

The noun/verb and predicate/argument structures

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Abstract

Previously, establishing a correspondence between the noun/verb and first order predicate logic's predicate/argument structures has been found problematic (Hurford, 2003a,b). The present paper argues that the predicate/argument system of natural language is more complex than that of first order predicate logic, with up to three levels of predicates and arguments and a rule system for generating predicates and arguments and converting predicates to arguments and vice versa. A property of this system is that nouns correspond to linguistic arguments and verbs correspond to linguistic predicates while the scope of linguistic arguments and predicates is not restricted to nouns and verbs. In addition, some particular properties of this system as well as general properties of any predicate/argument structure suggest that linguistic arguments (e.g. nouns) may be evolutionarily more fundamental than linguistic predicates (e.g. verbs). The second part of the paper analyzes this hypothesis, originally proposed by Heine and Kuteva (2002, 2007), and concludes, with a number of new arguments from a variety of domains, that the evidence of linguistic arguments predating linguistic predicates is overwhelming.

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1. Introduction: language fossils

As Ray Jackendoff has noted, the claim that language does not fossilize is not entirely correct (Jackendoff, 1999). While it is true that “linguistic behavior does not fossilize” (Hauser et al., 2002:1571), this does not preclude the existence of language fossils as structural-functional types.¹ It is plausible that such ‘language fossils’ have been maintained in modern language since no better functional analogues have been and possibly could not be developed. The evolution of language, especially the evolution of grammar and vocabulary has largely been driven by a need for higher precision and explicitness (cf. Heine and Kuteva, 2002, 2007; Newmeyer, 2004). By hypothesis, this

Abbreviations: A, argument; AC, argument clause; ADJ, adjective; ADP, adposition; ADV, adverb; AUX, auxiliary verb; COP, copula; DET, determiner; DP, determiner phrase; F, flexible; GER, gerund; INF, infinitive; INFL, verbal inflection; IP, inflection phrase (see INFL); LA, linguistic argument; LAX, linguistic argument marker; LP, linguistic predicate; LP/A, linguistic predicate/argument; LPx, linguistic predicate marker; M, masculine; N, noun; N/V, noun/verb; NL, natural language; NP, noun phrase; P, predicate; P/A, predicate/argument; PC, predicate clause; PJ, projection; POSS, possessive; PAST, past tense; S, sentence; S/NP, sentence/noun phrase; S/XP, sentence/x phrase (see footnote 4); TAM, tense-aspect-mood; V, verb; XP, x phrase (see footnote 4).

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¹ Observe that the use of the word ‘fossil’ here is different from that of in Bickerton’s (1990) ‘fossils of language’. For Bickerton, the fossils were not structural types but primitive ‘languages’, such as pidgins, the ape ‘language’, the ‘language’ of under-twins and the ‘language’ of Genie.

development has left some structural features bearing on the core communicative functions of language intact. These structural features are ‘language fossils’. Language fossils are focussed on speed or some other basic aspect of communication (see below), and form a subset of natural language structures that function independently of the “higher” principles of grammar which craft the meaning of complex propositions. Jackendoff proposes the following set of possible language fossils: (1) situation-specific symbols that cannot be integrated into syntax (except in quotes) like *hey!*, *ouch!*, *wow!* and *shh!*, (2) noun-noun compounds like *snowman*, *bellboy*; principles like (3) grouping (modifiers appear adjacent to what they modify), (4) Agent First (as in *he hit me*) and (5) Focus Last (as in *the book was dull*). For a related example, imperative mood verb forms (e.g. *Run!*, *Go!*), like the first type of Jackendoff’s language fossils, are usually shorter than all others and syntactically independent, which is an evidence of their adaptation for rapid reaction and articulation/parsing speed, important in crisis situations.

2. The linguistic predicate/argument distinction

To Jackendoff’s list of language fossils one more can be added: the linguistic predicate/argument (LP/A) distinction. It is unclear whether the noun/verb (N/V) distinction is universal in the world’s languages (Anderson, 2004; Bach, 2004; Laudanna and Voghera, 2002), but it is generally agreed upon that the syntactic functions of nouns and verbs are linguistic argument (LA) and linguistic predicate (LP), respectively (e.g. Bhat, 2000; Croft, 2005; Peterson, 2007; Sasse, 1993), and that the LP/A distinction is universal in the world’s languages.² Without further measures taken (see section 3), nouns function as LAs but not LPs, and verbs function as LPs but not LAs. Those languages that putatively lack the N/V distinction are claimed to have, instead, a class of lexical items (stems) that can function as both LAs and LPs (Czaykowska-Higgins and Kinkade, 1998; Jelinek and Demers, 1994; Kinkade, 1963; Swadesh, 1939). The latter have been sometimes named universals (Biggs, 1971; Pawley, 1966). In line with the more comprehensive terminology of flexible parts of speech (Don and van Lier, 2007; Hengeveld, 1992; Hengeveld and Rijkhoff, 2005; Rijkhoff, 2002), I name them flexibles instead (Luuk, in press). The English words *walk*, *run*, *kill*, *love*, etc. that can function as both arguments and predicates are examples of flexibles. I define noun, verb and flexible (F) as follows:

- (1) N = the propensity of stems to receive LA markers but not LP markers.
- (2) V = the propensity of stems to receive LP markers but not LA markers.
- (3) F = the propensity of stems to receive both LA and LP markers.

LA markers mark LAs, and LP markers mark LPs, by definition. Thus, N is aligned with LA, V is aligned with LP, and F is aligned with both LA and LP. LA and LP markers are defined in (4) and (5). Morphologically, ‘root’, ‘stem’ and ‘word’ are designated as follows: root = the base form; stem = root plus any number of derivational affixes (if applicable); word = stem plus any number of inflectional affixes (if applicable).³ The reference to ‘stems’ complies with the common assumption that stems rather than functional heads bear lexical categories, and with several specific observations (e.g. that tense–aspect–mood markers attach to stems rather than to full words in most languages—see below). If we were to assume that functional heads rather than stems bear lexical categories (Borer, 2003, 2005a,b; Marantz, 1984), we could have definitions like “N = the propensity of LP but not LA markers to mark a particular stem” instead of (4)–(6). The definitions would work either way.

There are two reasons why I assume that stems rather than functional heads bear lexical categories. First, this assumption is intuitively more plausible and, thus, shared by the majority of researchers (e.g. Anderson, 2004; Anward,

² LA and LP refer to NL arguments and predicates **only**. This is important, as LA and LP do not have to correspond to first order predicate logic arguments and predicates. There is no confusion over this matter: whenever LA or LP is mentioned, I am referring to NL not predicate logic arguments and predicates. Throughout this paper, all references to predicate logic arguments and predicates are clearly marked.

³ Word has traditionally been a difficult concept to define (Broschart, 1997; Di Sciullo and Williams, 1987; Greenberg, 1963). Although Dixon and Aikhenvald (2002) propose separate definitions for ‘phonological word’ and ‘grammatical word’, I do not find the distinction particularly useful. First, their definition for ‘phonological word’ has no bearing on semantics or grammar. Clearly, this is not what is meant by ‘word’ in any other (i.e. non-phonological) sense. In order to have any non-phonological significance, ‘phonological word’ must refer to phonological criteria for ‘word’. As this would, obviously, require ‘word’ to be defined beforehand, ‘phonological word’ is either (a) of no consequence outside phonology, or (b) by definition secondary, and of secondary importance, as compared to a definition of ‘word’. I propose the following definition: a minimal unit of speech understood (though not necessarily used) outside context. This defines elementary word and does not preclude compound words (*doormat*) or word sentences like Yup’ik *kaipiallrulliniuk* (‘the two of them were apparently really hungry’—Mithun, 1999:38). Homonymy aside, the meaning of isolated articles and adpositions (*a*, *the*, *in*, *to* etc.) is transparent though they are never used outside context. The meaning of isolated suffixes (*-y* in *discovery*, *-ed* in *walked* etc.), however, is transparent only in the context of words they appear in.

