

## **Pragmatic Phenomena as Living Fossils of Language Evolution**

Nobo Komagata

Department of Computer Science, The College of New Jersey

PO Box 7718, Ewing, NJ 08628, USA

komagata@tcnj.edu

### **Abstract**

While human languages are highly “analytic” in that an utterance is made up of words, primitive communication, e.g., of primates, is “holistic” in that a signal refers to the whole situation. One of the main questions is how to account for the continuity, i.e., how human languages could have evolved from primitive communication. One point is that holistic aspects can still be found in modern human languages, e.g., certain frozen expressions convey meaning more holistically than analytically. This type of linguistic property can then be seen as evidence of language evolution, i.e., a living fossil. Other potential living fossils include primitive aspects of language that surface when modern language is disrupted, e.g., in creoles, and primitive semantic type distinction of human babies’ speech.

Although the above-mentioned living fossils are essential for explaining the continuity, they are not sufficient for explaining how the analytic aspect emerged from the holistic one. Existing models of language evolution spanning this gap generally do not explain the transition. In order to bridge the gap, we would ask whether there be living fossils relevant to the holistic-analytic transition. If so, how would emerging analytic structures look and what would be motivating such a transition? Answers to these questions are important for understanding language evolution.

This paper identifies pragmatics as an area where one can find additional evidence of language evolution, especially in connection to the holistic-analytic transition. This point also suggests another possibility. That is, a variety of hypotheses and techniques used in the study of language evolution, including quantitative analyses and simulation, would become available to identifying and analyzing principles in pragmatics.

First, the paper observes multiple pragmatic phenomena corresponding to the holistic aspect of language. The literature has already reviewed speech acts as a pragmatic feature shared by both primates and humans. In addition, we can consider the notion of “inference” as a holistic aspect of human language in the following sense. Inference is a relation between two propositions, where one is a logical consequence of the other and each proposition corresponds to a holistic situation. Some aspects of “presupposition” can also be considered holistic, as it is closely related to inference.

Second, the paper introduces information structure, roughly the organization of “old” and “new” components in a sentence, as a possible living fossil. This point is based on the following observations. Since information structure does not affect the transmission of the propositional meaning of an utterance, it could have evolved independently from the propositional semantics. The division between old and new is not always clear-cut, especially in narratives. In addition, the linguistic realization of information structure and the degree of “grammaticalization” vary greatly among languages. For example, in spoken English, information structure is conveyed by intonation, fairly clearly; in written English, where intonation is lost, information structure is conveyed partially by word order, much less clearly. Information structure might still be evolving along the holistic-analytic transition, gradually establishing a language-specific means of facilitating efficient communication.

## 1. Introduction

One of the grand challenges in understanding language evolution is to fill the huge gap between human language and its beginning, presumably primitive communication comparable to that of non-human primates. While human languages are highly “analytic” in that an utterance is made of a complex composition of words, primitive communication is “holistic” in that a signal refers to the whole situation (e.g., Wray, 2000). Although such a distinction is certainly useful, we are also interested in explaining the continuity, i.e., how human languages could have evolved from primitive communication. One point put forward here is that holistic aspects can still be found in modern human languages (Wray, 2000). For example, certain frozen expressions convey meaning more holistically than analytically. This type of linguistic property can then be seen as indirect evidence of language evolution, i.e., a living fossil. Other potential living fossils include noun-noun compounds (Jackendoff, 2002) and primitive aspects of language that surface when modern language is disrupted, e.g., in creoles (Bickerton, 1981).

Although the above-mentioned living fossils are essential for explaining the continuity (Wray, 2000), they are not sufficient to explain how the analytic aspect emerged from the holistic one. While Jackendoff (2002) proposes a model of language evolution spanning this gap, he does not explain the transition. While Wray proposes an account, there remain questions about the emergence of categories. Would there be living fossils more relevant to the holistic-analytic transition? If so, how would emerging analytic structures look and what would be motivating such a transition? Answers to these questions would contribute to the understanding of language evolution.

