

THE ORIGINS OF LINGUISTIC PREDICATE/ARGUMENT STRUCTURE[Ⓢ]

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The paper shows the necessity to distinguish between four different predicate/argument structures – the perceptual, the logical, the linguistic and the conceptual – and posits their logical and temporal (albeit not necessarily evolutionarily linked) sequence: perceptual → conceptual → linguistic → logical. The substance of the linguistic predicate/argument structure and its possible relations to each of these other structures are discussed.

1. Introduction¹

Predicate/argument (P/A) structure is a natural way of encoding modification, operation and relation (objects been modified by their properties, variables being operated on, elements being related with oneself or each other). A less formal and general (but still a valid) statement would be that P/A structure is a natural way of encoding **events** – objects/properties caught in actions/changes. Prototypically, nouns (N) denote objects/properties and verbs (V) denote actions/changes. There is a general agreement that argument and predicate are the syntactic/propositional functions of N and V, resp. (e.g. Broschart, 1997; Croft, 2005; Ramat, 1999; Sasse, 1993).

2. Perceptual P/A structure

The logical P/A distinction is well known (and we get to explaining the linguistic P/A structure below) but according to Hurford (2003b, 2003c), a P/A distinction is also hardwired in the brain, with distinct neural pathways for the

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¹ Abbreviations: A argument, CCLI cultural constraints on linguistic interpretation, N noun, NL natural language, NP noun phrase, P predicate, S sentence, V verb, XP noun phrase or determiner phrase (depending on the theory).

perceptual P and A processing. As the claim is about higher mammals, this perceptual P/A structure is clearly distinct from the P/A structures in logic and language (as non-human species lack language – not to speak of mathematical logic, which is dependent on the linguistic P/A structure). There is also a fundamental logical difference between linguistic (e.g. CAME(man)) and the corresponding perceptual (MAN(x) & CAME(x)) P/A formulas. We will return to this below.

3. Logical and linguistic P/A structures

Hurford (2003b, 2003c) has also formulated what he calls the ‘Aristotle problem’: in natural language, the same kind of term can fill both the argument and the predicate slot (e.g. *a man died* and *Plato is a man*), whereas in first (and second) order logics the same terms cannot be arguments and predicates.

Of course, there is a way around this problem in these logics – namely analyzing *a man* always as a predicate: e.g. $\exists x$ (MAN(x) & DIED(x)) and MAN(plato), resp. (cf. Gazdar, Klein, Pullum, & Sag, 1985; Montague, 2002 [1973]; Pollard & Sag, 1994). However, besides complicating the semantics of *a man died*, the analysis contradicts our basic intuition of these two sentence being (roughly) of the same complexity. Another problem is the lack of semantic distinction between *man* and *be a man* (cf. Partee, 2002). It would be more natural to use higher-order logic here, e.g. DIED(A(man)) and A(MAN(plato)). Then, man and MAN would be, resp., an argument and a predicate of different orders, and the Aristotle problem would be solved without resorting to any "unnatural" semantics. At the same time, various logic-specific considerations (e.g. incompleteness) might prevent us from using logics of higher than first order altogether.

All this shows that if we want to describe an (or perhaps even the most) exact, parsimonious and natural way of P/A parsing of NL, referring to it as first, second or higher-order (or even worse, mathematical) logic is insufficient. For describing the P/A system of natural language, these logical P/A systems may be both too limited in some aspect and redundant in some other. For example, by barring predicates and arguments of different orders, first and second order logics may be too restrictive, while by allowing quantifiers (\exists) and an explicit use of variables (x), all logics may be redundant for this particular task². The problem of natural P/A parsing of NL is usually not even recognized,

² The idea that connectives, quantifiers and variables might not belong to the semantic representation of NL is not new (cf. Lakoff & Ross, 1976; Purdy, 1991; Seuren, 2010).

much less solved, which is the principal reason why one should, at this point at least, keep the linguistic and logical P/A systems strictly apart.