2001; Croft, 2000; Crystal, 2004; Hopper and Thompson, 1984; Jespersen, 1924; Langacker, 2004; Lyons, 2004; Sasse, 1993; Wierzbicka, 2000). Second, the hypothesis that functional heads rather than stems bear lexical categories cannot successfully account for the failure of functional heads to bear lexical categories, as in **the embarrass*, **a comprehend*, **prairied*, etc., where the functional heads TAM and DET cannot bear lexical categories (presumably V and N, respectively). The hypothesis can account for this situation (e.g. “N = the propensity of LP but not LA markers to mark a particular stem”) only with self-subversive implications, by tacitly assuming that stems have a hidden property, a ‘functional value’ (Borer, 2005a:354–355), alluded to by “a particular stem..” in the definition above, which drives the marking. Thus, the hypothesis is not only counterintuitive but also non-parsimonious and self-subversive. In addition, Borer’s and Marantz’s hypothesis contradicts Heine and Kuteva’s (2002, 2007) theory of grammatical evolution, according to which nouns, verbs, adjectives and adverbs predate functional heads (demonstratives, case and tense markers, etc.). Definitions (1)–(3), on the other hand, provide a straightforward and uniform account of lexical categories.

If a language has N or V, it may have N or V derivation. When nouns, verbs or flexibles are nominalized or verbalized, the roots and lower order stems do not change their propensity. Instead, the derivational affix has changed the propensity of the higher order stem. Correspondingly, we have to assume that the higher order stem’s propensity overrides the propensities of lower order stems. In effect, we can have derivational chains like *agree* (V) → *agreement* (N) and *revolve* (V) → *revolution* (N) → *revolutionize* (V). Observe that, by the definition (4), pronouns and proper names constitute a subclass of N, as they, too, receive LA but not LP markers.

Thus, the universality of the LP/A distinction is independent of the universality of the N/V distinction, but not vice versa, if N and V are defined by their syntactic functions LA and LP, as they usually are (cf. (1)–(3) and Bhat, 2000; Croft, 2005; Peterson, 2007; Sasse, 1993). I argue that, in addition to the universality of the LP/A distinction across languages, linguistic arguments are universally marked by (a subset of) determiners, possessives and LP/A word order constraints, and linguistic predicates are universally marked by (a subset of) tense–aspect–mood, voice markers and LP/A word order constraints (Luuk, in press). Thus:

- (4) LAx = determiners, possessives and LP/A word order constraints.
- (5) LPx = tense–aspect–mood, voice markers and LP/A word order constraints.

Depending on the distributional criteria (see below), only a subset of determiners, possessives, TAM and voice markers in the language may qualify as LA and LP markers. Observe that many languages do not have some of these grammatical categories (e.g. determiners). However, I know of no language that fails to have at least one category of LAx and one category of LPx. According to Heine (1997), possessives are universal. Observe also that a single word order constraint could mark both LA and LP. Several approaches have proposed (a subset of) these categories, as well as gender, number, person and case, to be indicative of nouns and verbs or arguments and predicates (Broschart, 1997; Croft, 1990; Gil, 2000; Hopper and Thompson, 1984; Peterson, 2005, 2007; Sasse, 1993). For particular languages, the selection of markers in (4) and (5) may seem too narrow or conservative but my aim was to establish sufficient and universal sets. The sets of markers in (4) and (5) appear to mark LAs and LPs universally, i.e. in all languages. The issue is not simple, however. For example, N and even DET accept TAM marking in some languages, e.g. Wakashan, Chamicuro and Lardil (Jacobsen, 1979; Nordlinger and Sadler, 2004). Importantly, however, TAM marking on N or DET appears to be restricted to a proper subset of TAM paradigm in these languages. Thus, we should consider a distributional criterion which incorporates this proper subset condition in establishing LAs and LPs and, consequently, the word classes N, V and F in the world’s languages. Observe that this subset condition is covered by the formulation “. . . universally marked by (a subset of). . .” above.

In sum, the reason why number, gender and case are not included among the categories in (4) and (5) is that in many languages they mark other lexical classes besides nouns (Blake, 1994; Polinsky and van Everbroeck, 2003). In most of the cases, the marking on non-noun appears to be an instance of agreement. In some languages it is rather obvious that the words that agree with nouns or flexibles in case and/or gender bear a variety of LA marking that marks the whole XP instead of just N or F.⁴ This makes the particular LA marking, of course, useless for defining N and F. It might be

⁴ Hurford (2007) avoids the DP vs. NP debate (e.g., Bošković, 2007; Bruening, 2008; Lulu and Haitao, 2007; Progovac, 1998) by labeling the phrase XP. I suggest that, besides being a sensible precaution until the possible verdict is reached on the universality of either NP or DP, XP has the additional benefit of accommodating projections of proper names as well as argumental projections of F (e.g., *the handsome Mr. Smith*, *the run, a long walk*). Observe that this does not necessitate the NP-style analysis for XP but merely includes it as an option alongside with the DP analysis. XP is a theory-neutral term for all LA projections regardless of their licensing heads.

argued that nouns are distinct from adjectives in that the former have fixed gender whereas for the latter gender can vary. This is certainly true but the question is in the applicability of gender marking as such, not in its particular qualities. In Russian, for example, verbs can be also marked for gender. Cross-linguistically, number or person-number marking on verbs is common (found in, e.g. English, Estonian and Russian). Moreover, nouns and verbs can take identical person-number affixes, e.g. in Estonian and Classical Nahuatl (Evans and Osada, 2005). Adpositions are analyzed in more detail in section 3.1.

3. Noun-argument and verb-predicate correspondences in natural language

James Hurford has pointed to a problem with Aristotle's predicate/subject (or predicate/argument—P/A) structure (Hurford, 2003a,b). Essentially, the problem is that the same kind of term can fill both the argument and the predicate slot. For example, a term such as *man* can be the argument of *the man died* and the predicate of *Plato is a man*. First order predicate logic, on the other hand, is more distanced from the surface forms of natural languages, and the same terms cannot be both arguments and predicates. Hurford concludes that it remains to provide an explanation for the typical structure of modern languages, organized around the noun/verb dichotomy. Below I will provide the first part of an explanation by showing how the correspondence between nouns and verbs and NL predicates and arguments can be established. As any predicate logic is an artificial system which NL has no need to correspond to, the second part, establishing the correspondence between NL and predicate logic arguments and predicates, is a technical matter of representing NL predicates and arguments in predicate logic. Here are some natural language (NL) examples analyzed with respect to their P/A structure ([A ..] marks argument and [P ..] predicate).⁵ Observe that these are still linguistic not logical predicates and arguments—A and P are used instead of LA and LP only for the sake of brevity:

- (6) [A *John*][P *runs*]
 (7) [A *John*][P *loves*][A *her*]
 (8) [A *John*][P *is*][A *a man*]

I suggest that in English (and a myriad of other languages), copula heads secondary predicate, as in (8).⁶ Alternatively, in some languages like Russian, Maltese and Moroccan Arabic, secondary predicate is specified by juxtaposing two arguments.⁷ Here is an example from Russian:

⁵ It is arguable whether *loves her* in (7) should be analyzed [P *loves*][A *her*] or [P *loves*][A *her*]. The latter concords better with NL notation, where [P *loves*][A *her*] is interpreted as a VP. However, VP and NP are themselves logical abstractions and thus may be no better than first order predicate logic. I prefer the simpler interpretation [A *John*][P *loves*][A *her*], which has the logical form LOVES(x,y), and the order of arguments (x,y) stipulated by case, with the first argument (Subject) *John* taking nominative and the second argument (Object/Patient) *her* taking accusative. From the viewpoint of logic, the difference between [P *loves*][A *her*] and [P *is*][A *a man*] makes sense, as *love* is a verb that has necessarily 2 arguments. At the same time, I would not say that *be* (or *is*—see footnote 6) is a verb that has necessarily two arguments (cf. *I think, therefore I am*). Similarly, *loves her* is, uncontroversially, a verb followed by an object. Few, if any, linguists would claim that *is a man* is a verb followed by an object. It is standardly assumed that, if copula is a verb at all, it is a special kind of verb (see footnote 6), and I am not aware of predicate complements being analyzed as objects.

