the criticism of their details.

proto-*e*-element is directly modified as nominal and verbal, as suggested by the narrow syntax analysis (Mitrović & Panagiotidis, 2020), thus, arriving at desirable analysis which mimics and reflects the independently motivated, yet inherently meaningless, structure of adjectives.

Note, however, at the outset, that the difference between versions One and Two is not a superficial one. While One takes there to exist various kinds of *e*-type elements which are mapped onto *e*-subsets to form denotata (spaces) from which the eventual and minimal nominal/verbal expression takes its meaning from, version Two does locate, rather directly, the difference of and between minimal categorial denotata in the ontology. The notion of granularity precludes/includes certain proto-elements in this sort-theoretic view to be ontologically excluded from taking meaningful categorial shape, i.e. to incarnate as minimal nouns/verbs.

What about adjectives? I believe an answer to this question can adjudicate on the question of where the variation is to be found: whether its distribution is linguistic or ontological.[5]

The stuff that makes up the underlying common concept is common to all three categorial incarnations, presumably (directly) by virtue of the uniform sort-theoretic view on the extension of everything being of type *e*. Under the most current proposal, whereby adjectival first-phase syntactic derivation includes both *v* and *n* categorial formatives.

In this regard, Chierchia (2013, 446) notes, while motivated on empirical grounds of an independent kind, that "[w]hat is implausible is that the structure-building apparatus (merge) and the inferential one have a radically different status". The programmatic idea advocated in this chapter aims to demonstrate how morphosyntax and semantics actually have radically similar status.

3 THESIS

We work with a root ingredient $\sqrt{\text{DG}}$, ultimately yielding 'dog'[6], for deriving a common noun via merger with *n*. Bare-phrase structurally:

(10) $n \Leftrightarrow \{\text{dog}\}$

$n \quad \sqrt{\text{DG}}$

We take Common Nouns, corresponding to the structural entirety above, $\langle e, t \rangle$, with *e* as the ontological type-signature of *n*, while Verbs are of *t*-conjoinable type and never *e*. Adjectives, for instance, are universally grad-

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5 An empirical parallel to this question can be found in the mass-count literature, for instance: while general approaches contend that the mass and count nouns differ with regard to how the objects in questions are differentiated by linguistic structure, as argued for by Borer (2013), Link (1983) considered mass and count nouns to have different ontological statuses altogether. But also see Bach (1986) and citations there for a related discussion.

6 Roots are given in "Semitic" notation format, but no theoretical significance is attached to this. Vocabulary Items, morphological spell-outs, are within curly brackets.

able and we take that to mean their type 'grid' is $\langle\langle\sigma,(t)\rangle,d\rangle$ generally (for some type σ).

Crucially, I take roots to be semantically invisible ('untypeable') in the the way the standard type-driven composition after the first phase should proceed, relying on the idea that a function of narrow syntax is ensuring not only categorial but also type-wise visibility (cf. Embick & Marantz 2008, 8, Panagiotidis 2011).

One motivation for the treating roots in a system other than standard type theory is the conceptual connection this affords with syntactic invisibility. An alternative view would be to treat roots as abstract properties with the same meaning, and type, as mass nouns, à la Link (1983). This would mean the role of the categoriser is type-theoretically lame, so to speak, as it would simply pass on the type from the root to the nominal phase. This gets us away from the conceptual romanticism of bringing syntactic category theory closer to semantic type theory by recognising categorisation, or the first phase, as a means of modulating properties (as I develop below).

How can roots bear lexical meaning without type-readability? Roots do not bear lexical meaning which obtains only after categorisation takes place. Nonetheless, similar to or just like, say, nouns, roots denote properties. Lexical meaning obtains *at* first-phase, i.e. at the point of merger of the categoriser and the root. To demonstrate the conceptual lack of the state of the art, consider the accidental and conceptually ungrounded manner in which roots are treated semantically.

Koontz-Garboden & Beavers (2017), without theoretical motivation, assume that roots (that are categorial complements) have a heavy logical form of seemingly arbitrary type:

(11) $[\![\sqrt{\textsc{crack}}]\!] = \lambda x \lambda s [\textsc{has.fissure}(x,s) \wedge \exists e'[\textsc{become}(e',s)]]$

Given the ideas we started out with, encoding of events and situations is not what roots are designed to do. They associate with structural components that provide the weight. An approach, such as the one reported in (11), is couched in a conceptually untenable ad hoc stipulation and demonstrates just how desperately needed a first-phase semantics really is. A generative linguistic theory, after all, not only seeks to formalise specific linguistic levels, such as morphology, syntax, or semantics, but to understand in equal and principled terms the nature of cross-modular (i.e., interface) mechanics. An important, if not fundamental, aspect of cross-modular compatibility between the structure-building and the structure-interpreting components of grammar is the way logical type- and morphosyntactic category-theory are taken in concert. Even if the reported analysis oh how they are taken to live parallel yer compatible lives, I hope the explicit desire for a requirement that there exist a compatibility is convincing.

One desideratum we are pursuing is the non-arbitrariness of type-weight of roots. In fact, we want to maintain that they are, in the sense to be devel-

oped, 'un-typable' and that the logical weight is contributed by, and only by, the categorial formative elements in the first-phase structure.

The limit notation provides intuitive formal means of capturing this desideratum of mine.

(12) $$\lim_{\sqrt{\mathrm{DG}}\to n} [\![\sqrt{\mathrm{DG}}]\!] = \lambda x[\mathrm{DOG}(x)]$$

Let me now turn to the crux of the proposal and sketch a treatment of first-phase lexicalisation in formal semantic terms.

4 IMPLEMENTATION: ROOTS AS PROPERTIES, CATEGORIES AS KINDS

The present theory will, as a desideratum, deliver the type of the denotation of an nP as $\langle e, t \rangle$, leaving the traditional type-theoretical treatment intact. I propose to treat roots as denoting properties, in the property-theoretic sense, and categorised roots as kinds thereof.

To sketch informally or intuitionistically, using two of Carnap's examples, consider the main conceptual impetus for Chierchia's (1984) and, ultimately, Chierchia & Turner's (1988) development of property theory: to capture self-reference.

(13)   (Carnap [1931, 230n2] 1959, 70n2)

     a. [Der Regen regnet.] The rain rains.

   b. [Das Nichts nichtet.] The nothing nothings.

(14)   (Being) fun is fun.   (Chierchia & Turner, 1988, 293n10c)

Just as 'fun' refers itself to a propositionally asserted a property of itself as true, so (13-a) expresses a proposition in which both the verbal predicate and the nominal argument are true of the same property. Grammatically crucially, however, never at the level of the same phase: the subject 'fun' is a deadjectival nominal (involving recategorisation) true of the adjectival predicate (involving a single phase). Ditto for Carnap's rain: 'to rain' is denominal and therefore not a purely first-phase construct in the sense that I am interested in in this chapter.

In this regard, I adopt the type-theory for properties of Chierchia & Turner (1988) with the e-type as universal. This will, prima facie, seem incompatible with the promissory note on leaving standard type-theoretic treatments of CNs intact. However, given that type-theory can be recast as a first-order multi-sorted theory, there is no formal objection to the eclectic approach to the domain of individuals advocated here. As Chierchia & Turner (1988, 279) themselves remark, "the approach [they] adopt casts some of the relevant distinctions as 'horizontal' subdivisions internal to the domain of individuals while others are characterised in a 'vertical' manner by building function spaces externally to [their] property theoretical domain." Note that this is

derivable also from Cocchiarella's *homogeneous stratification* (see Chierchia 1984 for details).

