In their target article, Schlenker et al. make a case that the architecture of modern formal semantics and pragmatics as it has become standard in the analysis of human language can fruitfully be applied to the study of primate communication as well. In particular, they adopt three key assumptions from linguistic theory:

– Meanings (in the sense of truth/reference conditions) are distinct from interpretations.
– Meanings are derived compositionally, i.e. the meanings of complex signals are recursively derived from the meanings of their components and the mode of syntactic combination.
– The interpretation of a sentence/discourse is inferred from its meaning using pragmatic principles plus contextual and world knowledge.

The authors list an impressive number of fascinating case studies for primate signaling systems with a syntactic structure, and they deploy various versions of the general architecture \textit{compositional semantics + pragmatics}.

The case for compositionality strikes me as entirely convincing. With regard to formal monkey pragmatics, I am not so sure. There are two reasons for me to remain skeptical; one pertains to Occam’s razor and the other to considerations of evolutionary plausibility.

A common reading of Occam’s razor is something like\footnote{Quoted from https://en.wikipedia.org/wiki/Occam’s_razor, accessed on 3/30/2016.} \textit{Among competing hypotheses, the one with the fewest assumptions should be selected}. Let us consider the possible analyses of the calls of Putty-nosed monkeys (Section 4 of the target article) under this perspective.

The non-compositional analysis is concisely expressed in three clauses in (38) of the target article, which is quoted here for convenience:

\textbf{“(38) Non-compositional analysis of pyow-hack sequences […]”}

\[ \text{for any } n \geq 1, k \geq 1 \text{ and } k < n: \]

\footnote{Corresponding Author: Gerhard Jäger: Tübingen University, Institute of Linguistics, Tübingen, Germany. Email: gerhard.jaeger@uni-tuebingen.de}
a. for any sentence $S$ of the form $S = P^n$, $\|S\| = 1$ iff there is an alert and the alarm level is at least $n$

b. for any sentence $S$ of the form $S = H^n$, $\|S\| = 1$ iff there is a serious raptor-related alert and the alarm level is at least $n$

c. for any sentence $S$ of the form $S = P^kH^{n-k}$, $\|S\| = 1$ iff the group is moving and the alarm level is at least $n$”

(Schlenker et al., this volume, subsection 4.2)

Compare this to the compositional analysis given in (42):

“(42) Sentential semantics (compositional — with an urgency parameter)

a. $\|P\|^a = 1$ iff there is an alert and the alarm level is at least $a$

b. $\|H\|^a = 1$ iff there is a serious non-ground movement-related alert and the alarm level is at least $a$.

c. If $w$ is any call and $S$ is any sequence, $\|wS\|^a = 1$ iff $\|w\|^a = 1$ and $\|S\|^a+1 = 1$.”

(Schlenker et al., this volume, subsection 4.3)

These three semantic clauses have to be complemented by quite a few additional principles and assumptions:

1. the Urgency Principle (34),
2. the (revised) Informativity Principle (44),
3. the assumption of Alarm decay (40), and
4. the piece of world knowledge given at the end of (45): “The most common situations in which there is a serious non-ground-movement-related alert but not one which is due to a threat involve group movement.”

So the compositional analysis requires seven assumptions, as opposed to three for the non-compositional analysis. Of course it is somewhat subjective how one counts assumptions, but the asymmetry here is fairly striking.

Schlenker at al. argue in favor of the compositional analysis as it is “more explanatory than the non-compositional one, which simply stipulates the meaning of pyhow-hack sequences” (op. cit., subsection 4.3). I readily concede that the compositional analysis is more elegant and intellectually more pleasing than the non-compositional one. Whether it is really more explanatory is a somewhat different matter though. The Urgency Principle is formulated as a general principle, but it actually has only one instance. It seems to me that for such an
axiom to be explanatory, it should be applicable to at least two non-trivially different cases.