⁶ Similar rules of type-shifting have been proposed in, e.g., Partee (2002) and Chierchia (1998) within the framework of formal semantics, which views NPs as generalized quantifiers. This, in turn, necessitates type-shifting for referential and predicative readings of NPs. Working in predicate logic, Partee and Chierchia align linguistic predicates and arguments differently not only from what has been proposed here but also from one another. According to Chierchia (1998), bare lexical nouns can be predicates, arguments, or both, depending on the language (he suggests, however, argumental to be the default type acquisition-wise). In traditional formal semantics, however, there would be no difference in meaning at all between *cat* and *be a cat, asleep and be asleep*, etc. (Partee, 2002). According to Partee (2002), the English *be* is a potentially universal operator that is always available to turn an $\langle\langle e, t \rangle, t \rangle$ ("generalized quantifier") meaning into an $\langle e, t \rangle$ ("predicative") meaning. However, it should be noted that, according to Becker (2004), English has two copulas: one is a verb (*be*), while the other is an INFL head and is not raised from a V position (*is, am*, etc.). A more traditional analysis would view copulas as special kinds of verbs (Afarli and Eide, 2000; Bowers, 1993; Eide and Afarli, 1999). To avoid positing a separate word class for it, the copula *is* (if it exists) or *be* (if *is* does not exist) is analyzed as a subclass of verb in the present paper, as it accepts LP (TAM) but not LA marking.

⁷ In some languages at least, this holds for present tense indicative mood constructions only. As soon as, e.g., past or different mood is specified, the copula is required. Cf. the following Russian examples: *eta byla moya kniga* ~ lit., this was my book; *eta dolzha bytj moya kniga* ~ lit., this must be my book.

- (9) [A *On*][P[A *sportsmen*]].
Lit: He sportsman.
'He is a sportsman.'

The Russian *sportsmen* is an argument, as it can be marked by LA markers, e.g. determiners (*etot sportsmen*—this sportsman) but not LP markers, e.g. TAM (**sportsmen-al*—sportsman-PAST.M—**sportsmanned*). In addition, if we reverse the order of words in (9), we get *sportsmen on*—‘the sportsman is he’, where *sportsmen* functions exactly as *on* did in (9). In English, the suffix *-ing* derives a secondary argument from a verb or flexible stem:

- (10) [A *He*][P *started*][[*fir*]A *-ing*].

The resulting word, a gerund, is a V_s/F_s -*ing* construction in English (the notation is explained in footnote 8). As English gerund marking is identical to that of imperfective participle (or ‘present participle’), the two should not be confused. (11) is an example of gerund and (12) of the participle:

- (11) *This is *a/the running I expected from you.*

- (12) *John is (*a/*the) running.*

Gerunds and infinitives (e.g. *to*+ V_s/F_s constructions) are secondary arguments derived from stems of primary predicates V and F. Here is an example of English infinitive:

- (13) [A *I*][P *want*][A *to*[P *go*]].

In all languages, infinitives and gerunds function as linguistic arguments. A difference between infinitives and all other primary and secondary LAs in English is that infinitives cannot be marked by LA markers and do not project XPs, as it would violate the constraint of adpositions being peripheral constituents of LAs and LPs (cf. section 3.1). Below are two examples:

- (14) *I liked the swimming.*

- (15) **I liked the to swim.*

The adposition *to* cannot appear in the middle of LA, as in (15). As verbs and flexibles can take XP complements, so can gerunds and infinitives, as they are derived from V_s/F_s . Examples are given in (50)–(55). In Russian, gerunds and infinitives are used similarly to English:

- (16) [A *On*][P *ljubit*][A *chitat*']. He likes to read

- (17) [A *On*][P *ljubit*][A *chtenie*]. He likes reading

In addition to the above-mentioned, ‘argument’ has another meaning in linguistics. I refer to the observation that whole clauses can function as arguments under the main clause predicate (Dixon, 2006). These clausal arguments are called complement clauses (or argument clauses), and are generated by appending a clause to a complementizer, as in *I know **that** he will come; I know **where** you hid it; I know **when** it happens; I know **what** you did*. Alternatively, *that* can be omitted, as in *I know he will come*. Observe that the clauses themselves are comprised of LAs and LPs and are predicative in nature (plausibly because they are headed by V or F). Correspondingly, the term ‘predicate clause’ can be used for all main and unmarked clauses (as explained above, the marking is done by complementizers or clause order). Some examples follow (AC = argument clause, PC = predicate clause):

- (18) [PC [A I][P know][AC that [A John][P knows].]
- (19) [PC [A He][P said][AC [A winning][P was easy]].]
- (20) [PC [A Who][P knows][AC what [P happened]]?]

ACs and PCs are necessarily higher-order units than LAs and LPs, as PCs and ACs are necessarily comprised of LAs and LPs. At the same time, I am aware of only one possibility how an LA or LP could consist of a PC or AC. The possibility is complex XP, like *the things (that) you said* or *the man who was ill*. In complex XPs, an AC is adjoined to an LP (or an LP followed by an LA) to produce a higher-order LA (the XP). The rule for this is as follows (see footnote 8):

- (21) {LP+}[LA+] \Rightarrow LA₃ (*He is/knows [the man] who was ill*)

(21) stipulates that ACs preceded by LPs (which are optionally followed by an LA) are rendered as tertiary LAs. Below are some examples:

- (22) *I know [AC₁ who was ill].*
- (23) *I know [[A₁ the man][AC₁ who was ill]].*
- (24) *He started [[A₂ the nagging][AC₁ that eventually made me sick]].*
- (25) *He insulted [[A₁ the writer][AC₂ (that)[A₁ the man][AC₁ who was ill]] had seen before].*
- (26) *He pondered over [[A₁ the insults][AC₃ (that)[A₁ the writer][AC₂ who had seen [A₁ the dentist][AC₁ who was ill]] had written]].*

Three levels of clausal embedding, as in (26), is about the maximum in normal (i.e. non-metalinguistic, non-juridical and non-nonsensical) natural language usage (cf. [Karlsson, 2007a,b](#)). In (22)–(26), the outmost [...] designates LA₃. LA₃s are normal LAs in every respect. For example, they can be incorporated into PCs as well as into secondary ACs. Below are two examples:

- (27) [PC [A₃ *The man who was ill*] recovered.]
- (28) [PC John said [AC₂ (that) [A₃ [A₁ *the man*][AC₁ *who was ill*]] recovered].]

In (21), the LA on the left of the double arrow can be an LA₃. Below is an example:

- (29) *I know [[A₃ who was [A₁ this man]][AC₁ who died]].*

Here, as in (22), the outmost [...] designates AC and LA₃ (by rule (21)). In (29), *who was this man* qualifies as an LA₃; cf. *I know [who was [A₁ this man]].*

The fact that PC is headed by a predicate does not imply that PC is a predicate (cf. section 3.2). PC is a sentence. Remember what Meillet and Bloomfield said about sentence ([Graffi, 2001](#)): sentence is the largest unit of grammar. Thus, it cannot, by definition, have any arguments (as these arguments would have to be grammatically marked with respect to sentence, which would mean that sentence could not be the largest unit of grammar). If it cannot have arguments, it cannot be a predicate.