The proposal here, then, is that the sub-categorial meanings are composed property-theoretically (or 'horizontally', $\mathcal{D}_e^{\leftrightarrow}$), while the supra-categorial meanings are derived type-theoretically (or, 'vertically', $\mathcal{D}_e^{\updownarrow}$). The first-phase (*qua* lexical categorisation) is the line of division. To sketch:

(15)
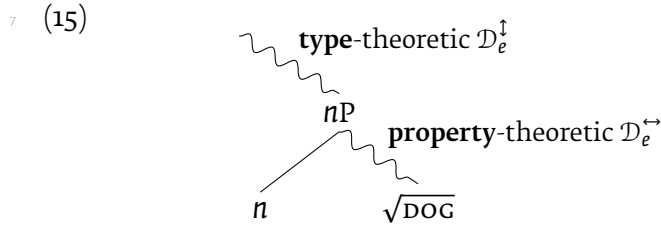
Where the two types of type-mechanical worlds meet, I will resort to a process of *modulation*, which translates one into the other; this minimal function allows for parsing and conversion of property-theoretic objects into standard type-theoretical objects (I will require only one such function). Recall my initial thesis, transplanted and adapted from Carlson (1989), that categorisers individuate the properties (themselves denotations of roots) and this individuation is on a par with a kind. As Chierchia (1989, 12) notes, "a long standing semantic tradition analyses common nouns like cat as properties (or propositional functions). Carlson's point is that each such property (including complex ones like those corresponding to 'blue striped suits') has a special sort of individual correlate, namely a kind." I propose that the correlation between properties and kinds is syntactically structural: the categorisation is kind-denoting in this sense. According to Carlson, the kind (k) and the property (P) related to it are universally connected, as given in (16), where I submit that one clause of the biconditional is a property-theoretic description of the first-phase-internal meaning composition, while the other clause describes a vanilla type-compliant property in predicate form. The biconditional has the logical profile of my modulation conjecture.

(16) $$\forall P\Big[\forall x[\; \Box\; [\; \underbrace{\overbrace{R(k(P),x)}^{\text{first-phase-\textbf{internal} LF}}}_{\textit{property-theoretic}} \Longleftrightarrow \underbrace{\overbrace{P(x)}^{\text{first-phase-\textbf{external} LF}}}_{\textit{type-theoretic}}]]\Big]$$

(Chierchia 1989, 12n1 summarising Carlson 1989)

I take (16) to essentially be the profile of the proposed modulation function which equates property- and type-theoretic profiles of the three lexical categories (to which I turn in §6 and §7).

---

6   It seems to be reasonable to motivate a conjecture which extends the application and operation of modulation as a epiphenomenally phasal:

(i)   Every phase head triggers modulation at the conceptual-intentional interface.

While the application is less obvious, technically, in the $v*$-domain, the CP-domain introduces the p variable, which is presumably absent from TP/CP-internal composition.

The property theory (PT$_1$) adopted from Chierchia & Turner (1988) is the following. PT$_1$ is a multi-sorted first-order language with four basic sorts: u, nf, i, e. The sort u represents 'urelements', nf is the sort of nominalised functions, i the sort of information units, and e the sort of individuals, whereby $i \subset u \subset nf \subset e$. For Chierchia & Turner (1988), properties in the predicative position are identified with functions on E to E (for any $e \in E$) and the nominalisations with elements of E (but see also Feferman (2015) for clarification and discussion). This, combined with some of the mappings, are provided in Fig. 3.

FIGURE 2: Chierchia & Turner's (1988) PT$_1$.

Since PT has only one type, the only complex sort is $\langle e, e \rangle$. There is also a standard λ-operator, a nominalisation operator '$\cap$' that turns functions into individuals, and a predication operator '$\cup$' that does the inverse. For any sort α, ME$_\alpha$ is the following set of meanings expressions of sort α, where α is any sort, $\{i, u, n, e\}$, VAR$_\alpha$ is a denumerable set of variables of α-sort, and CONS$_\alpha$ a set of α-sort constants (there are no variables of sort $\langle e, e \rangle$) (Chierchia & Turner, 1988, 266)

(17) a. VAR$_\alpha$, CONS$_\alpha$ $\subseteq$ ME$_\alpha$.
      b. If $t \in$ ME$_e$ and $x \in$ VAR$_e$, then $\lambda x[t] \in$ ME$_{\langle e,e \rangle}$.
      c. If $t \in$ ME$_{nf}$, then $^\cup t \in$ ME$_{\langle e,e \rangle}$.
      d. If $f \in$ ME$_{\langle e,e \rangle}$, then $^\cap f \in$ ME$_{nf}$.
      e. If $f \in$ ME$_{\langle e,e \rangle}$ and $t \in$ ME$_e$, then $f(t) \in$ ME$_e$.
      f. ME$_i$ $\subseteq$ ME$_u$; ME$_u$, ME$_{nf}$ $\subseteq$ ME$_e$.
      g. If $t \in$ ME$_e$, then $^+t \in$ ME$_i$
      h. If $\psi, \phi \in$ ME$_i$, $t, t' \in$ ME$_e$, and $x \in$ VAR$_\alpha$, for any basic sort α, then $(t \equiv t'), \neg\psi, (\psi \lor \phi), (\psi \land \phi), \exists x(\psi), \forall x(\psi), (\psi \to \phi), (\psi \leftrightarrow \phi)$ are all in ME$_i$.

The u sort has is not utilised in this fragment of PT$_1$ and plays a role in Chierchia & Turner's (1988) development of PT$_2$ which includes the sort of

possible worlds and generalised quantifiers, which Chierchia & Turner (1988) require for sentential composition. However, for the purposes of First Phase, the logic of PT_1 is sufficient.

The purpose of this section was to motivate the following thesis:

(18) **Thesis** (non-final)

    a. Roots denote properties.

    b. Categorised roots denote information states of properties.

5 A BIVERSAL SORT-THEORETIC PROPERTY THEORY FOR ROOT CATEGORISATION

This section motivates progressively a semantics for the first-phase. In order to get a working programme for a semantics of the first-phase, I first start by transplanting Chierchia & Turner's (1988) Property Theory, which I subsequently refine and minimally adapt.

5.1 $BPT_{1.0}$

Let me first introduce Chierchia & Turner's (1988) Property Theory which I use as background against which I sketch a working Biversal Property Theory ($BPT_{1.0}$). As per our preliminary assumption, we take there to exist a categorial biverse, and not a tri- or multi-verse, i.e. only two lexical categories exist: n and v. $BPT_{1.0}$ seeks to derive PT_1 exact meaning associated with the nominal and verbal categories.

The semantics of the nominal and verbal meanings is not an explored topic. Baker (2003), for instance, pivots his account on assuming and asserting that what makes nouns nouns is their inherent referentiality, and, obversely, what makes verbs verbs is their inherent anti-referentiality. Semantically, this is controversial, at most, since (common) nouns, by themselves, do not refer, at least not necessarily more than verbs refer.

Panagiotidis (2015, 81, ex. 7), on the other hand, makes the following (verbatim) semantic distinction between nouns and verbs (emphasis mine):

(19) LF-interpretation of categorial features

    a. An [N] feature imposes a **sortal perspective** on the categorizer's complement at LF.

    b. A [V] feature imposes an **extending-into-time perspective** on the categorizer's complement at LF.