4. Linguistic P/A structure: a universal

In Luuk (2009a, 2009b), I have tried to describe linguistic P/A system in some detail. As predicted by the consensus among linguists on P and A being the syntactic functions of V and N, resp. (see section 1), it was possible to establish N-A and V-P correspondences – nouns are linguistic arguments and verbs are linguistic predicates, while the set of linguistic arguments and predicates is not restricted to nouns and verbs. Technically, my solution to the Aristotle problem is the second of those mentioned above: a proper subset of higher-order logic, with multiple levels of linguistic arguments and predicates but without connectives and quantifiers. The exact structure of the logic of NL was irrelevant – what mattered was an optimal (the most exact, parsimonious and universal) description of the P/A system of NL. The Ps and As were defined in terms of NL entities (e.g. word classes and constructions), while their relations were described as various constructions and rules. As the system had to be universal, it was illustrated with numerous examples from different languages.

Although one cannot provide an evidence that all natural languages have Ps and As, this can be inferred from the inconceivability of an alternative (and indirectly also from the fact that all theories that explain both syntax and sentential semantics subsume P/A structure at some level or another). Modern language syntax is based on the principle that linguistic predicates take arguments that are differentiated by analytic (adpositions, word order) and/or synthetic (morphological) case markers. Thus, all languages that have adpositions or morphological case have linguistic P/A structure by definition. I am not aware of a modern language that would lack both. The universality of linguistic P/A structure also explains the universality of the sentence / noun phrase (S/NP) or, in a reformulated version, the S/XP distinction (the claims made by Carstairs-McCarthy (1999) and Hurford (2007), resp.). S is commonly defined through grammatical predicate (linguistic predicate). Thus, there can be no S before there is linguistic predicate, and there can be no linguistic predicate before there is linguistic P/A distinction (as predicate applies to an argument which is provided beforehand). Thus, the universality of S/XP reduces to the universality of linguistic P/A.

5. The evolution of linguistic P/A structure

Unless the whole complexity of natural language was there from the beginning, complex linguistic structures must have evolved from simpler ones. The same applies to linguistic P/A system. Several authors have suggested that nouns and verbs (i.e. primary linguistic arguments and predicates – Luuk, 2009a, 2009b) emerge at the earliest stages of language evolution (Heine & Kuteva, 2002, 2007; Hurford, 2003a; Newmeyer, 2003). Thus we have reasons to believe that linguistic P/A structure is both functionally and evolutionarily among the most fundamental ones in language.

5.1. *Are linguistic P/A structure and grammar interdependent?*

The fact that all human languages have linguistic P/A structure and grammar might point to an equivalence relation between the two. Being one of the most fundamental syntactic structures, linguistic P/A system implies syntax (Luuk, 2009a, 2009b). Oddly, however, it is possible to imagine syntax (and grammar) without linguistic P/A structure. It is simply not known whether the first grammar rule stipulated linguistic P/A structure. Thus the interdependence between NL grammar and linguistic P/A structure remains merely a possibility.

Word order is the simplest grammatical device (Heine & Kuteva, 2002; Johansson, 2006). The first word order constraint **automatically** results in two grammatically distinct categories for words³. Theoretically, a word order rule would suffice for linguistic P/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’). Owing to a greater transparency of interpretation and a greater potential for combinations, distinct word types would be the more plausible alternative. But distinct semantic roles would be a syntactically simpler, i.e. the more parsimonious alternative. Thus, linguistic A and P would be perhaps the most obvious but not the only candidates for the first grammatical categories. Other authors have proposed that the first grammatical distinction was N/V (Heine & Kuteva, 2002; Hurford, 2003a; Newmeyer, 2003), i.e. linguistic P/A.

³ Unless the constraint is phonological (e.g. that the word beginning with a vowel comes first) or lexical (e.g. that the word standing for the concept ‘tree’ comes first). Both of these possibilities seem remote at best.