The situation, then, looks as follows. We have two sets of rules: (a) generates linguistic predicates from adjectives and linguistic arguments, and (b) generates linguistic arguments from verb and flexible stems (resulting in infinitives

and gerunds), argument clauses and linguistic arguments. Below are four examples (as the rules are to some extent language-specific, the list may be incomplete)⁸:

(a.1) {LA+}COP+ADJ/LA \Rightarrow LP₂ (*He is rich/a sportsman.*)

(a.2) {LA+}ADJ/LA \Rightarrow LP₂ (*On bogatyi/sportsmen.* 'He is rich/a sportsman' in Russian)

(b.1) INF/GER = LA₂ (*to see / seeing*)

(b.2) {LP+}[LA+]AC \Rightarrow LA₃ (*He knows [the man] who was ill*)

As LA, LP, ADJ, INF and GER can take complements and/or adjuncts, the rules include only the necessary components for secondary predicates and secondary and tertiary arguments. The full complexity of syntax can be accounted for by XPs and predicate phrases, which are the projections of LAs and LPs, respectively (cf. footnote 4 and section 3.1). (a.2) is a variant of (a.1) for the languages that lack copulas or can omit them in predicative constructions. Russian is different from English in that infinitives cannot be converted to secondary predicates. **Zhitj umeretj* (literally, 'To live to die') and **On umeretj* ('He to die') are impossible in Russian, and would have to be rephrased (e.g. *Zhitj znachit umeretj*—'To live means to die') in order to be grammatical. However, Russian gerunds comply with rule (a.2). Thus, *Eto chtenie* (lit., 'This reading' ~ This is reading) is acceptable. In addition to (a.1), a few English adverbs can be used predicatively on their own in COP+ADV constructions (e.g. *back*, as in *He is back*). As there are very few such adverbs, all COP+ADV constructions that can end sentences should be viewed as idioms. Below are some examples that illustrate rules (a) and (b):

(30) [A₁ *John*][P₂ is [A₁ a painter]].

(31) [A₁ *The winner*][P₂ is [A₁ him]].

(32) [A₁ *The winner*][P₂ is [A₁ John]].

(33) [A₂ *Seeing*][P₂ is [A₂ believing]].

(34) [A₁ *This*][P₂ is [A₂ good thinking]].

(35) [A₂ *Running*][P₂ is healthy].

(36) [A₂ *To run*][P₂ is healthy].

(37) [A₁ *He*][P₂ is [A₂ to win]].

(38) [A₂ *To live*][P₂ is [A₂ to die]].

(39) [A₁ *It*][P₂ is clear][A₃ [AC₁ that [A₁ John][P₂ is ill]]].

(40) [A₁ *He*][P₂ is [A₃ [A₁ the man][AC₁ who [P₂ is ill]]]].

(41) [A₁ *I*][P₁ asked][A₃ [A₁ him][AC₂ who [P₂ is [A₃ [A₁ the man][AC₁ who [P₂ was ill]]]]]].

⁸ / means "or"; \Rightarrow indicates generation transfer; {...} specifies a necessary but non-transferred condition for the rule to hold; [...] designates an optional but transferred condition; T_s is a stem of a word of type T in the given language; T_n is an element of type T on derivational level n, where n is the natural number which corresponds to the element's derivational level (primary, secondary, tertiary, etc.).

3.1. Adjectives, adverbs and adpositions in the linguistic predicate/argument structure

Ns are prototypical LAs, Vs are prototypical LAs, and F can be both depending on the marking, but there are still two major word types that need to be accounted for—namely, adjectives and adverbs. As adjectives and adverbs are usually adjuncts of N, V, F or ADJ, their LP/A status is determined by their lexical heads. In effect, adjectives and adverbs can become parts of XPs and predicate phrases. As I pointed out in footnote 5, VPs typically include LAs, i.e. VP is unsuitable for the category of predicate phrase if we are to maintain the LP/A distinction. Predicate phrases include phrasal verbs (e.g. *carry out*), numerous idioms (e.g. *kick the bucket*), V/F constructions modified by adverbs, as in (42) and (43), adjectives and infinitives modified by adverbs in copular constructions ((44) and (45)), and gerunds, nouns and flexibles modified by adjectives (that can, in turn, be modified by adverbs) in copular constructions ((46) and (47)). Observe also that modifiers (adjuncts) do not have to be adjacent to their modified heads (48):

- (42) *He [P talked interestingly].*
 (43) *They [P reluctantly agreed] to close the case.*
 (44) *This [P is very interesting].*
 (45) *The patient [P is soon to die].*
 (46) *This [P was almost perfect skiing].*
 (47) *This [P was a very interesting potato/talk].*
 (48) *I [P know] this place [P well].*

In (48), *know (x) well* should be analyzed as one predicate phrase not two predicates. XPs can contain adjectives and adverbs as adjuncts of N/F/GER and ADJ, respectively (cf. (49)). Infinitives and gerunds can have adverbs as adjuncts. In addition, as verbs and flexibles can take XP complements, infinitives and gerunds can have XP complements as well (cf. (50)–(55)):

- (49) *[A₁ a nearly perfect evening/walk/skiing]*
 (50) *John wanted [A₂ to close [A₁ the unpleasant case] quickly].*
 (51) *Our goal is [A₂ to buy [A₁ a BMW] quickly].*
 (52) *[A₂ To close [A₁ the unpleasant case] quickly] is our goal.*
 (53) *[A₂ Buying [A₁ a BMW] quickly] is our goal.*
 (54) *You'd better start [A₂ buying [A₁ a BMW] quickly].*
 (55) *I want [A₂ [A₁ you] to buy [A₁ a BMW] quickly].*

In (49), the adjective *perfect* and the adverb *nearly* are incorporated into the LA (and XP) *a nearly perfect evening/walk/skiing*. Under the NP analysis, the LA would be the projection of the N/F/GER *evening/walk/skiing*, under the DP analysis it would be the projection of the article *a*. The fact that the LA is neutral with respect to the licensing head justifies the use of XP as a theory-neutral term for LA projections. In (50) and (52), the XP *the unpleasant case* is the complement of the verb *close*, the adjective *unpleasant* is the adjunct of the noun *case*, and the adverb *quickly* is the adjunct of the verb *close*.

Intrinsically, adjectives and adverbs are predicative, i.e. predicating a quality or circumstance. The reason why they are perceived as intrinsically predicative is probably because the main function of adjectives and adverbs is to modify N and non-N, respectively, and modification presupposes arguments (the modifier and the modified), thus being intrinsically predicative. However, as adjectives have both predicative (*the sky [is blue]*) and argumental (*[the blue sky]*) use, they could be viewed as a category that lies functionally in between LA and LP. In addition, adjectives have a distinct metonymic use of representing objects by their salient properties, as in *the good, the bad and the ugly*. In this (and only in this) use, standalone adjectives accept LA markers (both DET and POSS) in English. As LA markers mark LAs by definition, adjectives in the metonymic use are LAs by definition. However, this is a clearly marginal use, which does not interfere with definition (1). Moreover, the metonymic use of adjectives is sharply distinct from the others both grammatically (due to LA markers) and functionally, as adjectives so used do not stand for properties but for the objects that have these properties. This is supported by the fact that adjectives' supposed propensity to receive LA markers does not depend on the adjective but on the object it refers to. For example, a woman but not an evening could be referenced as '*the beautiful*', although *a/the beautiful evening* is a common expression.

In English, predicative adjectives (like *good* in *x is good*) are encoded differently from verbs, i.e. they cannot receive LP marking. Along with many other languages, English has a non-verbal encoding of predicative adjectives. However, in a number of languages (e.g. North-East Ambae, Korean, Lao, Qiang and Semelai), predicative adjectives are encoded exclusively by LP markers (Hajek, 2004). There are also many languages of mixed type, with both verbal and non-verbal encoding options available for predicative adjectives (Stassen, 2008). Languages with exclusively verbal encoding of predicative adjectives are concentrated in the Asia-Pacific region (Hajek, 2004; Stassen, 2008). In Lao, for example, TAM marking on adjectives seems to encompass the whole TAM paradigm of the language. Obviously, this poses the problem of distinguishing adjectives from verbs in Lao. As a solution, Enfield (2004) has suggested that Lao adjectives are a subclass of verbs. In all other languages, TAM marking on adjectives is restricted to proper subsets of the TAM paradigms of the languages (Hajek, 2004). Crucially, whenever adjectives are marked by LP or LA markers, they are LPs or LAs, by definition.