Since minimal verbs alone do not make reference to time intervals, or even events, I propose that both n and v, which carry the inherent categorial [N/V] features, each impose kind-level meanings which correspond to the proto-forms of sortal individuals (for nouns) and inherently scalar events (for verbs), or what can be dubbed 'perspective'. This finds its obverse in PT_1

since everything derives from the *e*-type, which allegorically or actually derives from the fact that

(20)   Everything is a thing.

One way to seek the sortal subdivisions that would yield nominal versus verbal perspectives, is the *scalar* (σ) versus *non-scalar* (δ) dimension of individuals, where individuals are not just individuals but things in the sense of (20).[7] The δ individuals are the standard individuals (unicorns, Marys, Johns, etc.); the scalar entities are those that form some discrete scale with partial ordering and consequent entailment – I call them by the name Chierchia (1984) came up with: *durationless temporal atoms* (i.e., elements that have the relevant properties that, in the course of derivation beyond first phase, can be mapped onto events, times, intervals, etc. – I return to this). These atoms are of the kind that lexical verbs denote.

The $BPT_{1.0}$ thus (still, like PT_1) has a single type e and altogether found sorts: e, δ, σ, i. Both δ and σ are sub-sorts of *nf* and *i* is the sort of information units, as per PT_1.
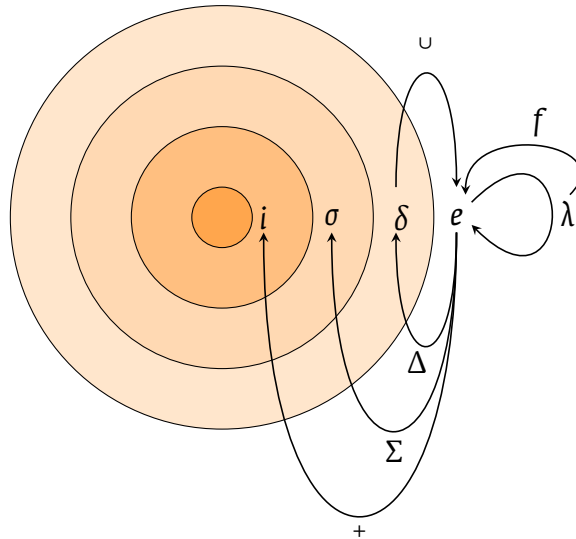
FIGURE 3: A working $BPT_{1.0}$, based on PT_1.

The working thesis in (18) can be stated in more detail in (21):

(21)   **Thesis** (non-final)
    a.   Roots denote properties.
    b.   Categorised roots denote information states of properties.
        (i)   Nouns denote non-scalar information states of properties.
        (ii)   Verbs denote scalar information states of properties.

---

7   Cf. Chierchia (2013) from where I draw my ontological labels, first used in Mitrović (2021), δ and σ. I return in the conclusion to a conjecture on how this connection beyond labels may be viably conceived.

The dual logical operations of 'non/scalarisation' and $^+$ (formation of information states) can be accounted for independently: n and v are categorisers and phasers. Categorisation may be seen as imposing non/scalar perspective on the property (root), while the formation of information state can be relegated to the phasal nature of categorisation. This is also makes further, and independent, prediction about all phases being information states (I return to this in my discussion of 'modulation' later on).

5.2 BPT$_{2.0}$

The BPT$_{1.0}$ suffers from supposing that non-scalar elements are derived from scalar kinds, which I now turn to revoking and rectifying by assuming that the sub-sorts of e (in the proto-property-theoretic sense) are disjoint. Graphically, this can be schematised in a way that Fig. 4 suggests. Additionally, fewer $\langle e, e \rangle$ functions are defined; essentially only three kinds of such functions are assumed to exist, defined semi-trivially according to their range: Δ-functions being those that return δ-sorts, Σ those that return σ-sorts, and $^+$-functions as those that return information units of sort i. Note that I am assuming that $^+(x_e)$ is undefined for natural language since there are no categorial meanings that are neither nominal, verbal, or both/adjectival.
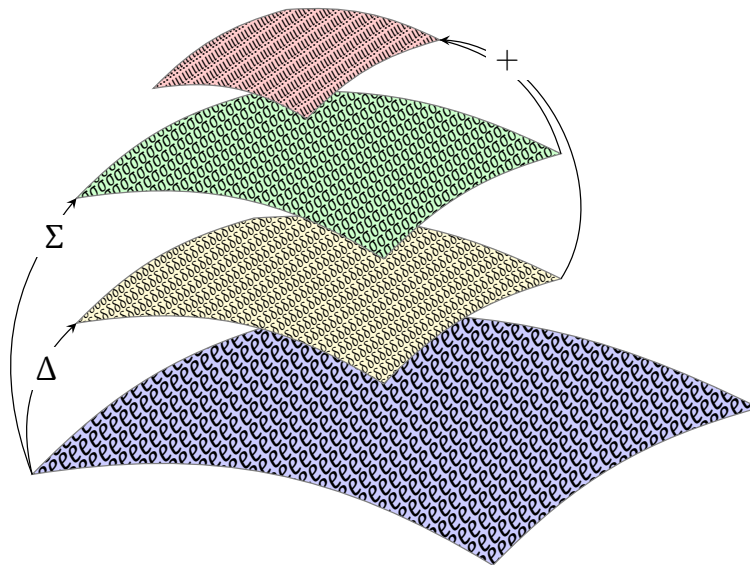
FIGURE 4: An upgraded BPT$_{2.0}$, based on BPT$_{1.0}$ that abolishes the scalar-non-scalar dependence, with a subset of functions given.

With he disjoint model of property-theoretic space of e, one could assume that nominal Δ-kind meaning is the marked one with the verbal Σ-kind meaning instantiating an 'elsewhere' case. (Uli Sauerland, pers. comm.) Verbs could symbolically be charactersed as denoting all those things whose granularity does not meet the categorial-semantic conditions imposed by n. While attractively parsimonious, and ontologically analogous to Baker's (2003) system in which referentiality is the relevant nominal feature against

which verbs are defined as lacking, being non-referential, this approach suffers conceptual drawbacks once adjectives as categorial composites are considered. Even though this in itself does not bury such an approach, I will advocate for another one, which can be characterised as a modificational: the meaning of a root is *definitivised*[8] by virtue of the categorial meanings that attach onto it.

6 DERIVING NOUNS AND VERBS

In this section, I demonstrate how the first-phase semantics of verbs and nouns proceeds, each characterised as an information-state. I do not devote much, or perhaps even deserving, attention to nouns and verbs in this paper, but I do so for a simple reason. It is logically sufficient to demonstrate the homeomorphy of a type-theoretical and a sort-theoretrical denotation, the latter being more precise versions of the former, in order to show, at least cursively, how the sort- and type-wise composition proceeds.

6.1 NOUNS

In standard type-theoretic terms, a common noun NP, such as 'dog', denotes a set of type $\langle e, t \rangle$. Therefore, our first desideratum is to have a compositional analysis that reflects the non-atomicity of an NP, containing a nominalisation head n and a root $\sqrt{\text{DG}}$, while still returning as compositional output the set-denoting meaning of type $\langle e, t \rangle$.

The sort-theoretic approach I advocate here can capture the compositional non-atomicity while composing a type-compliant standard denotation, as shown below.

