RESEARCH ARTICLE

Reference, Phases and Individuation: Topics at the Labeling-Interpretive Interface

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Following on from recent work in minimalist syntax and ethology, I explore the implications of assuming that the operation Label is the defining feature of the human computational system. It is shown that labeling is responsible for a number of semantic and cognitive properties of the interpretative systems, a conclusion with direct repercussions for the study of the mind/brain. Finally, it is shown that the emergence of Label limits and directs human referentiality.

> *How syntax builds wholes from parts may be rather more like how a cubist painting builds a guitar from parts: in the absence of the whole, the parts make no sense.* (Hinzen 2012: 335)

Throughout the history of generative grammar, a primary theoretical goal has been to reduce the complexity of the human language faculty to the bare minimum, keeping to traditional scientific guidelines of simplicity and elegance. Certain aspects of language are plainly shared with other species, such as a great deal of speech perception. But since the emergence of the *biolinguistic enterprise* in the 1950s and 1960s (Lenneberg 1967), a major concern of linguists has been to uncover the biological basis of what syntacticians deem to be unique to language. The current version of generative syntax, the Minimalist Program, proposes that the human capacity for language is genetically encoded in the computational system of the mind/brain (see Boeckx forthcoming for a discussion of the relationship between minimalism and biolinguistics). Minimalists typically assume that the operation 'Merge' is what permits humans to construct an unbounded number of hierarchically structured linguistic expressions (Chomsky 2015a, Hauser et al. 2014). Merge builds a new set-theoretic syntactic object out of two items taken from the lexicon. Merge (*the*, *chair*) would form {the, chair}. I will assume the following standard definition:

(1) *Merge*:
Take two lexical items α and β and form the set {α, β}:
$_M(\alpha, \beta) = \{\alpha, \beta\}$

I will additionally assume, following Boeckx (2014: 27), that the objects of narrow syntax are *flat* and *atomic*, or 'lexical precursor cells' (LPCs). That is, LPCs are not fully-fledged words, but are rather conceptual representations the syntax assembles into 'root' concepts (Marantz 1997, Borer 2014), to be enriched by morphology. We can call the resulting lexicon the Precursor Lexicon, $_p$LEX

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for short. There is also reason to believe that, when roots concatenate with other lexical atoms, they do so across the smallest search space possible, leading Larson (2015: 60) to propose the following restriction:

> (2) *General Restriction on Merge*:
> Merge can only apply to an object in a given search space if there is no possible Merge with an object in a more constrained search space.

Merge thus appears to be *optimally designed*, the centre of a 'perfect' computational system (Chomsky 2015a: ix), suggesting, among other things, that it emerged suddenly through a genetic mutation and was shaped by natural law, and not through gradualist natural selection (Hauser et al. 2014). Most minimalists additionally hold that when two lexical items are merged, the constructed set is given a syntactic status independent of its parts, which relies on the featural specification of one of the items. Departing from this, I will partially adopt Boeckx's (2014) model, which assumes that interpretation requires a symmetry-breaking process, but I will claim that this is achieved by labeling, not cyclic Spell-Out. The set $\{\alpha,\beta\}$, then, would be 'labeled' either an 'Alpha Phrase' or a 'Beta Phrase'; or, if a verb Merged with a noun, it would constitute a Verb Phrase (VP), as in *Jason ran*. The label indicates the structure's meaning to the conceptual-intentional (CI) system (an axiom assumed by Chomsky 2013b, 2015b), roughly speaking the 'thought system.'

The Decompositionalist Project: From passives to projections

I recently argued in Murphy (in prep) that the 'unbundling' (Collins 2014: 1) of the language faculty's core operations – from complex operations like 'passivise' to simple generic operations like 'word movement' – can be taken one step further, decomposing Merge into Concatenate (unordered set-formation) and Label. We could call this the Decompositionalist Project, in line with

Poeppel's (2012) goal of investigating the human 'cognome', or the set of computations performed by the human nervous system. Hornstein and Pietroski (2009: 113) similarly noted that the operation combine(a,b) (or Merge) is not primitive, and consists of label[concatenate(a,b)], with labeling being 'perhaps distinctively human.' Collins is mistaken, then, in claiming that his formula 'Merge(X,Y) = {X,Y}' is 'the simplest possible formulation of Merge' (2014: 2). A small number of others linguists have pointed to the possibility of decomposing Merge, but few have attempted to derive any architectural consequences from this.