The case for the *Informativity Principle* is certainly stronger as it has several applications, also across species. I have not compared the number of semantic clauses for non-pragmatic (compositional or not) analyses with the number of semantic clauses plus pragmatic principles in each case, but my overall impression is that — given the small number of different patterns for each species considered — it does not significantly simplify the semantics. Additionally it requires the assumption of abstract, unobservable “meanings”, as opposed to interpretations. Therefore, on the basis of Occam’s razor it is arguably not justified to assume a pragmatic component on top of the semantics module in the cases discussed here.

The second reason for my skepticism towards monkey pragmatics comes from evolutionary considerations. Given the discussion in the theoretical literature on the evolution of signaling, it seems plausible that natural selection can, under the appropriate circumstances, lead to the emergence and evolutionary stability of compositional languages even in the absence of consciousness, Theory of Mind etc. For instance, (Nowak and Krakauer 1999) argue that Darwinian evolution favors the development of compositionality if signals are transmitted via a noisy channel (and if some additional boundary conditions are met).

(Zuidema 2005, chapter 5) points out various weaknesses in Nowak and Krakauer’s account, and then develops a refined model affording natural selection for compositionality. He draws a distinction between two different properties of signaling systems:

- **Regularity**: The mapping between meanings and signals preserves the topological structure, i.e. similar signals tend to have similar meanings.
- **Compositionality**: The meaning of complex signals is composed of the meanings of their components (and the way they are derived).

(*Compositionality* is still to be distinguished from *productive compositionality* here, which involves generalization to novel signal combinations.)

Natural language is *regular* in this sense since replacing a single word in a sentence by a different one usually leads to a sentence with a somewhat similar meaning. The sentences *The cow is black* and *The swan is black* are somewhat similar insofar as they both ascribe the property of having black color to some definite object. Natural language phonology/phonetics is of course not regular in this sense; *red* and *led* have very dissimilar meanings despite their similarity in form.

Regularity is a weaker requirement than compositionality. For instance, indicating the height of a child with a mark on a doorframe constitutes a simple
signaling system which is regular (if two marks are close to each other, the two children in question have similar height) but not compositional.

Zuidema considers two boundary conditions:
1. The interlocutor’s payoff is monotonically related to the similarity between the sender’s intention and the receiver’s interpretation. (This means that slight misunderstandings yield a higher payoff than severe ones.)
2. Signal transmission is noisy, but not arbitrarily so. With high probability, the perceived signal is similar to the one intended by the sender.

Using various computer simulations, Zuidema demonstrates that under these conditions, natural selection often leads to the emergence of regular signaling systems. If the space of meanings and signals are appropriately structured, these are often compositional ones.

While many questions regarding the evolution of compositionality remain open, Nowak and Krakauer’s and Zuidema’s work demonstrate that there are plausible scenarios for the emergence of compositionality under Darwinian evolution.

With regard to pragmatics in the sense of the target article, this case still has to be made. Note that in the mentioned studies, natural selection operates on payoff (i.e., fitness) differences related to different meanings. Meanings are conceptualized as actions of the receiver which induce different fitness values for both sender and receiver. So they correspond to “interpretations” rather than “meanings” if we draw a distinction between semantics and pragmatics. Abstract meanings, however, being abstract, are not directly relevant for fitness. This begs the question how they — and therefore the distinction between semantics and pragmatics — could have evolved in the first place in connection with innate signaling systems.

Also, it should be noted that in the presence of pragmatic principles as invoked in the target article, interpretations (as opposed to abstract meanings) are not always compositional. So it seems that making a distinction between “meanings” and interpretations possibly undermines the evolutionary scenarios that could sustain the emergence and stability of compositionality.

The distinction between abstract meanings and interpretations — what is said vs. what is meant — is well-justified in the case of human languages. Meanings can be conceived as the invariant, context-independent aspects of interpretations, based on acquired properties of lexical items and syntactic constructions. The differences between the meaning and the interpretation of a signal is predictable from general properties of rational communication. Monkey signals, however, are arguably innate, i.e. their meanings are not acquired by individuals, and rationality considerations seem to play no role in the cases of primate com-
communication discussed in the target article. So it appears that there are neither a priori reasons to postulate a distinction between semantics and pragmatics here, nor is this distinction suggested by the empirical data.

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**References**