(22)   Composing/interpreting the nominal first-phase:
$$[\![\, [_{n\text{P}} \, n \, \sqrt{\text{GRFF}} \,] \,]\!] =^+ [\Delta[\![\, \sqrt{\text{GRFF}} \,]\!]]]$$
$$=^+ [\exists P \in \mathcal{D}_\delta [P = \Delta(\text{GIRAFFE})]]$$
$$= \exists x \in \mathcal{D}_i [\exists P \in \mathcal{D}_\delta [P = \Delta(\text{GIRAFFE}) \wedge P(x)]]$$
$$\textit{(by modulation)} \mapsto \lambda x \in \mathcal{D}_e^{\updownarrow} [\text{GIRAFFE}(x)]$$

The composition relies on my divorcing the nominal and the categorial, or phasal, features on the *n* head. Each of the two is given a separate meaning: while one extracts or definitivises (makes more precise sortally) the property that the root carries and expresses, the other forms an information state out of that result.

---

(23)   A categorial interpretation of minimal nouns:

$$
\left[\!\!\left[
\begin{array}{c}
n\text{P} \\
\diagup\diagdown \\
[\pi_k]n\text{P} \\
\diagup\diagdown \\
n_k^0\sqrt{\text{GRFF}}
\end{array}
\right]\!\!\right]
=
$$

$$\overset{\{\text{giraffe}\}}{}$$

$$
\lambda x \in \mathcal{D}_e^{\updownarrow} \\
[\text{GIRAFFE}(x)]
$$

$$\big\} \textit{modulation}$$

$$
\exists P \in \mathcal{D}_\delta \\
\left[\begin{array}{c}\exists x \in \mathcal{D}_i \\ [P = \Delta(\text{GIRAFFE}) \wedge P(x)]\end{array}\right]
$$

$$
\lambda P \left[\begin{array}{c}\exists x \in \mathcal{D}_i \\ [P(x)]\end{array}\right]
\qquad
\begin{array}{c}\exists P \in \mathcal{D}_\delta \\ [P = \Delta(\text{GIRAFFE})]\end{array}
$$

$$
\lambda R \in \mathcal{D}_e^{\leftrightarrow} \\
\left[\begin{array}{c}\exists P \in \mathcal{D}_\delta \\ [P = \Delta(R)]\end{array}\right]
\qquad R
$$
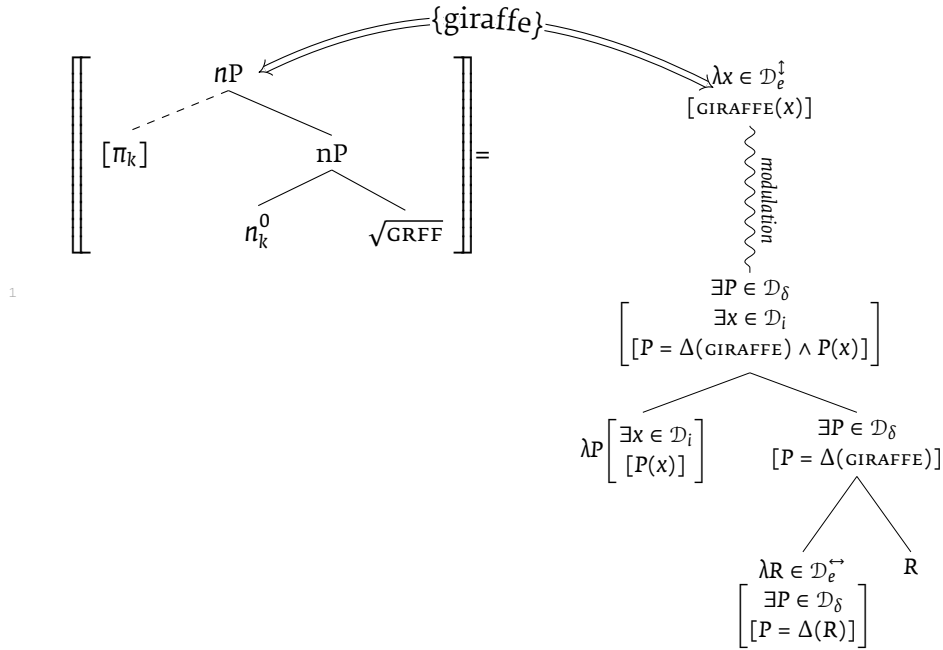
What, then, is the *stuff* of nouns? The categorial meaning of nominality appears easier to pin down, at least in the intuitionistic sense: nouns, whatever they are, denote sortal/individuational elements. Recall the argument regarding the explanatory insufficiently of set-theoretic notion of predicativity, since the notion of predicate cannot distinguish in any 'internal' fashion between nouns, verbs, and adjectives. One desideratum is to therefore consider nouns property-theoretically in terms of a multisorted type theory (24-a) and yet ascribe a standard type- and set-theoretic correspondence to such a rule (24-b).

(24)   a.   Nouns sort-theoretically:
        $\langle \delta, i \rangle$
        b.   Nouns type-theoretically:
        $\langle e, t \rangle$
        c.   First-phase nominalisation as sort-to-type modulation:
        $\langle \langle \delta, i \rangle, \langle e, t \rangle \rangle$

6.2 VERBS

Just like nouns, a simplex intransitive verb, such as 'bark(s)', also denotes a set of type $\langle e, t \rangle$, which reflects the technical and conceptual insufficiency of standard type-theory to capture the empirical and ontological difference between nouns and verbs. Nonetheless, we wish to retain the type-theoretic $\langle e, t \rangle$ signature with the non-atomicity of the minimal verb category, comprising the *v* categoriser and a root $\sqrt{\text{BRK}}$.

The meaning composition at first-phase would proceed in the verbal domain in a similar way as I have sketched for nouns, with the exception of Σ

which would act as a sorting device, rather than Δ.

(25) Σ induces a total preordering. (Δ does not.) This total preordering can be achieved by positing $\mathcal{D}_{\langle e,e \rangle}$, where for every $x \in e$, there exists a relation R and R is a total preorder. Encyclopaedia dictates which roots are compatible (or necessarily associating) with the preorder R.

The motivation for Σ is empirical: while *walks* and *walker* ultimately denote the same set (the set of walkers), the former can be tensed (*walked*) and the latter can be pluralised (*walkers*). While nouns express properties of sorts of kinds (via Δ), verbs have the ability to extend into time and thus express, to transplant Chierchia's (1984) terms, 'durationless temporal atoms'. I associate these with the scalar nature of σ, which is totally pre/ordered by Σ and which is semantically utilised at subsequent phases (turning the proto-eventive semantics of a minimal verb into the meaning of events, intervals, etc.).

In both the verbal and the nominal domains, a compositional analogue to phasehood is, I propose, additionally present and discernible: the notion of information-state formation by virtue of the $^{+}$-operator. Conceptually this amount to my assuming that each of the two features, the categorial/phasal and the nominal/verbal. No impediment is clear to me why such an approach, equating phasal delimitation with the $^{+}$-operation, cannot be extended to the second (thematic/argument-structuring) or the third (proposition-forming) phase at $v*$P and CP levels, respectively. I do not pursue this here; instead, let me turn to the core empirical application of such a property-based first-phaase sort-theory – the compositional derivation of adjectives.