Along with labeling effects, another candidate for human-uniqueness is the hotly debated *referential* capacities of language and cognition. Terrace, reviewing decades of ape communication studies, claims that there is 'No evidence that apes used any of the symbols they learned to refer to objects or events, or that those symbols had any function other than to request food or drink' (2005: 101, see also Chomsky 2013a). What ethologists define as 'the eagle call' (that is, a monkey call announcing the presence of an eagle) may not, in fact, refer to eagles: 'ACS units aren't designed to refer, they're designed to get other animals to do things' (Bickerton 2009: 12). Moreover, under a phase-based syntax (Abels 2012), as lexical material moves to the edge of the phase away from the interior, $[_{E} [_{I}]]$ (e.g. [[The man] I met in London is not the one you know]) a special kind of 'referentiality' emerges (Hinzen & Sheehan 2013, Murphy 2014), which is a phasal, and not a lexical/featural, phenomenon. This form of reference uses syntactic structures to access intensional dimensions of meaning (Hinzen & Sheehan 2013: 37–47). This leads Martin and Hinzen (2014: 102) to propose the following hypothesis:

> (3) *The Grammar-Reference Link Hypothesis*:
> Referential strength (from predicativity to deixis) is not an intrinsic prop-

erty of lexical items, but rather of certain grammatical configurations.

Under phase theory, syntactic derivations proceed via 'chunks' of material being sent to the CI and sensorimotor (SM) systems, instead of the sentence being sent as an entire unit, for reasons of computational efficiency. The minimalist grammar is assumed to be composed of the CI and SM systems, narrow syntax (Merge), and, as of Chomsky (2013b), a labeling algorithm.[1] The phases are typically assumed to be CP and v*P, and often DP in addition. Phase theory (Chomsky 2001) together with the H-α schema eliminates endocentric projection, XP-movement, pied-piping, and other aspects of the syntax (Narita 2012) – though not, crucially, labeling. Note that the existence of labeling is not tethered to phases (neurobiological evidence for this view can be found in Ramirez et al. 2015), but under a phasal approach to the grammar labels are given a central role in interpreting transferred, and subsequently 'referenced,' structures.

Despite Boeckx and Grohmann's (2007: 205) caveat that phases typically 'recode insights from the past' rather than enhance understanding, phasal referentiality has been well motivated in recent work by Hinzen and Sheehan (2013, see also Reichard 2013). Edge-heavy Determiner Phrases (DPs) are strongly referential, correlating with edge-heavy v*Ps: when v fails to project fully sub-events arise, as in 'Jason's having been left' (see De Villiers 2014 for another phasal account of human event structure, and Ramchand & Svenonius 2014 for related discussion).[2] Contrary to compositionality (Pietroski 2005), only when a given phase is complete do we know how a root is used to refer. Hence operations of semantic composition (Boolean conjunction, etc.) become unmotivated; all that is needed is the label-driven phase. If the word book 'refers to a particular book … this is a consequence, not of the lexical feature specifications of "book," but the phrasal syntactic configuration in which is it used' (Hinzen 2012: 313).[3] Only human infants appear to

be capable of declarative pointing (which acknowledges the viewpoints of conspecifics as sharing knowledge of external objects), and not just imperative pointing (requests, demands), which is perhaps the 'first manifestation' of a grammatical mind (Hinzen & Sheehan 2013: 246). DPs can 'only denote an object in space, on a scale from maximal indefiniteness (generics, indefinite existential, etc.) to maximal definiteness (definite specific DPs)' (Hinzen 2012: 325). But whilst 'The ontology and the grammar of reference … co-vary' (Hinzen 2013: 11), 'mediation does not imply possible reduction,' as Boeckx (2014: 108) cautions. Further research is needed before what we might call a *phasal semantics* can truly emerge. But assuming that the ontology of reference and truth arises via phase, it becomes needless to base these notions in a Strong Minimalist Thesis-type post-grammar CI system. Hence the fact that humans share aspects of their CI system with other great apes should be considered only alongside a framework of phasal analysis when exploring referentiality and truth: lacking Label and $_p$LEX, these notions cannot even be formulated. As Bolhuis and Wynne (2009: 833) put it, 'As long as researchers focus on identifying human-like behaviour in other animals, the job of classifying the cognition of different species will be forever tied up in thickets of arbitrary nomenclature that will not advance our understanding of the mechanisms of cognition.'