Adpositions are LA-LP relation modifiers. Typically, they modify relations between XPs and clause predicate. Cf. the following examples:

(56) *He walked [A to the house].*

(57) *He walked [A into the house].*

(58) *He walked [A inside the house].*

(59) *He walked [A behind the house].*

As LA-LP relation modifiers, adpositions should be analyzed as peripheral constituents of either LAs or LPs. The prepositional phrases (56)–(59) are examples of the former and phrasal verbs are examples of the latter:

(60) *The plan [P was carried out].*

(61) *He [P logged in].*

3.2. The linguistic predicate/argument conversion system: noun-argument and verb-predicate correspondences

The LP/A conversion system works as follows. Rule (b.1) converts primary LP stems to secondary LAs. Rules (a) convert primary, tertiary and (partly) also secondary LAs to secondary LPs. If primary and secondary LPs are incorporated in ACs they can be converted to tertiary LAs by rule (b.2):

(62) *We know [A₃ [AC₁ that John [P₁ sleeps]]].*

(63) *We know [A₃ [AC₁ that John [P₂ is ill]]].*

Depicted graphically, the LP/A conversion system is as follows (cf. footnote 8):

$$(64) \quad \begin{array}{l} (A_1, A_{2*}, A_3) \text{---(a)} \rightarrow P_2 \\ P_{1s} \text{---(b.1)} \rightarrow A_2 \\ (P_1, P_2) \text{---(b.2)} \rightarrow A_3 \end{array}$$

Arrows indicate possible conversions and on the arrows are written the rules which stipulate the conversions. However, Russian infinitives cannot be converted to secondary predicates (see section 3). As infinitives are of type A_2 , the restriction that not all elements of this type can be converted to secondary predicates is signalled by A_{2*} in (64). Three inferences can be made from (64). First, all LPs can be converted to LAs but not all LAs can be converted to LPs. Second, as (a.1) and (a.2) are essentially a single rule (a) that is slightly different for different languages, tenses and moods (cf. footnote 7), there are more rules for converting predicates into arguments than vice versa. Third, there are three levels of arguments but only two levels of predicates. Together with the inherent asymmetry of P/A structure (essentially, arguments being elements and predicates being operations with these elements—see point 1 in section 5), the inferences suggest that LAs may be evolutionarily more fundamental than LPs, a point taken up in section 5.

If we are concerned only with the core components of LAs and LPs (i.e. if we ignore adjuncts and adpositions), the lexicon we are interested in reduces to $\{N, V, F, \text{ADJ}, \text{LAX}, \text{LPx}\}$. N, F bearing LAX and ADJ bearing LAX are primary LAs. V, F bearing LPx and ADJ bearing LPx are primary LPs. Now we can have an overview of what count as LAs and LPs

$$(65) \quad \text{LA} \in \{N, F+\text{LAX}, \text{ADJ}+\text{LAX}, (b)\}, \text{PJ(LA)}$$

$$(66) \quad \text{LP} \in \{V, F+\text{LPx}, \text{ADJ}+\text{LPx}, (a)\}, \text{PJ(LP)}$$

LAs are nouns, flexibles bearing LA markers, adjectives bearing LA markers (cf. section 3.1), and the products of rules (b). In addition, LAs include projections of LAs (i.e. XPs). LPs are verbs, flexibles bearing LP markers, adjectives bearing LP markers, and the products of rules (a). LPs also include projections of LPs (i.e. predicate phrases as outlined in section 3.1). Finally, observe that even if all languages have LAs and LPs, it does not entail that all languages have all the eight elements from the sets in (65) and (66). For example, there is no consensus whether all languages have nouns and verbs (Anderson, 2004; Bach, 2004; Laudanna and Voghera, 2002), and the claims of adjectives not being universal (Beck, 2002; Hengeveld, 1992; Junker, 2003; McCawley, 1992; Rijkhoff, 2000; Sasse, 1993) are more frequent than those of the contrary (Baker, 2003; Dixon, 2004).

I conclude that noun-LA and verb-LP correspondences, though complicated by grammar, can be established (cf. (65) and (66)). This is a crucial step towards establishing complete correspondence between first order predicate logic and NL notations of P/A structure. It is certainly correct to argue that first order predicate logic is an artificial system which NL has neither need nor pressure to correspond to. However, it is likely that more potential correspondence problems can, like the one posed by Hurford (2003a,b), be overcome by having multiple levels of predicates and arguments in natural language.

4. The evolution of the noun/verb and the linguistic predicate/argument structures

It has been claimed that the sentence/noun phrase (S/NP) or, in a reformulated version, the S/XP distinction is universal in the world's languages (Carstairs-McCarthy, 1999; Hurford, 2007). I propose that the universality of S/XP derives from the universality of LP/A. The overwhelming majority of the definitions of S are centered around LP

(grammatical predicate).⁹ Thus there can be no S before there is LP, and there can be no LP before there is the LP/A distinction (cf. section 5, points 1 and 6). Therefore the LP/A distinction is more fundamental than the S/XP distinction. S/XP follows from LP/A, as LP provides the basis for S, and LA for XP. This answers the question of the origins of S and XP. The separate question of why do all languages provide parallel XP and S structures to express essentially the same proposition, as in [S: *the flower is delicate*][XP: *the delicacy of the flower*] and [S: *the rat runs*][XP: *the running of the rat*], assumes the universality of construction correspondences for this semantic “equivalence”, e.g.

$$(67) \quad LA_1+LP_2 = LA_1+POSS+LA_{1'}$$

as in [LA₁ *the flower*]+[LP₂ *is delicate*] = [LA₁ *the flower*]+[POSS 's]+[LA_{1'} *delicacy*], and possibly also some conversion rules (e.g. from LP₂ to LA_{1'} and/or vice versa).¹⁰ An answer to the third question of why such correspondences are universally found in the world's languages, is that they provide a structural foundation for semantic diversity. In the S/XP case, the semantic diversity, as argued by Hurford (2007), is the topic/comment structure (he aligns XP with topic and S with comment).

I have shown that S/XP can be reduced to LP/A. What could be said about the origins of the LP/A structure? Obviously, it is impossible to offer a detailed overview of its emergence. However, if Hurford (2003a,b) is correct about the perceptual P/A structure being common among mammals, we have to assume that, in certain species at least, the perceptual P/A structure was mapped onto conceptual structure, resulting in a corresponding conceptual P/A structure. This conceptual P/A structure was, in turn, projected onto language as the LP/A structure in the earlier stages of language evolution (cf. section 2). At this point, not much more can be conjectured on this issue.

In mathematics, function is a proper subset of relation, which in turn can be expressed as a predicate (Hummel, 2000). The pervading universality of P/A structure strongly suggests that the structure is not an arbitrary but an evolutionary result with neural implications, which would qualify it as a hardwired fossil—distinct from language fossils that do not have to be hardwired in the brain (cf. section 1). It has been claimed that ventral and dorsal pathways in the brain handle the predicate and argument processing, respectively (Hurford, 2001, 2003a,b). Importantly, the claim is about the P/A structure in perception and cognition, not about the P/A structures in logic and NL. If the perceptual P/A structure is a hardwired fossil, it is not only the case that the linguistic and logical P/A structures subsume the perceptual P/A structure, but also that the perceptual P/A structure may have implications on conceptualization (e.g. in the form of a corresponding conceptual P/A structure). According to Hurford (2003a, 2006a,b), even a number of non-human species have the perceptual P/A structure. The main difference between the logical/linguistic and the perceptual P/A structures is that the latter is more elementary. Some arguments of the former are analyzed as predicates taking an argument in the latter, e.g.

$$(68) \quad \text{CAME}(\text{man})$$

$$(69) \quad \text{MAN}(x) \ \& \ \text{CAME}(x)$$

Capital letters denote predicates, small letters denote arguments (x is a deictic argument variable), & is a connective (conjunction), (68) is the linguistic and (69) the perceptual interpretation. (69) hints at the possibility of a ‘protolanguage’ without grammar and the LP/A distinction, where words would have the logical form of PREDICATE(x) and could be concatenated regardless of their order. This possibility is further supported by the fact

⁹ Importantly, S (sentence) is not equivalent to LP (cf. section 3.2). For example, *is a man* in *John is a man* is an LP but not S. Similarly, *John runs* is an S but not LP (as it is comprised of an LA and LP). In contemporary linguistics, sentence is seldom defined, except within various X-bar theories, where it is usually regarded as the maximal projection of V (Gazdar et al., 1985; Kayne, 1981; Marantz, 1980) or the maximal projection of INFL (Chomsky, 1981, 1995), in the latter case, it is commonly analyzed as IP. However, these are not the only definitions of sentence that have been circulating. Both Meillet and Bloomfield have defined sentence as “a form which is part of no other form” (Graffi, 2001:1843)—thus, sentence is the largest unit of grammar.