What, then, is the *stuff* of verbs? The stuff of verbs are, using Chierchia's terminology, originally not used as and intended to describe the semantics of categorisation, 'durationless temporal atoms'. In structurally more precise terms, these atomic elements can be pinned as proto-events. The conception of event semantics is introduced in the second phase, once the $v*$P is formed and which also represents the locus of verbal argument structure (citations here). How does, then, the categorising v gets its ontological flavour? One argument for this stems directly from the Shimada-inspired (Shimada, 2007) excorporation model which I have adopted and which obligates all functional material, which ends up being built on top of the lexical layer, to originate in the lexical layer and successively excorporates. It, therefore, seems reasonable for me to assume that such a pre-hardwired entry, qua verbal categoriser v, to have an ontological link by virtue of the structural locality of the two minimal categories/features: proto-eventive denotata for v and eventive denotata for $v*$.

As with nouns, we now consider and posit a sort-theoretic notion of the meaning of verbalisation at the first phase:

(26)   a.   Verbs sort-theoretically:

$\langle \sigma, i \rangle$

    b. Verbs type-theoretically:

$\langle e, t \rangle$

    c. First-phase verbalisation as sort-to-type modulation:

$\langle \langle \sigma, i \rangle, \langle e, t \rangle \rangle$
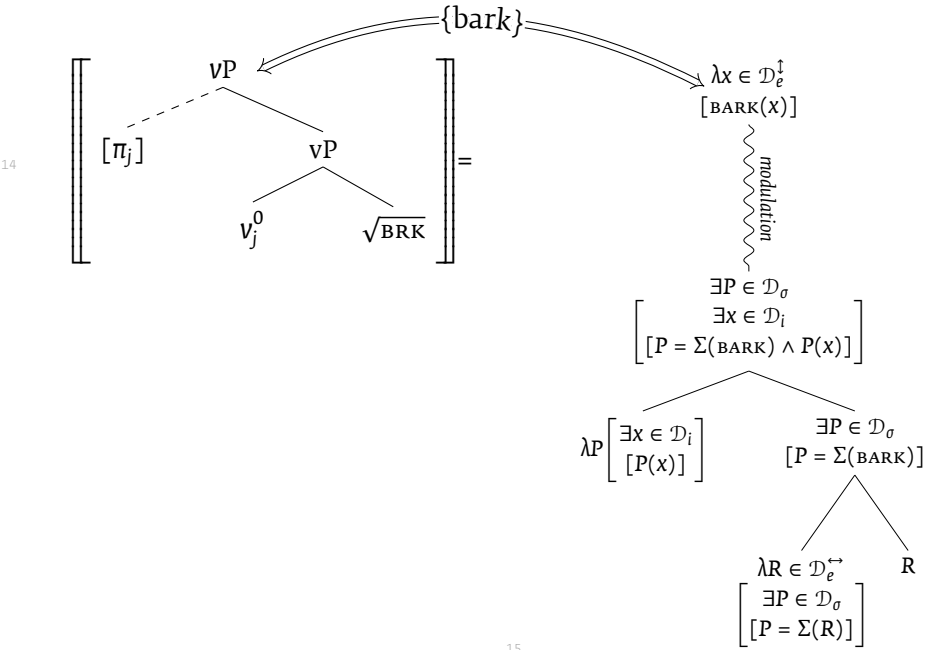
Let me briefly demonstrate what a compositional morphosemantics of a minimal verb would look like using this technology:

(27)   Composing/interpreting the verbal first-phase:

$$[\![\, [_{n\mathrm{P}} \, n \, \sqrt{\textsc{brk}} \,] \,]\!] =^+ \left[\Delta [\![\, [\![\, \sqrt{\textsc{dg}} \,]\!] \,]\!] \right]$$

$$=^+ \left[\exists P \in \mathcal{D}_\delta [P = \Delta(\textsc{bark})] \right]$$

$$= \exists x \in \mathcal{D}_i \left[\exists P \in \mathcal{D}_\delta [P = \Delta(\textsc{bark}) \wedge P(x)] \right]$$

$$\textit{(by modulation)} \mapsto \lambda x \in \mathcal{D}_e^{\updownarrow} [\textsc{bark}(x)]$$

As before, the first-phasal feature $[\pi]$ is represented as a separate formative.

(28)   A categorial interpretation of minimal verbs:

The two conjectures in (24-c) and (26-c) allow for another conjecture regarding the meaning of categorisation as a meaningful, denotational operation, namely information-state formation:

(29)   Meaning of categorisation:

    a. Information-state inducing clause

$\langle \alpha, i \rangle$

    b. Sort-modulating clause — indicator function for the modulation

of e-type:

$\langle \langle \alpha, i \rangle, \langle e, t \rangle \rangle$

This is a consequence we now demonstrate for the third and last lexical category, adjectives.

7 DERIVING ADJECTIVES

Let me now turn to demonstrating not only how but also why the proposed semantic programme for an enquiry into the meaning of morphosyntactic categorisation might be on the right track. Independently, adjectives share both verbal and nominal properties. The recent theory of deriving adjectives of Mitrović & Panagiotidis (2020) claims that the lexical status of adjectives derives from a composite noun-verb categoriser.

Mitrović & Panagiotidis (2020) depart from the general view that there are three core lexical categories, abolishing the existence of a. Instead, they assume and defend a view of the categorial "biverse", notated $\mathcal{C}_2$, i.e. a universal doubleton inventory of categorisers, containing verbalisers[9] (v) and nominalisers (n) alone. Crucially, they contend that the adjective category derives as categorial composite, as suggested in (32-b), as opposed to a triversal ($\mathcal{C}_3$) structure for a minimal adjective (32-a)

(30) Nouns:

$n_{[i\phi]}\text{P}$

$n^0_{[i\phi]}$ $\sqrt{\text{RT}}$

(31) Verbs:

$v\text{P}$

v^0 $\sqrt{\text{RT}}$

(32) a. Adjectives in $\mathcal{C}_3$

$a\text{P}$

a $\sqrt{\text{RT}}$

b. Adjectives in $\mathcal{C}_2$

$v\text{P}$

v^0_1 $n\text{P}$

$\lambda 1$ $n_{[u\phi]}\text{P}$

$n_{[u\phi]}$ $\sqrt{\text{RT}}$

$n_{[u\phi]}$ t_1
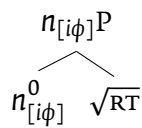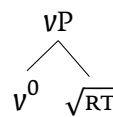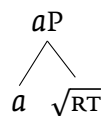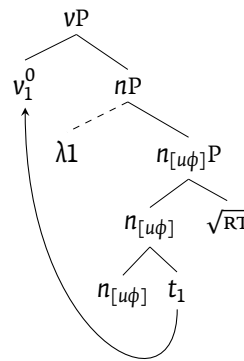
While this bicategorial treatment conceptually finds its roots in Chomsky (1970) who posited the featural specification [+V, +N] for adjectives. How-

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9 As Mitrović & Panagiotidis (2020) note, the minimal verbal category may well involve a bit more structure, given the evidence reported by Levin & Hovav (2005). I ignore such empirical pressures to extend the categorial structure of minimal verbs here, assuming that the core ingredients of my compositional programme would not be at risk. See Mitrović & Panagiotidis (2020), nonetheless, for the relevant discussion of facts and theory.