Like Hinzen and Sheehan's (2013) model, other phase-based theories of semantics have been proposed. Returning briefly to Neo-Davidsonianism, its representational devices yield what Boeckx (2014: 103) convincingly identifies as 'a near-perfect match' between phasal derivations and Neo-Davidsonian event representations, arguing for a causal relationship between the evolution of phases and complex event concepts (an observation also made by Hinzen 2008: 354). For instance, C corresponds to the point of existential closure, v to thematic role assignment, and n to the type-lifting that turns a predicate into an argument

(see Murphy 2015a). Points of transfer in syntax also correspond to points of semantic closure. It follows that the emergence of Label, in the context of phasal memory and transfer, yielded Neo-Davidsonian representations, which in turn 'allowed for the same event to be represented from different perspectives' (Boeckx 2014: 106). Collins, amongst others, is consequently misguided in claiming that 'syntax fails to match up with content in a principled way' (2007: 806). Labeling is 'the vehicle for making human semantics out of some ancient operation associated with concatenation' (Hornstein & Pietroski 2009: 125).

What I have called the Russellian phase (CP) can generate structures of propositional knowledge in the clausal domain in concert with the evaluation of tensed events by the Davidsonian phase ($v*$P) and the referentiality of the Fregean phase (DP), structures found only in human language (Murphy 2014). These Determiner, Aspect/Voice and Complementizer phase heads can label nominal, verbal, and other structures: [D/v/C[N/V/T]]. With only full CPs yielding truth judgements, which in turn contain 'events' and 'objects' lower in the phasal topology, Hinzen and Sheehan convincingly conclude that 'With the notion of truth, a notion of "world" arrives' (2013: 84).[4] It may well follow from this that while some animals have memories (Emery & Clayton 2001), none of them have a *past*, a way of evaluating situations with respect to other propositionally-constructed 'worlds' (Lewis 1979, Hinzen & Sheehan 2013: 62–3). I would also like to propose that the emergence of episodic memory (see Baddeley 2013 and Baddeley et al. 2014 for an overview), which is 'recently evolved, late developing, past-oriented' and 'probably unique to humans' (Tulving 1999: 278, though see Dere et al. 2006 for a contrary perspective), may be due to the interface of this phasal computational system with primate memory systems.

Discussing the functional hierarchy, Ramchand and Svenonius claim that the order of functional projections/labels comes from 'extralinguistic cognition,' a 'cognitive proclivity to perceive experience in terms of events, situations, and propositions,' rather than the grammar itself:

> [W]e have suggested that an EVENT is recognized as a special kind of object, with thematic participants, and that an event combined with a certain special kind of parameter … for example a time, is a SITUATION, a conceptually different 'sort' of object from an event. A situation includes an event as a privileged part, somewhat like the way a person includes a body. Similarly, a situation merged with another special kind of parameter … is a PROPOSITION, which is again a different sort from, and constitutively includes, the situation. (Ramchand & Svenonius 2014: 172)

This 'extralinguistic' account has certain advantages over the phasal theory of reference (it does not downplay the cartographic literature (Cinque 1999, 2014), for instance). But while Boeckx (2015: 167) correctly notes that 'claiming that properties of thought [reduce] to properties of grammar is explanatory only insofar as the properties of grammar are well understood,' and while truth does in fact appear to be the output of an interaction effect, and not a purely grammatical phenomena ('Since when does grammar indicate when sentences are true or false?' (Boeckx 2015: 177); 'Constructing sentences that can be true or false requires cognitive work, not just an exercise of our natural capacity to generate SEMs' (Pietroski 2010: 273)), this does not exclude the possibility that it emerged from grammar, perhaps in a similar way that grammar yielded, say, the principles of Relevance Theory (Sperber & Wilson 1995), which appear specific to language but are certainly not purely phasal phenomena. Elsewhere in their study, Hinzen and Sheehan (2013) deny