¹⁰ In English, a conversion rule stipulates that LA_{1'} must be derived from LP₂ in (67). Thus, *the man is interesting* = *the interestingness of the man*, but *the man is interesting* ≠ *the interest of the man*, because *interest* is not derived from *interesting* (obviously, it is vice versa). Similarly, *time passes* = *the passage/passing of time*, but *time passes* ≠ *the pass of time*.

that the LP/A distinction is made by grammar. Thus, necessarily, there was no such distinction before grammar. The fact that all human languages have grammar and the LP/A distinction could point to an equivalence relation between grammar and the LP/A distinction. However, it is not known whether the first grammar rule stipulated the LP/A structure (see below). Thus the equivalence relation between NL grammar and the LP/A structure is merely a possibility.

Word order is the simplest grammatical device. Irrespective of whether one takes the analytic or synthetic view on the emergence of syntax, the first rule sufficient for a primitive NL grammar was probably a word order constraint (Heine and Kuteva, 2002; Johansson, 2006). The synthetic view assumes that the original words of protolanguage were strung together to make the phrases and sentences of full language. The analytic view assumes that the original words of protolanguage were dissected into parts which came to express the atomic meanings of full language (for more details on this distinction, see Hurford, 2000b). Like Hurford (2000a), Bickerton (2000) and Jackendoff (1999), I prefer the synthetic view. However, my definition of ‘word’ in footnote 3 is universal. Thus, when Wray, in arguing for the analytic view, says that “if, besides *tebima* meaning *give that to her*, *kumapi* meant *share this with her*, then it might be concluded that *ma* had the meaning *female person + beneficiary*” (Wray, 2000:297), *ma* is specified as a word in the sense it is defined in footnote 3. This in turn stipulates a word order constraint as the first grammar rule. The first word order constraint **automatically** results in two grammatically distinct categories for words.¹¹ Theoretically, a word order rule would suffice for the LP/A distinction. However, we do not know whether the first grammatical categories were word types (like *man go*) or just semantic roles (like *man forest* interpreted as ‘a man go to the forest’). Distinct word types would be a more plausible suggestion owing to a greater transparency of interpretation, a greater potential for combinations, and the fact that movement is a perceptually salient property (which is associated with LPs—see point 4 in section 5). I conclude that LA and LP would be the most obvious but not the only candidates for the first word categories. With different argumentation and terminology (nouns and verbs instead of linguistic arguments and predicates), other authors have arrived at a similar conclusion (Heine and Kuteva, 2002; Hurford, 2003c; Newmeyer, 2003).

Suppose that the initial grammatical distinction between LAs and LPs was made solely by word order. Such language would have been much cruder than the modern variety. Still, it would have allowed to express **events**—objects/properties caught in actions/changes. In NL, the LP/A structure seems to be a precondition of expressing events in the above defined sense.

5. Eleven arguments for the evolutionary primacy of LA over LP

Below I present eleven arguments suggesting that LAs are evolutionarily more fundamental than LPs. But first, we must eliminate a possible source of confusion. It is not a contradiction that LAs could have evolved before LPs. LAs and LPs are complementary but that does not entail interdependence. For instance, dual and plural are complementary without being interdependent (dual implies plural but not vice versa). LA does not imply the LP/A distinction. In the absence of the LP/A distinction, only one thing had to be different: as LA was the only word type, there was no need for LA marking. There is no way of knowing what were the first words but the following arguments should make it clear that they most likely approximated nouns. The eleven arguments for the evolutionary primacy of LA over LP are as follows:

1. LPs presuppose LAs they act upon. A predicate applies to a variable, whose value is provided beforehand (Hurford, 2003a). This is the reason why a language without LAs is almost inconceivable, whereas a language without LPs seems accessible enough. Nouns are prototypical LAs and verbs are prototypical LPs. One can utter *ship Amsterdam tomorrow* and be understood that “a ship will arrive in or depart to Amsterdam tomorrow” but a nounless English construction expressing the same, though possible, is not likely to be univocally understood. J.L. Borges has explored the possibility of a nounless language in one of his short stories (Borges, 1964). The sample text he produces relies heavily on imagination and adjectives, whereas a verbless language can do with nouns alone. Asymmetry is inherent to P/A (and hence, to the LP/A—Luuk) structure (Hurford, 2003b). In section 3.2, we found

¹¹ Unless we are dealing with a phonological (e.g., that the word beginning with a vowel comes first) or lexical constraint (e.g., that the word standing for the concept ‘tree’ comes first). I am not aware that there were any such constraints in the world’s languages but I cannot preclude this possibility.

that all LPs can be converted to LAs but not vice versa, that there are three levels of arguments but only two levels of predicates, and that there are more rules for converting predicates into arguments than vice versa. Budd (2006) has suggested that in complex systems with asymmetrical dependencies, the functionally necessary core component must have evolved first in relation to the ‘unnecessary’ ones. Among words, LAs are the prime candidates for the functionally necessary core component. See also point 6 below.

2. Children’s early productive vocabularies are dominated by nouns, and infant comprehension of object names appears earlier than comprehension of relational terms (Fisher, 2002; Gentner and Boroditsky, 2001; Gleitman, 1993; Waxman and Lidz, 2006). Although it has been argued that early noun dominance is not universal cross-linguistically, the evidence for this is still weaker than the evidence against it (Gentner and Boroditsky, 2001; Gopnik, 2000).
3. A virtual experiment (Steels et al., 2002) has identified a condition favoring nouns (i.e. LAs) for the first words—the condition that agents must have parallel non-verbal ways to achieve goals of interactions (e.g. pointing). Actions/changes are difficult to point to—other than, perhaps, by imitating or carrying them out. Accordingly, as compared to the first LAs, the first LPs would have been more elaborate in gestural modality. This in itself does not rule out the possibility that LPs came first, as it has, for instance, been proposed that language began as a “mixture of isolated grunts and gestures” (Bickerton, 2003:81). However, the fact that language opted for vocal not gestural modality still favors LAs over LPs for the first words.
4. LAs appeal to geometrical and LPs appeal to kinaesthetic properties of images. As Pylyshyn has argued, the intrinsic properties of images are geometrical rather than dynamic, both because the spatial intuitions are among the most entrenched, and because there is evidence that geometrical and optical-geometrical constraints are built into the early-vision system. While we can easily imagine the laws of physics being violated, it seems nearly impossible to imagine the axioms of geometry or geometrical optics being violated (Pylyshyn, 2002). Prototypically, nouns are associated more with geometrical and verbs with kinaesthetic properties. A quick look into Webster’s (1988) English dictionary supports this intuition. For example, of the first 10 nouns starting with the letter K (*Kaiser, kale, kaleidoscope, kalology, kalong, kampong, kangaroo, kaolin, kapok, karma*) only two (*kalology* and *karma*) do not appeal to geometrical properties but none appeal to kinaesthetic properties. After excluding the flexibles (which are expected to evoke both geometrical and kinaesthetic properties), only five verbs starting with the letter K remain (*kindle, knap, knead, kneel, know*). If we add the first five verbs starting with the letter L (*lacerate, lambaste, lave, learn, legislate*), we see that only three (*know, learn, legislate*) do not appeal to kinaesthetic properties. Perhaps not incidentally, these are also the verbs that do not appeal to geometrical properties. It would seem that kinaesthetic properties presuppose geometrical properties. Indeed, it is impossible to imagine movement without or outside space-time. This asymmetric dependency—the kinaesthetic properties of images depending on the geometric ones but not vice versa—together with the tendency of nouns to evoke geometric properties and the tendency of verbs to evoke kinaesthetic as well as geometric properties, suggests that nouns are cognitively more fundamental than verbs and verbs are cognitively more complex than nouns. This, in turn, suggests that nouns (LAs) may evolutionarily predate verbs (LPs).
5. Words of different grammatical category can be selectively harmed. It has been established that while some patients with language disorders show a worse performance with verbs than nouns, others show the opposite pattern. Noun superiority is frequently found in association with Wernicke’s and Broca’s aphasias and verb superiority with anomic aphasia (Mondini et al., 2004). Selective impairment of verbs is more frequent than selective impairment of nouns (Arevalo et al., 2007; Luzzatti et al., 2002). There are two mutually nonexclusive explanations for this: 1. Extensive damage to the left hemisphere language areas induces the emergence of right hemisphere lexical abilities that are limited to high frequency concrete nouns (Crepaldi et al., 2006). 2. Selective impairment of verbs is a function of argument structure complexity that is regularly associated with verbs. It has been shown that the impairment is greater with 3-place than 2-place verbs, and 2-place than 1-place verbs (Kim and Thompson, 2000; Luzzatti et al., 2006). Moreover, production of argumental nouns like the Italian *passeggiata* ‘a walk’, *risata* ‘laughter’, *pugnata* ‘a stab’, etc. is impaired at an equal level with production of argumental verbs (Collina et al., 2001).¹² I point out that all these findings