ever Mitrović & Panagiotidis (2020) develop a theory of categorial structure, not just the formal categorial features, and motivate their theory on empirical grounds since adjectives are not universal in a typological perspectives (they behave like Vs, Ns, or both).
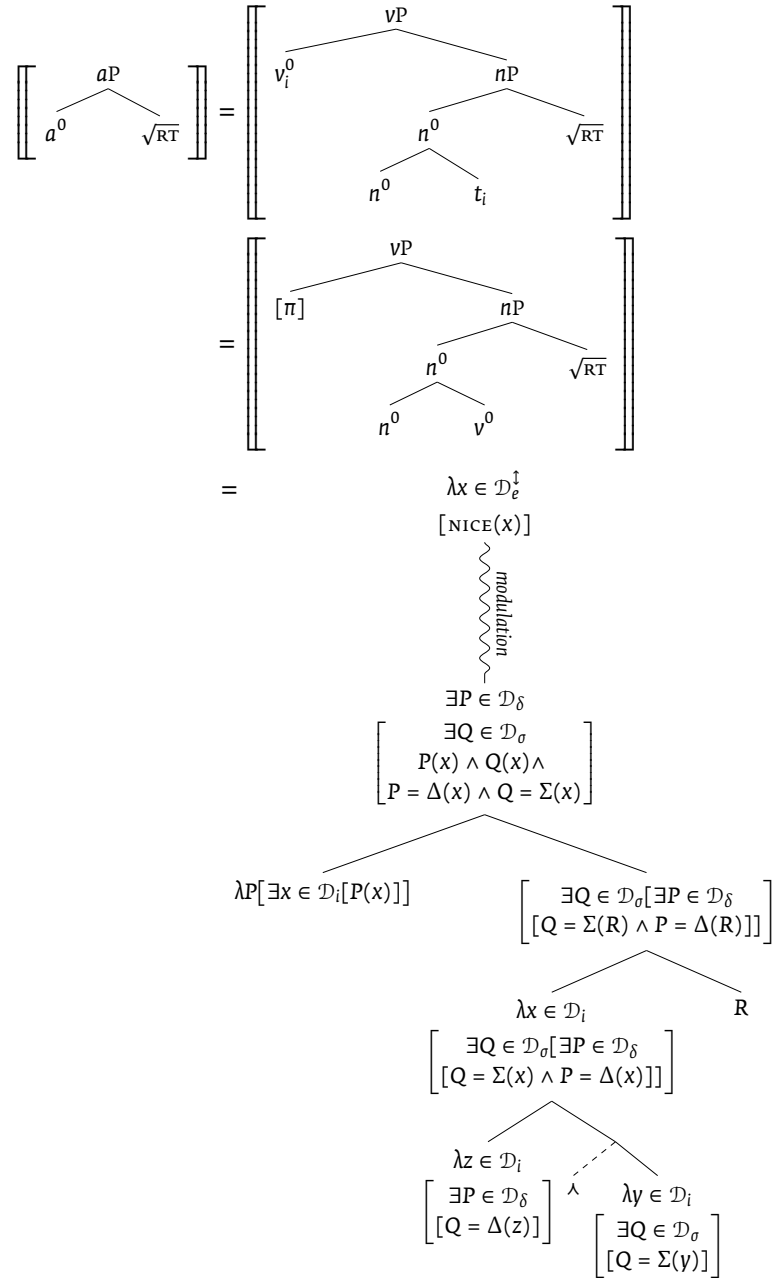
If the theory I present here is on the right track, and assuming the bicategorial decomposition of adjectives holds, then the meaning of adjectives, derived through 'dual' categorisation of a root (property) should yield adjectival meanings. In fact, I contend that not only is the interplay of the verbal- and nominal-denoting meaning derived through the sort-theoretic approach I developed, but that the phasal status of categorisation is a reflex of the information-state operation that is inherent to the formal system advocated here.

As with minimal nouns and verbs before, let me sketch a type-schema for adjectives along the same lines.

(33)   a. Adjectives sort-theoretically:
            $\langle \langle \sigma, \delta \rangle, i \rangle$
        b. Adjectives type-theoretically:
            $\langle e, t \rangle$
        c. First-phase adjectivisation as sort-to-type modulation:
            $\langle \langle \langle \sigma, \delta \rangle, i \rangle, \langle e, t \rangle \rangle$

To interpret the categorial composites that make up an adjective compositionally, I will assume that he excorporated elements, in the case of Indo-European it would be v (32-b).

(34)   A bicategorial interpretation of adjectives:

$$
\left[\!\!\left[
\begin{array}{c}
a\text{P} \\
a^0 \quad \sqrt{\text{RT}}
\end{array}
\right]\!\!\right]
=
\left[\!\!\left[
\begin{array}{c}
v\text{P} \\
v_i^0 \qquad n\text{P} \\
n^0 \quad \sqrt{\text{RT}} \\
n^0 \quad t_i
\end{array}
\right]\!\!\right]
$$

$$
=
\left[\!\!\left[
\begin{array}{c}
v\text{P} \\
[\pi] \qquad n\text{P} \\
n^0 \quad \sqrt{\text{RT}} \\
n^0 \quad v^0
\end{array}
\right]\!\!\right]
$$

$$
= \quad \lambda x \in \mathcal{D}_e^{\updownarrow}
$$

$$[\textsc{nice}(x)]$$

$$\wr \text{ \textit{modulation}}$$

$$
\exists P \in \mathcal{D}_\delta
$$
$$
\left[
\begin{array}{c}
\exists Q \in \mathcal{D}_\sigma \\
P(x) \wedge Q(x) \wedge \\
P = \Delta(x) \wedge Q = \Sigma(x)
\end{array}
\right]
$$

$$
\lambda P[\exists x \in \mathcal{D}_i[P(x)]]
\qquad
\left[
\begin{array}{c}
\exists Q \in \mathcal{D}_\sigma[\exists P \in \mathcal{D}_\delta \\
[Q = \Sigma(R) \wedge P = \Delta(R)]]
\end{array}
\right]
$$

$$
\lambda x \in \mathcal{D}_i \qquad R
$$
$$
\left[
\begin{array}{c}
\exists Q \in \mathcal{D}_\sigma[\exists P \in \mathcal{D}_\delta \\
[Q = \Sigma(x) \wedge P = \Delta(x)]]
\end{array}
\right]
$$

$$
\lambda z \in \mathcal{D}_i
$$
$$
\left[
\begin{array}{c}
\exists P \in \mathcal{D}_\delta \\
[Q = \Delta(z)]
\end{array}
\right]
\quad \wedge \quad
\lambda y \in \mathcal{D}_i
$$
$$
\left[
\begin{array}{c}
\exists Q \in \mathcal{D}_\sigma \\
[Q = \Sigma(y)]
\end{array}
\right]
$$

While roots denote proper properties, the *v* in adjectival structures yields the meaning of scalarised nominalised functions. The combination of the *v* and *n* categorisers, yielding a composite kind-individuator, can be derived using

(35) $[\![\, \wedge \,]\!] = \lambda f \in \mathcal{D}_\sigma\big[\lambda g \in \mathcal{D}_\delta[\lambda x \in \mathcal{D}_i[f(x) \wedge g(x)]]\big]$

which is inspired by Heim & Kratzer (1998, 183n10) and given as an optional function (dashed) in (34). It also follows from this that if property-individuation is kind-denoting in Carlson's sense as adapted for first-phase lexical categorisation, then the adjectival category, being bicategorial in nature, yields a 'composite' kind. Note, however, that the structural analysis of adjectives as involving double categorisation is parallel to standard double categorisation, or recategorisation. Mitrović & Panagiotidis (2020) rely on the notion of phasehood and defectivity of the two categorising heads to distinguish a recategorised category (such as a verbalised noun) and an a composite n-v category (adjective). While the former features two phasal and non-defective categorisers, the latter involves a mono-phasal composite of two defective categories (but see Mitrović & Panagiotidis 2020 for extensive discussion and references).