the existence of structures like object and event in non-human primates. Yet phases are of no explanatory force when it comes to objecthood, though certain concepts are no doubt lexicalised in such a way as to permit a phasal system to recombine them with other concepts. Relatedly, in contrast to Bruening's (2014) *phase-command* model, I have made the case against placing phases at the centre of an account of binding relations (Murphy 2015c). Epstein et al. (2014) even propose that, by extending Chomsky's (2013b, 2015b) minimal search labeling algorithm to successive-cyclic A-movement, the postulate *phase* is rendered unnecessary in analysing cases of illicit A-movement, which can instead be reduced to labeling failures. Further research is needed, however, before the status of phases within the architecture of the grammar can be seriously brought into question. Nevertheless, let's assume that certain movement phenomena are indeed the result of initial labeling failures, with a moved element giving the resulting phrases (say, XP and YP) shared prominent features (ϕ-features or Q-features, for instance). If this is the case, it lends credence to a Boeckxian anti-lexicalist biolinguistics, and suggests that the 'relabeling' theory of Cecchetto and Donati (2015) is unmotivated. Their lexicalist account claims that words have a relabeling capacity, with a moved word sometimes assigning a structure a new label. This analysis is brought into question when we consider, with Adger (2013), that the root clauses upon which Cecchetto and Donati focus most of their attention are always labeled pre-movement, a labeled object only receives a single interpretation, and that the labeling algorithm doesn't apply to anything as morphologically internally complex as words, but roots. But Cecchetto and Donati (2015: 31) are correct to note that 'labels belong to the core part of grammar that … cannot be relegated to the interface', and their Simplified Phase Impenetrability Condition (SPIC) also builds a stronger connection between phases and labels:

(4) *Simplified Phase Impenetrability Condition*
When a phase is concluded, only its label remains accessible to further syntactic computation.

SPIC can be motivated independently of Cecchetto and Donati's relabeling approach, such as through Boeckx's (2014) transitive-intransitive phase model, under which the only constituents remaining in the derivation post-transfer would be labels. Yet Cecchetto and Donati (2015: 157) also propose that 'referentiality is a feature', stipulating that this sophisticated cognitive capacity can be accounted for through featural stipulations. The next section will question this assumption by attempting to ground certain aspects of referentiality in other components of the grammar.

Phasal and Representational Individuation
A further potential problem for Hinzen and Sheehan is posed by Boeckx (2015: 181): '[W]hy, if grammar is so discontinuous from the rest of primate cognition, does it resort to classes like object, event, etc., as opposed to other conceivable notions (smells, colors, etc.)?' But if grammar (Concatenate/Simplest Merge plus Label under the assumptions of the Decompositionalist Project) interfaced with CI then it would have to interface with it in some way, and perhaps objects and events are more salient/prominent in primate CI systems than other classes – or at least sufficiently salient/prominent or generic – to permit the kind of universal phasal mapping discussed by Hinzen and Sheehan. Still, despite the phasal constraints imposed on reference, the act of reference itself may constitute what Boeckx (2015: 182) calls 'the application of an ancient mechanism applied to novel mental units detached from their perceptual inputs,' that is, lexical items. Summarising related findings, Zuberbühler (2006: 124) notes that, due to a lack of understanding about the mental

states of conspecifics, 'non-human primates referential signalling thus takes place in a remarkable state of mind-blindness' (see, for instance, Cheney & Seyfarth 1990).