¹² Observe that many putative argumental “nouns” or “verbs” are, in fact, flexibles (e.g. English *walk, stab, run* etc., Italian *pianto, urlo, passeggiata, pugnata* etc.). Cf. *pianto* ‘crying’—*piangere* ‘to cry’, *urlo* ‘a yell’—*urlare* ‘to yell’, *passeggiata* ‘a walk’—*passeggiare* ‘to walk’, *pugnata* ‘a stab’—*pugnare* ‘to stab’.

- are consistent with two hypotheses. (1) The N/V double dissociation in aphasia is an effect of the conceptual P/A double dissociation in the brain (the circumstance that argumental nouns are impaired at an equal level with argumental verbs refers to the conceptual P/A rather than the LP/A double dissociation). (2) The N/V double dissociation is an effect of argument structure complexity. It is difficult to disentangle (1) from (2), as they have many correlated features. I conclude that the fact that the processing of LPs is more specialized and/or resource demanding than the processing of LAs suggests that the latter may be evolutionarily more fundamental.¹³
6. In all natural languages, LP is the cornerstone of syntax. Cf. Ross (1972:325): “nouns are more inert, syntactically, than adjectives and adjectives than verbs”. NL syntax is based on the principle that LPs take arguments that are differentiated by analytic (adpositions, word order) and/or synthetic (morphological) case markers. Thus, there seems to be an equivalence relation between NL syntax and LP (i.e. if a system has LPs, it has NL syntax; and if it has NL syntax, it has LPs). In addition, the utility of LAs without syntax is obvious but the utility of LPs without syntax is dubious (although imperatives can be syntactically independent, as they are optimized for producing and parsing speed—see section 1). The hypothesis that LP is equivalent to syntax, together with the axiom that there was no syntax in the beginning (Jackendoff and Pinker, 2005), favors LA over LP for the first words. Bickerton remarks that symbol and syntactic structure can be dissociated—the latter without the former is useless, whereas the former is useful per se. He further argues that this logico-pragmatical dissociation has a historical counterpart: “a variety of factors/—/suggest that, in the evolution of our species, symbolism may have preceded syntax by as much as two million years” (Bickerton, 2003:81). It is a possibility, then, that the historical dissociation between symbol and syntax is distantly reflected in NL structure in the form of the LP/A distinction.
 7. In analyzing the syntactic functions of major parts of speech, it has been frequently suggested that the function of nouns (including pronouns and proper names) is the most basic one. For a simplified language model, it has been found that noun is the only constituent class that all sentences have in common at the highest level of constituent-structure (Lyons, 2004). Referring to Jespersen, Lésniewski and Ajdukiewicz, Lyons conveys that nouns are “categories of the first degree” and that “all other parts of speech are derived, complex categories. Categories of the second degree combine with categories of the first degree (according to the principles of well-formedness/—/) to form sentences/—/” (Lyons, 2004:219–220). In analyzing semantic classes (situation, event, place, time etc.) Anward writes that “while the semantic class of person/thing seems lexicalizable by nouns, other semantic classes can be lexicalized in several ways” (Anward, 2001:730).
 8. Nichols has formulated two important principles of historical morphology: 1. Headward migration: “If any adposition or piece of affixal morphology moves, it will go from dependent to the head of the constituent, not vice versa” (Nichols, 1986:86). 2. Reduction: the original dependents get cliticized and eventually become morphological markers of their head. Principle 1 suggests that the initial marking is more likely to appear on dependent. Together, the principles suggest a morphological migration pattern from dependent to head (e.g. from N to V). The fact that, cross-linguistically, verbal morphology appears to be richer than nominal morphology, is consistent with this. Although the evidence for it circumstantial, it is not unreasonable to suspect that the morphology appeared on older elements first. As morphology obscures lexical items’ form and meaning, the latter have to be sufficiently conventionalized before any morphology can attach to them. It is plausible that older elements are more conventionalized than younger ones. Second, statistically, the longer an element has been around, the more chances it has had to attract morphology. Thus, the default assumption would be that the element that became a dependent is older than the element that became its head. An analysis of constituent types and their head-dependent relations confirms this. Cf. Table 1 (based on Helmbrecht, 2001:1425).

From Heine and Kuteva (2002, 2007) it follows that, in three pairs (2, 3, 4), the dependent element is older than the head element. In one pair (1), the situation is the other way around. Thus, the evidence for the dependent element being

¹³ It has been also found that nouns are more readily recognized than verbs in homographic priming tests (Laudanna and Voghera, 2002). In homographic priming tests, the test word is primed with a word the stem of which is phonologically and orthographically identical but semantically and grammatically different from the test word, as with the Italian *colpire* ‘to hit’ and *colpa* ‘fault’.

Table 1
Constituent types and head-dependent relations.

Constituent	Head	Dependent
1. NP	N	ADJ
2.	ADP	N
3. Clause	V	N
4.	AUX	V

older than the head element is stronger than the evidence for the contrary. Combined with the considerations put forth by Heine and Kuteva (2002, 2007), this adds up to a modest evidence that, in pair 3, N is older than V.

9. The first stage of spontaneous adult second language acquisition features noun-based utterance organization and lacks verb/argument structure (Klein and Perdue, 1997; Perdue, 1996). It has also been established that the priority of setting a (static) time reference for a situation viewed as a whole before giving it an aspectual (dynamic) perspective is characteristic of early untutored second language varieties and adult home signs (Benazzo, 2006).
10. There are more nouns than verbs, and more productive noun than verb derivation in the world's languages (Gentner, 1981; Gentner and Boroditsky, 2001; cf. Jacobsen, 1979). This also suggests that nouns are more fundamental, i.e. possibly predate verbs.
11. In the world's languages, there is at least one example of LP marking on an LA marker (TAM on DET in Chamicuro—Nordlinger and Sadler, 2004). I know of no examples of LA marking (DET or POSS) on an LP marker (TAM or voice). This asymmetry—LA markers being more independent and having a more substantial role in the lexicon than LP markers—begs an explanation. A plausible explanation is that LA markers are generally older than LP markers.¹⁴ Lexical items' form and meaning have to be sufficiently conventionalized before they can be modified by markers (cf. point 8). The conjecture that LA markers are generally older than LP markers lends some additional support to the hypothesis that LAs predate LPs.

Assuming that the initial function of language was to give orders, it could be argued that the first words might have approximated imperatives, i.e. verbs or flexibles (e.g. *Run!*, *Help!* or *Catch!*). I have already presented five rather direct arguments against this (see points 1, 3, 4, 6, 7) but let me add two more. First, as words are always interpreted in the context, orders can be also given by other word types, e.g. nouns (*Tiger!*, *Tree!*) or adverbs (*Up!*, *Quickly!*). Second, a language is not necessary for giving orders. In many cases, the desired reaction can be elicited simply by drawing listeners' attention to a potentially dangerous situation or object. Many species have developed natural alarm signal systems the effect of which approximates the intended effect of orders like *Run!*, *Flee!* or even *Help!*. Vervet monkeys have developed an alarm call system which distinguishes four different predation patterns (snakes, birds of prey, large cats, primates), eliciting a different flee response for each (Hauser, 1997). Indeed, it has been even argued that these calls might approximate words like *leopard* and *eagle* (Zuberbuhler et al., 1999). While this seems far-fetched, it goes to show that even non-human animals have calls which are functionally equivalent to fairly specific orders. Returning to humans, an inarticulate cry is usually sufficient to draw their attention to a dangerous situation. The resulting reaction (e.g. running, fleeing or helping) is an instinctive and/or learned behavior which does not require any semantics—a common knowledge of dangerous situations and how they can be neutralized is sufficient.