MODULATING DEGREES AND DERIVING GRADABILITY

If gradable adjectives can be analysed as relations between individuals and degrees,[10] then verbs can be analysed as (implicit or lexicalised) relations between individuals and intervals, or point thereof. This parallel is evident in the present analysis since both verbs and adjectives make property-theoretic reference to Σ. As it stands, we derived the modulated type $\langle e, t \rangle$, which we now need to upgrade to $\langle \langle e, t \rangle, d \rangle$.

One approach is consider the presupposition of the d-related meaning to stem not from the minimal adjectival structure per se, but rather from a superstructure that emerges in the course of a derivation, such as a POS operator. This non-inherent scalarity of adjectives is desirable also on empirical grounds,

As Hansen & Chemla (2017) note, scalar adjectives (36-a) are associated with functions from individuals to degrees on a scale, while non-scalar adjectives (36-b) associate simply with functions that map arguments to truth values.[11]

(36) a. $[\![\text{prime}_{\langle e,t \rangle}]\!] = \lambda x[\text{PRIME}(x)]$

 b. (i) $[\![\text{expensive}_{\langle e,d \rangle}]\!] = \lambda x[\text{PRIME}(x)]$

 (ii) $[\![\text{POS}_{\langle \langle e,d \rangle, \langle e,t \rangle \rangle}]\!] = \lambda G[\lambda x[G(x) \succeq \text{STANDARD}(x)]$

 (iii) $[\![\text{POS expensive}_{\langle e,t \rangle}]\!] = \lambda x \begin{bmatrix} \text{EXPENSIVE}(x) \succeq \\ \text{STANDARD}(\text{EXPENSIVE}) \end{bmatrix}$

Along these lines, we could assume, following a textbook idea of Kennedy & Heim (2002), that the degree argument is bound by a default existential quantifier with an unspecified restriction **C**, whose value is also fixed con-

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10 For details and historical background, see Seuren (1973), Cresswell (1976), Hellan (1981), Von Stechow (1984), Heim (1985), M. (1989), Klein (1991), Kennedy (1999), Bobaljik (2012), among others.

11 But see Bobaljik (2012), Bartsch & Vennemann (1972), Kennedy (2007), and those they cite for background and details.
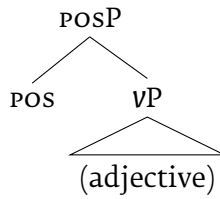
textually to pick out the appropriate standard of comparison that is intro-
duced by the POS^0 which builds on top of an adjectival core that ends up
expressing standard scalar adjectival meaning (where Kennedy & Heim's
(2002) AP corresponds to our categorially composite phrase):

(37) $[\![\,[_{\text{AP}} \text{ expensive}] \,]\!] = \lambda x[\exists d[\mathbf{C}(d) \land \textsc{expensive}(x) \succeq d]]$

(Kennedy & Heim, 2002, 8n46)

I take the existential presupposition of a *d*-variable meaning encoded on
POS to project from the existential supposition of a scalar property $Q \in \mathcal{D}_\sigma$
(courtesy of *v*) related to the sortal property $P \in \mathcal{D}_\delta$ (courtesy of *n*). Aside
from theoretical consideration, an empirical argument may be made for
such a tretment, which divorces the lexical (categorial composite) layer from
the degree-encoding POS structured on top. Warlpiri adjectives have been
reported to not express degrees (Bowler, 2016). Bochnak (2015) cites analo-
gous evidence for the systematic lack of degree morphology in Washo (iso-
late/Hokan). This sufficiently motivates the idea that the POS and the adjec-
tival category in concert yield a possibly scalar structure representing scalar
adjectives.

(38)

a. $[\![\,\textsc{pos}\,]\!] = \lambda P_{\langle e,t \rangle}[\exists d_{\bar{d}}[P(d)]]$

b. $[\![\,\textsc{deg}\,]\!] = \lambda G[\lambda x[\exists d[\mathbf{R}(d) \land G(d)(x)]]]$

(Kennedy & McNally, 2005, 367)

c. $[\![\,\textsc{pos}\,]\!] = \lambda G[\lambda x[\exists d[d > s_G \land G(d)(x)]]]$

For instance, Kennedy & McNally (2005) model the general case as in (38-b),
where *G* is a gradable predicate of type $\langle d, \langle e, t \rangle \rangle$ and $\mathbf{R}$ is a variable for the
restriction placed on *d*. The formulation of POS in (38-c) is adapted from
Kennedy & McNally (2005), where s_G is the standard for *G*.[12]

LAXING FILTERING EFFECTS

The present account, which considers property sorts to derive from appro-
priate filtering imposed by categorises, leaves an analysis of adjectives as
bicategorial constructs oddly squared. Since both verbal and nominal filters
are presumably at play during a derivation and construction of the adjectival
category, and thus, meaning, I take this to lend support in favour of a lin-

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12   For an alternative implementation of how the contextual standard is introduced into the
structure via a the silent degree modifier, see Rett (2007) for details and Bochnak (2015) for
discussion.

guistic view and against the ontological view. Consider the non-defectivity of ϕ-features in adjectival constructions: the nominal behaviour of adjectives is defective insofar as the $[\phi]$-feature is consistently void, represented as $[u\phi]$ on the adjective-forming n^0, as shows for English and Slovenian below.

(39)   Adjective as modifier:

     a.   a wise-　　　∅　　　woman-　　　∅
        N.[+DEFECT] $[u\phi : \text{VAL}_i]$ N.[−DEFECT] $[i\phi : \text{VAL}_i]$

     b.   (i)   modr-　　　　　a　　　žensk-　　　　　a
             wise.N.[+DEFECT] $[u\phi : \text{F}_i]$ woman.N.[−DEFECT] $[i\phi : \text{F}_i]$

        (ii)   rdeč-　　　　　∅　　　avto-　　　　　∅
             red.N.[+DEFECT] $[u\phi : \text{M}_i]$ car.N.[−DEFECT] $[i\phi : \text{M}_i]$

        (iii)   zelen-　　　　　o　　　mest-　　　　　o
             green.N.[+DEFECT] $[u\phi : \text{N}_i]$ city.N.[−DEFECT] $[i\phi : \text{N}_i]$

(40)   Adjective as modifiee:

     a.   general-　　　ly　　　　　wise-　　　∅
        N.[+DEFECT] $[u\phi : \varnothing \Rightarrow \text{DEFAULT}_k]$ N.[+DEFECT] $[i\phi : \varnothing]$

     b.   pretežn-　　　　　o　　　　　modr-
        generally.N.[+DEFECT] $[u\phi : \varnothing \Rightarrow \text{DEFAULT}_l]$ wise.N.[+DEFECT]

        a/　　　∅/　　　o　　　(NP)
        $[u\phi : \text{F}_i/]$ $[u\phi : \text{M}_j/]$ $[u\phi : \text{N}_k]$ N.[−DEFECT]$[i\phi : \text{VAL}_{\{i,j,k\}}]$

If the categorial-featural impoverishment in syntax is evident on the current analysis, there is an expected spill-over effect in semantics, too. Since ϕ is semantically interpretable (Sudo, 2012; Bassi, 2021), its inexistence on the deficient nominal categoriser that features in adjectives (40) entails a weaker interpretation of the relevant n-formative, which the cited data can be analysed as demonstrating.