Lacking phase-based hierarchical structure-building and LPCs, non-humans are incapable of freely combining conceptual units. They are capable only of generating 'functionally referential signals' (Macedonia & Evans 1993, Townsend & Manser 2013). Petitto writes that a chimpanzee uses the sign for *apple* to refer to 'the action of eating apples, the location where the apples are kept, events and locations of objects other than apples that happened to be stored with an apple … *all simultaneously* and without apparent recognition of the relevant differences or the advantages of being able to distinguish among them' (2005: 86, emphasis mine).[5] Despite the relative inflexibility of their referential capacities, predator-specific alarm calls are very common amongst Diana monkeys, vervet monkeys, lemurs, and capuchins (Lemasson et al. 2013: 188, Macedonia 1990). Nim Chimsky produced signs that were far less diverse in combinatoriality than those of two-year old children (Yang 2013). Yet, when we attend to the 'all simultaneously' part of Petitto's discussion, and compare it to complex semantic phenomena like copredication in (5), in which we can attend to different aspects of the meaning of a word simultaneously (i.e. its abstract and concrete features), perhaps the gulf between human and primate reference is not so wide after all (see Murphy forthcoming for discussion).[6] Maybe it is only the *mode of reference*, a phasal grammar, which is unique to humans:

(5) a. The newspaper I held this morning has gone bust.
    b. Liverpool burned down and was rebuilt a few miles up the river.

Further to this, empirical, topographic approaches to concept clustering (Troche et al. 2014, Pollock 2014) provide reason to believe that the conceptual basis for abstract words like *justice* and *morality* extends beyond the lexicon.[7] Gärdenfors and Osvath (2005) have also argued that non-humans do not actually 'plan' at all (contra Emery & Clayton 2004). Squirrels who store food for winter are concerned only with the present, having no conception of *winter*, whilst a chimp who remembers where food is stored is most likely reminded of its location through a somatosensory stimulus from hunger. Similar results lead Gruber et al. (2015: 1) to conclude that 'Apes have culture but may not know that they do', finding 'no evidence for metarepresentations of cultural knowledge.' They propose the 'Jourdain Hypothesis' under which apes engage in cultural interactions without being aware of the cultural nature of their existence, putting this down to cognitive limitations on their knowledge representation faculties. Townsend and Manser (2013: 8), reviewing the literature on animal reference, also conclude that there currently exists no operational 'definitions of external "objects" or "events"' which animals are supposed to refer to. I think that given the flexibility in perspective granted by the labeling of lexical categories onto 'roots', it is reasonable to propose that the combinatorics seen in the type of grammar attributed to certain aspects of language, mildly context-sensitive grammar (Joshi 1985, Fitch & Friederici 2012), permits a level of detachment from external stimuli, of *stepping back* from the world, rather than relating us to it.

Correspondingly, the biolinguistic claim (Hinzen 2006) that mapping to SM is ancillary to semantic interpretation is supported by cross-species studies (Hauser 2008). Male zebra finches sing when alone, an act that cannot conceivably have any sexually seductive or communicative properties (Sossinka & Böhner 1980). Even the category of 'animal communication' is a 'biologically illusory one': '[T]he range of application of the [term] is so wide and heterogeneous … that one cannot expect any reliable extrapolations from putative token instances of the category to extend to the category as a whole' (Balari &

Lorenzo 2013: 4, 56, see also Scott-Phillips 2010). It is not at all clear, then, that much sense can be made of Savage-Rumbaugh et al.'s (1998) proposal that 'primate communication' is an intermediate stage between animal communication and human language (see Murphy in preparation for further ethological review).

In concert with the pragmatic faculties, which perform enrichment operations like *saturation* (Stanley and Szabó 2000), linguistic processing appears to fit a model I have called Phasal Eliminativism (Murphy 2015b):

> (6) *Phasal Eliminativism*:
> Lexical items supply instructions to the CI-system to build pragmatically saturated concepts in a cyclic fashion.

This model supports the notion that words are not concepts but rather *instructions to build concepts (from their semantic features)* (Pietroski forthcoming, see also Hinzen forthcoming). Pragmatic processes enrich syntactic structures, which are radically underspecified for conceptual content. LPCs acquire their lexical features as the derivation proceeds and phases are transferred to the interfaces (Munakata 2009). Lexical categories arise post-derivationally due to the impact of general cognitive effects upon the syntax-interface convergence (Adger p.c.). What lexical features contribute is a unique configuring of other mental systems, providing instructions to them (Chomsky 2012: 191).