As for other arguments for the contrary—the primacy of LP over LA—I have found only one, presented by Hengeveld (1992) and Rijkhoff (2002, 2003). This argument, however, relies on a specific assumption, viz., that if a language has a reduced number of nouns, it lacks the category noun. I find this viewpoint inconsistent. If a language has any number of nouns (other than zero, of course), it has the category noun by definition. The lack of a typological

¹⁴ As a single word order constraint could mark both LA and LP, we cannot assume that LA markers are, as a whole, older than LP markers. Assuming the lexicon of two word types, LA and LP, a word order constraint could be sufficient for the LP/A distinction (cf. section 4).

trait must be pervasive for it to be declared absent in a particular language (Baker, 2003; Croft, 2000; Evans and Osada, 2005; Itkonen, 2000). Indeed, in their recent papers, Hengeveld and Rijkhoff have revised their views on this issue (Hengeveld et al., 2004; Hengeveld and Rijkhoff, 2005).

The claim that N is evolutionarily more fundamental than V is not new. Previously, this has been tentatively suggested within the framework of grammaticalization (Heine and Kuteva, 2002, 2007). In reconstructing early language, Heine and Kuteva (2007) propose that at stage 1 there was only one lexical category, namely “nouns” (time-stable, referential units expressing primarily thing-like concepts). The present paper agrees with this, while presenting a number of new arguments, gathered from a variety of domains, to support the claim. To my knowledge, only argument 9 and one point (the possibility of a verbless language) from argument 1 have been suggested before, by Heine and Kuteva (2007). By itself, none of the eleven argument above is sufficient to establish the primacy of LA over LP, but taken together, the evidence is overwhelming.

As for the referential origins of the LP/A dichotomy, one might speculate that all LPs are ultimately derived from the LAs used or involved in these actions—for instance, *stone* → *to stone (somebody)*, etc. This, however, is merely a speculation as the referential source for the first LPs might have been autonomous. Whichever is the case, if one assumes an equivalence relation between grammar and the LP/A distinction, LP had to evolve before grammar (i.e. in protolanguage) to support that distinction. Nowak and Krakauer (1999) have hypothesized that the N/V distinction reflects the natural way humans perceive reality—specifically, conceptualizing it as a series of **events**: somebody does something, something happens to somebody, etc.—simple constructions that, minimally, should require nouns and verbs (or, as I more conservatively suggest, LAs and LPs) to be expressed in modern language. Thus, the grammar of NL seems to have evolved to reflect the underlying “grammar” of the world we live in. Observe, however, that while it is reasonable to assume that events were conceptualized before the emergence of NL, it is not self-evident that they were conceptualized the way Nowak and Krakauer (1999) propose. In addition, there is the problem of metalanguage: Nowak and Krakauer’s formulation “somebody does something, something happens to somebody” already includes, i.e. tacitly assumes N and V.

6. Conclusion

The linguistic predicate/argument structure is the universal backbone of natural language syntax. I have argued that, in addition to the universality of the linguistic predicate/argument (LP/A) distinction, linguistic arguments are universally marked by (a subset of) determiners, possessives and LP/A word order constraints, and linguistic predicates are universally marked by (a subset of) tense–aspect–mood, voice markers and LP/A word order constraints (Luuk, *in press*). It has long since been noticed that, in natural language, the same kind of term can fill both the argument and the predicate slot, whereas in first order predicate logic the same terms cannot be arguments and predicates. This is what Hurford (2003a,b) called the ‘Aristotle problem’; Hurford concluded that it remains to provide an explanation for the typical structure of modern languages, organized around the noun/verb dichotomy. I suggest that the ‘Aristotle problem’ has remained unsolved because natural language’s predicate/argument structure has been assumed to be isomorphous to that of first order predicate logic. I argue that natural language has its own intrinsic predicate/argument structure, which is more complex than that of first order predicate logic—for instance, it has up to three levels of arguments and predicates, and a rule system that allows (among other things) to convert predicates into arguments and vice versa. Besides making things more complex, this property of the rules—linguistic predicates being convertible into linguistic arguments and vice versa—may provide also a key for the correspondence between natural language’s and predicate logic predicate/argument structures. Essentially, the solution to the ‘Aristotle problem’ lies in the following three assumptions:

- (c) In natural language, predicate/argument categorizations can be overridden by rules (a) and (b).
- (d) From (c) it follows that linguistic arguments and predicates of **different levels** can correspond to predicate logic arguments and predicates.
- (e) The generic linguistic predicate/argument system as reproduced below (observe that there may be more rules analogical to (a) and (b) in the world’s languages; the notation is explained in Abbreviations and in footnote 8):

- (70) N = the propensity of stems to receive LA but not LP markers.
- (71) V = the propensity of stems to receive LP but not LA markers.
- (72) F = the propensity of stems to receive both LA and LP markers.
- (73) LAx = determiners, possessives and LP/A word order constraints.
- (74) LPx = tense-aspect-mood, voice markers and LP/A word order constraints.
- (75) $LA \in \{N, F+LAX, ADJ+LAX, (b)\}, PJ(LA)$
- (76) $LP \in \{V, F+LPx, ADJ+LPx, (a)\}, PJ(LP)$
- (a.1) $\{LA+\}COP+ADJ/LA \Rightarrow LP_2$ (*He is rich/a sportsman.*)
- (a.2) $\{LA+\}ADJ/LA \Rightarrow LP_2$ (*On bogaty/sportsmen. 'He is rich/a sportsman' in Russian*)
- (b.1) $INF/GER = LA_2$ (*to see / seeing*)
- (b.2) $\{LP+\}[LA+]AC \Rightarrow LA_3$ (*He knows [the man] who was ill*)

An important property of this system is flexibility, as evidenced by (72), (75), (76), (a) and (b), and by the fact that a language does not require all the categories specified in (70)-(b) in order to have a working LP/A system with conversion possibilities. As the backbone of natural language syntax, the generic LP/A system is expected to be robust. By (70)-(b), a language without nouns, verbs, adjectives, determiners, copulas and voice oppositions could, in principle, have an LP/A system as powerful and flexible as that of languages with all these categories. The gist of the ‘Aristotle problem’ is that nouns and verbs do not correspond to first order predicate logic arguments and predicates. As I have shown, nouns and verbs correspond to linguistic arguments and linguistic predicates (cf. (75) and (76)). Technically, as natural language does not have to correspond to an artificial system (e.g. predicate logic), the final part of establishing the correspondence reduces to representing linguistic arguments and predicates in predicate logic by premises (c)–(e).

From rules (a) and (b), two inferences can be made. First, as (a.1) and (a.2) are essentially a single rule (a) that is slightly different for different languages, tenses and moods (cf. footnote 7), there are more rules for converting predicates into arguments than vice versa. Second, there are three levels of arguments but only two levels of predicates. Together with the inherent asymmetry of P/A structure (arguments being elements and predicates being operations with these elements), the inferences suggest that LAs may be evolutionarily more fundamental than LPs. In a slightly modified version (with N and V instead of LA and LP), this hypothesis has been tentatively proposed within the framework of grammaticalization (Heine and Kuteva, 2002, 2007). Section 5 analyzes evidence for and against this hypothesis, and reveals a number of new arguments that lend additional support to the hypothesis. The conclusion is that the evidence for the evolutionary primacy of LA over LP is overwhelming, the evidence for the evolutionary primacy of LP over LA is absent, and the evidence for interdependence between LP and LA is feeble.

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