Another seemingly indepdendent consequence of the defectivity of the n and v formatives making up the adjective is their inability to project functional structure as their non-defective counterparts may and do.

(41)   EP(n)
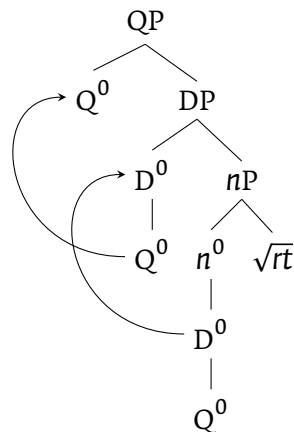
(42)   EP(v)
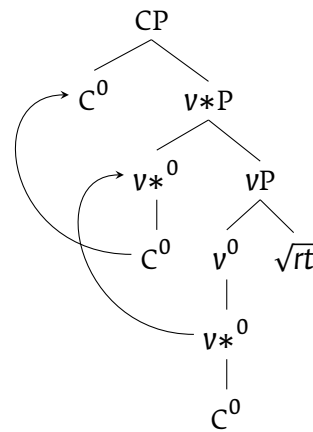
	[−DEFECTIVE]		[+DEFECTIVE]		
	verbs	nouns	verbs	nouns	adjectives
lexical entry	$\begin{bmatrix} v^0 \\ \mid \\ v*^0 \\ \mid \\ C^0 \end{bmatrix}$	$\begin{bmatrix} n^0_{[i\phi]} \\ \mid \\ D^0 \\ \mid \\ Q^0 \end{bmatrix}$	$\begin{bmatrix} v^0 \end{bmatrix}$	$\begin{bmatrix} n^0_{[u\phi]} \end{bmatrix}$	$\begin{bmatrix} n^0_{[u\phi]} \\ \mid \\ v^0 \end{bmatrix} \begin{bmatrix} v^0 \\ \mid \\ n^0_{[u\phi]} \end{bmatrix}$

TABLE 2: Representation of stored entries of the two categorial formatives *n* and *v*, in defective and non-defective/full formats, on Shimada's (2007) analysis of successive excorporation.

Furthermore, the defectivity distinction, coupled with the assumption that lexically encoded elements are pre-installed with functional heads which successively excorporate during the course of a derivation (Shimada, 2007), allows us to lexically specify the nominal and verbal ingredients of the adjective components as defective, i.e. those heads that do not form the excorporation chain in the numeration.

What about the functional phasal extensions of adjectives? In the verbal domain, the predicate-encoding, argument-structuring and event-introducing *v*∗ is a functional upgrade of the categorising v and, by the same token, the proposition-encoding C is built on top of such a *v*∗P. Obversely, the nominal domain contains Q > D > n, the three presumably phasal functional categories. Adjectives, however, do not. See Nitschke (this volume) for a discussion.

8 DISCUSSION

CONCLUSIONS

This paper has proposed a property-theoretic treatment of adjectives specifically and all three lexical categories more generally. Aiming to retain type-theory while making formal semantics more sensitive to the morphosyntactic structure independently posited, the present chapter supposed a sort-theoretical domain of type *e* which can derive 'nominality', 'verbality', and 'adjectivity' as a meta-property of interpretation that standard type-theory is too blind and insensitive to distinguish between nouns, verbs, and adjectives (43) beyond apparent and implicative synonymy since type-theoretically all three grammatically distinctive categories are identical.

(43) a. *Running* is tiring
      b. Mary *runs*
      c. A *running* person

A non-Davidsonian and type-compliant logical structure of grammatically

distinct terms must be considered a desideratum for natural language se-
mantics, probably most attractively so for reasons of aligning the linguistic
modules in a way that is as parallel and as stipulation-free as possible. The
first-phase seems to me to be a fundamental segment of grammar where
this should, and can, be done.

PROBLEMS AND OUTLOOK

A conceptual problem we identify at this stage is the stipulative nature of
the non/scalar sort arrangement, as given in Fig. 2, that is: why is σ a sub-
set of δ, and not vice versa? However, the nature of this system is reflective
of the inherited problem that the narrow-morphosyntax of Mitrović & Pana-
giotidis (2020).

Rather exposing this as a shortcoming of the principles underlying Mitro-
vić & Panagiotidis's (2020) excorporation system, it is considered as a matter
of parametric variation, which crucially derives the two typological profiles
of adjectives: the noun-like (Indo-European) and the verb-like (Korean), as
well as be ambicategorial-like (Japanese). Likewise, the seemingly flexibil-
ity of the choice in compositional sequencing $\Sigma \circ \Delta$ versus $\Delta \circ \Sigma$ should yield
the same typological taxonomies, since, say, a verb-like adjective in Korean
is interpreted in a verb-like fashion. My analysis thus far predicts no in-
trinsic empirical distinction to be borne out since I consider the categorial
phasal head ot be interpreted in two positions: phasality is interpreted at
root level, while the categorial head is interpreted in-situ.

Another important empirical question left open regard the semantic sim-
ilarities of gerunds/infinitives and adjectives. The property theory I adopted
here was developed by Chierchia (1984) to account for the meaning of gerunds
and infinitives and their type-theoretic status. Just like gerunds, adjectives
are taken here to be both verbal and nominal elements. The nature of such
morpho-semantic similarities, which may well extend beyond the treatment
of gerunds as non-first-phase phenomena or adjectives as first-phase phe-
nomena, is something that is left for the future. The distribution and na-
ture of the 'non/defectivity' of categorial formatives (cf. Tab. 2) seems to be
the adjudicating feature here since, unlike (English) adjectives, gerunds (in
English) do not seem categorially defective at all, or at least not in the same
way as adjectives are on the current analysis.

BEYOND FIRST-PHASE: A SORT-THEORETIC AETIOLOGY OF ALTERNA-TIVES

I turn to a further conjecture that follows from the system as is set up right
now. It seems to me conceptually desirable to derive not only core interpre-
tational aspects of lexicality from the kind of sort-based property theory but
also some independent interpretational properties from it. One important
development in modern formal semantics is the treatment of alternative-

based valuations, such as Focus among others.[13] The way in which the proposed work is relevant pertains to 'where alternatives come from'. Rather than being contextually determined, a sort-based approach allows a principled way to attempt relating the sub-type-theoretic denotations of lexical roots with the alternative sets they belong to. For instance, a Focus alternative to a NP like 'dog' may be 'cat' but not 'bark', and likewise 'bark' may have as an alternative 'meow', and not a non-verbal term. While this much may be trivial, what is relevant for possible future work is to equate the δ and σ sorts with the alternative sets since both δ and σ are, under the current proposal, structurally represented as proto-lexical layers of meanings which build nouns, verbs, and – crucially – adjectives.

Beyond these concluding speculations, this paper has explored the preliminary application, or transposition, of sort-theoretic property theory as the key model of first-phase semantics.

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13 Alternative semantics generally started with Hamblin (1973) and Rooth (1985). Recent years have seen a wealth of technical and empirical advancements in this field – see, for instance, Kratzer & Shimoyama (2002), Alonso-Ovalle (2006), Fălăuş (2013), Chierchia (2013), Tieu et al. (2015); Katzir (2007); Fox & Katzir (2011); Gotzner (2017), or those cited for a fragment of research demonstrating the wealth of alternative-based analyses.

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