5.2. *Conceptual P/A structure (the event structure)*

Obviously, linguistic P/A structure must reflect on the conceptual level, as it requires the ability to conceptualize the corresponding functions. As linguistic P/A structure is functionally motivated by, e.g., our ability to talk about events (i.e. objects/properties caught in actions/changes), it is plausible that the underlying ability to conceptualize events in the above-defined sense (which relies on a conceptual P/A structure) predates linguistic P/A structure, i.e. P/A marking in language. This conjecture is supported by the fact that linguistic P/A structure is useless without the ability to conceptualize the functions of linguistic predicate and argument but the ability to conceptualize events is useful even in the absence of language (e.g. in behavioral planning, which increases the individual's fitness). A capacity to conceptualize events could be both possible and adaptive to a non-linguistic species. Quite obviously, this raises the question whether there are extant non-human species possessing it. Some recent findings on, e.g., non-human mental time travel (Correia, Dickinson, & Clayton, 2007; Osvath, 2009; but see Suddendorf & Corballis, 2010), seem to suggest that there might be.

5.3. *Protolanguage subsumes conceptual P/A structure*

Protolanguage lacks syntax by definition (Bickerton, 1990; Jackendoff & Pinker, 2005). Yet, as the event structure (something happens, somebody does something etc.) is a natural and ubiquitous correlate of human conceptualization, events were most likely expressed in protolanguage as well. The alternative – the assumption that the event structure was brought about by language – is implausible for the following reasons: 1. What was there to communicate in protolanguage if not real or imaginary events from past, present or future? 2. If, on the other hand, events were conveyed and conceptualized in protolanguage not by the event structure, it is difficult to imagine a way for this. Worse, there would be no continuity between protolanguage and language (at least not in fundamental meaning-conveying structures). 3. As language depends on the event structure (but not vice versa), the event structure either antedated language or the two arose simultaneously. As compared to the normal course of evolution (with the functionally necessary core components evolving before their dependents – Budd, 2006), the latter possibility would be next to miraculous.

How were events expressed in protolanguage? As protolanguage is either holophrastic or arbitrarily concatenated language, and the holophrastic hypothesis (Wray, 1998) seems to be ruled out (Bickerton, 2003; Johansson,

2008; Tallerman, 2007), the obvious way would be single-word utterances and free concatenation (e.g. *field wolf*, *wolf field* etc.). How was interpretation constrained? Whereas language=grammar+lexicon, for protolanguage the respective formula is protolanguage=CCLI+lexicon. Cultural constraints on linguistic interpretation (CCLI) are the pragmatic, logical and ontological constraints that are not imposed on linguistic expression grammatically or lexically but are necessary to narrow down its interpretation. CCLI maintain an expectancy horizon as to what counts as an 'event' in a given culture – a complex of features such as salience, possibility, feasibility, familiarity, unexpectedness, emotionality (Dessalles, 2008) etc., which help to guide the interpretation, while together providing a culturally unique relevance criterion.

6. Conclusion

It might be worthwhile to summarize some claims made in this paper. 1. Nouns are linguistic arguments and verbs are linguistic predicates but the set of linguistic arguments and predicates is not restricted to nouns and verbs. 2. Linguistic P/A structure is both functionally and evolutionarily one of the most fundamental types in language. 3. Linguistic P/A structure is universal in modern languages. 4. The universality of S/XP can be reduced to the universality of linguistic P/A. 5. Linguistic P/A distinction is a plausible but not the only candidate for the first grammar rule.

If Hurford's (2003b, 2003c) intuition and analysis in positing the perceptual P/A were correct, we have four different P/A structures in the following logical and temporal sequence: perceptual → conceptual → linguistic → logical. Observe that this does neither entail nor preclude that all these structures are evolutionarily linked. More specifically, the existence of an (intuitively appealing) evolutionary link between perceptual and conceptual P/A structures is unclear. Conceptual P/A structure is isomorphic to the linguistic one (see section 5.2), which means that it cannot be isomorphic with the perceptual P/A structure (as linguistic and perceptual P/A structures are non-isomorphic – see section 2). Of course, the non-isomorphism alone is insufficient to rule out the possibility of mapping perceptual P/A structure onto conceptual structure in a way that could (eventually) yield conceptual P/A structure. In whatever way conceptual P/A structure emerged, it was projected onto language as linguistic P/A structure at an early stage of language evolution.

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