

## Formal Monkey Linguistics

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based on joint work with

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### *Abstract*

We argue that rich data gathered in experimental primatology in the last 40 years might benefit from the type of analytical methods used in contemporary linguistics (from this methodological proposal, no claim follows about an evolutionary connection between primate calls and human language – a question we set aside here). Focusing on the syntactic and especially semantic side, we argue that these methods could help clarify five questions: (i) what syntax, if any, do monkey calls have? (ii) what is the 'lexical meaning' or proximate trigger of individual calls? (iii) how are the meanings of individual calls combined? (iv) how do calls or call sequences compete with each other when several are appropriate in a given situation? (v) what is the division of labor between call meanings and world knowledge in information transmission? We illustrate the benefits of this 'monkey linguistics' by way of cases studies in which we seek to assess the merits of competing theories.

In Schlenker et al. 2014, we investigated the alarm calls of male Campbell's monkeys from two sites, the Tai forest (main predators: leopards and eagles) and Tiwai island (main predators: eagles – and no leopards). Three features of the analysis are particularly relevant. First, a suffix, *-oo*, was taken to modify in a regular way the meaning of two roots (*krak* and *hok*), hence a non-trivial compositional structure at the word level. Second, there was evidence for apparent 'dialectal' variation: one of the calls, *krak*, was primarily used as a leopard alarm in Tai, but as a general alarm on Tiwai. Third, while one possible analysis posits a difference in the lexical meaning of *krak* across Tai and Tiwai, a possibly superior alternative posits a uniform meaning of general alarm at the two sites, together with a process of pragmatic enrichment akin to scalar implicatures: the competition between *krak* ( $\approx$  alarm) and (i) *krak-oo* ( $\approx$  weak alarm) and (ii) *hok* ( $\approx$  aerial threat) leads to an enriched meaning of 'serious ground alarm' in Tai, hence a predominant leopard use; on Tiwai, the same enrichment process leads to a nearly useless meaning for lack of ground predators, hence the enrichment operation isn't applied and the unadorned lexical meaning is seen.

One important weakness of Schlenker et al. 2014 was that the Campbell's data did not allow for clear syntactic generalizations, and hence no complete 'monkey fragment' could be defined. In recent work, we revisit two species whose calls display a much more manageable syntax, as well as interesting questions of semantic interpretation.

–Putty-nosed monkeys have two main calls, *pyows*, which have a general meaning, and *hacks*, which often have an eagle alarm function. They are arranged in four kinds of sequences: pure *pyow* sequences; pure *hack* sequences; series of *hacks* followed by series of *pyows* (= 'transitional sequences'); and a small number of *pyows* followed by a small number of *hacks* (= '*pyow-hack* sequences'). The main puzzle, discussed recently by Arnold and Zuberbühler 2012, is that *pyow-hack* sequences are predictive of group movement, although it is not clear how this function can be derived from the individual meanings of the calls. Arnold and Zuberbühler conclude that this is a case of syntactic combination without semantic composition, and propose that *pyow-hack* sequences have a kind of idiomatic meaning. We explore an alternative in which calls have an underspecified meaning, which is enriched not just by way of competition with other calls (as in our analysis of Campbell's semantics), but also by an 'Urgency Principle' which mandates that calls that are indicative of predators should come at the beginning of sequences; this turns out to derive the use of *pyow-hack* sequences without positing 'idiomatic' meanings.

–Titi monkey calls (Cäsar et al. 2012, 2013) are remarkable in that they give rise to relatively stable stereotyped sequences of calls, which were shown in controlled field experiments to convey information both about predator type (e.g. cat vs. eagle) and predator position (on the ground vs. in trees). While these results might initially suggest that Titi monkeys have a sophisticated proto-language with a complex syntax/semantics interface, we argue instead that the basic calls have very simple meanings (subject to some rules of pragmatic competition); and that the richness of the calling patterns is largely due to the interaction between independently motivated ecological conditions and these very simple meanings.

In sum, our Campbell's data highlight the importance of *competition among calls* to obtain enrichments akin to scalar implicatures; Putty-nosed data show that *further pragmatic rules* (our 'Urgency Principle') can be crucial as well; and Titi data suggest that complex syntactic patterns may correlate with rich environmental conditions without thereby *encoding* information about the latter at a semantic level.

**Relevant articles:**

Schlenker, Philippe, Chemla, Emmanuel, Arnold, Kate, Lemasson, Alban, Ouattara, Karim , Keenan, Sumir , Stephan, Claudia, Ryder, Robin, Zuberbühler, Klaus: 2014, Monkey Semantics: Two 'Dialects' of Campbell's Monkey Alarm Calls. *Linguistics & Philosophy* 37, 6: 439-501. DOI 10.1007/s10988-014-9155-7

LingBuzz: <http://ling.auf.net/lingbuzz/001792>

Website: <https://sites.google.com/site/philippeschlenkerresearch/home/monkey-semantics-l-p>

Schlenker, Philippe; Chemla, Emmanuel; Arnold, Kate; Zuberbühler, Klaus: to appear, Pyow-Hack Revisited: Two Analyses of Putty-nosed Monkey Alarm Calls. *Lingua*.

LingBuzz: <http://ling.auf.net/lingbuzz/002318>

Schlenker, Philippe; Chemla, Emmanuel; Cäsar, Cristiane; Ryder, Robin; Zuberbühler: in preparation: Titi Semantics: Context and Meaning in Titi Monkey Call Sequences

LingBuzz: <http://ling.auf.net/lingbuzz/002411>

Schlenker et al.: to appear, Formal Monkey Linguistics. Final version to appear as a target article in *Theoretical Linguistics*.