Taking us slightly further afield, what reasons do we have for assuming that labeling is a language-specific operation? Arsenijević (2008: 5), through exploring similarities between language and the cognitive maps of spatial cognition, argues that when two places have the same non-geometric featural description their position relative to another place may act as the distinctive feature. This suggests that spatial computations use hierarchical structures of the kind '[THE_SHELTER [BETWEEN [THE_TREE AND THE_ROCK [ALONG [THE_WATER [BEHIND [THE_HILL]]]]]]]'. This capacity requires

an External Merge (Concatenate) operation, but crucially not an Internal Merge (Concatenate/Copy and Label) operation, which implies labeling. Another salient language-vision connection could emerge from the possibility that 'a robust quantitative constraint on the number of arguments that a predicate can take [may be] attributed to a deep-rooted constraint on the number of separate objects the visual system can track' (Hurford 2011: 56). Music and mathematics require some form of concatenation operation, but headedness appears to be absent: The sum '7 + 12' does not produce a '7-like' or '12-like' construct, but an independent numerical structure, 19.

A Label-only perspective on the evolution of grammar has other rich and interesting consequences. For instance, the relationality of nouns such as edge and hand now emerges not from the semantics of these lexical items but rather from the syntax itself. Adger (2013) argues that their semantics is introduced by a light root, with a new category labeling the structure composed from the Self Merge (that is, yielding [[x]] from [x]) of this light root, denoted by ק: [ק [N side] [ק [PP of the table][ק √PART]. ק Merges with the Prepositional Phrase, which is the appropriate semantic type to Merge with N, yielding at CI: $\lambda x.\text{side}(x) \land \text{part}(x,\text{the-table})$. What Coetzee (2013: 122) calls 'chairs and their chairness' arises not through visual perception (which contributes, at most, sortal and colour features (see Carey 2009: 273 for an overview of these visual computations)) but rather from this labeling operation, which projects root concepts into a 'universal currency' (Boeckx 2010: 128) where they can recombine in novel ways.

If these perspectives are even approximately accurate, it follows that we should discard our favourite philosophy of language textbooks, which sever content from form (and universally sideline the latter), and instead approach the Decompositionalist Project by establishing a division between (semantic) content that relies on the forms of grammar and content that does not. As

mentioned, Epstein et al. (2014) demonstrate that syntactic derivations are driven by the need to label structures, providing interpretive instructions to the CI system. It remains to be seen what other syntactic and semantic phenomena labeling is responsible for, but for now we can conclude that Label plays a substantial – perhaps unique – role in human cognition.

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Competing Interests

The authors declare that they have no competing interests.

Notes

[1] The architectural and evolutionary implications of separating labeling from Merge have oddly not been discussed by Chomsky and other linguists assuming his model (e.g. Larson 2015).

[2] I assume DP/KP ([K[D,NP]]) is a phase (Svenonius 2004, Caha 2009, Bošković 2012), which forms part of a basic phase-non-phase rhythm to syntactic computation: [C-T[v-V[K-N]]] (Uriagereka 2012).

[3] If we also acknowledge the problem of copredication (Gotham 2012, 2015, Murphy 2012, forthcoming), perhaps it becomes more accurate to say that a book can be 'realised as' – or have as its 'host' – a physical medium, more than it would be to say that a given physical object is itself a book.

[4] Similarly, Hinzen et al. (2011: 278) note of consciousness that 'It is not clear whether any such form of self-reference can be sustained in the absence of a system of grammatical person'. Note that

philosophers of language (e.g. Ray 2014) universally ignore the importance of syntax in the construction of truth and reference.

[5] Informally speaking, it has been well established by ethologists that animals do not have names for things, but what is not recognised by most is that neither do humans: 'Internalist' studies in philosophy of language convincingly show that lexical items are highly intricate and conceptually independent of the entities posited by physical theory (Chomsky 2000, 2013a, Hinzen 2006, 2007). Contrary to externalists like Putnam (1975) and Burge (1979), water does not 'equal' H2O partly because 'Entities in a domain of the mind do not symbolize other elements in that domain: they are the elements' (Bouchard 2013: 44). Indeed, 'the belief in the existence of definitions is really utopian' (Hornstein 1984: 132).

[6] My thanks to Cedric Boeckx for helpful discussion on this point.

[7] See Varley & Siegal (2000) and Bloom (2000) for a particular lesion case providing support for the division of linguistic and conceptual meaning.

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