If language began with communicative functions, its beginning cannot be discussed without pragmatics. Then, the holistic-analytic transition must involve pragmatic phenomena and there must be living fossils in pragmatics. In particular, to investigate the holistic-analytic transition, we observe how a certain aspect of language evolution can be seen in the phenomenon of “information structure.” Making a connection between pragmatics and language evolution studies, this paper attempts to shed new light on sharing methods and tools in these two often isolated fields. For example, modeling and simulation techniques in language evolution studies can be applied to pragmatic analyses, while pragmatic theories can be applied to language evolution studies more actively.

In this paper, we make several assumptions. We know that human language did not evolve from the primitive communication of non-human primates, much like humans did not evolve from apes. However, we assume that the origin of human language share some properties with the primitive communication of non-human primates (e.g., Tomasello, 2003). In this connection, we also assume that the origin of human language was holistic (cf. Bickerton, 2003). However, non-human primates’ communication is not entirely holistic; we know that apes in captivity have demonstrated the use of “word” sequences (e.g., Koko). Although researchers propose different types of proto-languages between primitive communication and human language (e.g., Bickerton, 1990, Jackendoff, 2002), this paper does not discuss this issue. On the other hand, the main focus will be on the contrast between holistic and analytic aspects, regardless of the stages of language evolution. Since the holistic-analytic transition is a challenging topic, the paper does not claim to solve the problem; it simply presents a new insight into understanding the transition. There are good resources discussing recent developments in language evolution studies (e.g., Christiansen and Kirby, 2003).

This paper is organized as follows. In Section 2, we clarify the notion of living fossils as used in this paper, with some examples. Section 3 excavates several living fossils in pragmatics. Section 4 explains why information structure is relevant to the holistic-analytic transition. Section 5 hypothesizes the evolution of information structure. The discussion will then be concluded in Section 6.

## 2. Living Fossils

In this paper, “living fossils” refer to not fully-analytic aspects in modern human language, roughly following Jackendoff (2002) and others. A simple analogy would be human body; we still retain certain “ancient” aspects, e.g., appendix and tail bones. However, we do not consider living fossils, be it anatomical or linguistic, “fossilized” because even they must be evolving as well. Furthermore, the term “evolution” is used in a fairly loose sense in this paper, encompassing various diachronic changes.

Among the most commonly used part of language, we have frozen expressions, e.g., “ciao” and “hello,” which can be considered holistic (Wray, 2000) and thus living fossils. These expressions are used to refer to a whole situation, smoothing out social interaction in a complex manner, and are not decomposable. Naturally, it would not be the case that these expressions continued to exist from the beginning of language evolution. However, it is likely that they share certain properties with expressions used before human language became fully analytic.

Another example would be noun-noun compounds (Jackendoff, 2002), e.g., “cigar smoker” and “soccer mom.” These are not holistic, but in general not compositional and thus not as productive as the compositional part of human language. While the people in certain cultures can understand the meaning of “soccer mom,” it may not be the case for some others. The relation between the words *soccer* and *mom* in this compound involves an additional information, i.e., the one who plays soccer is the child(ren) of the mom, not the mom herself. In general, the implicit relation between the components in this type of compound is extremely complex. A more systematic system might be more explicit, much like the sentential grammar. In this respect, this construction is considered a living fossil.

Other examples have been provided in the literature. Since the focus of this paper is on pragmatic phenomena, we will explore some of them more in detail in the subsequent sections, hoping that pragmatic examples could shed some light on the holistic-analytic transition.

### 3. Excavation Part 1: Pragmatic Phenomena

In Section 1, various forms of living fossils were mentioned. While many of them are not pragmatic, e.g., frozen expressions, there are pragmatic ones as well. For example, Bickerton (1981) discusses disruption in creoles. When people of multiple languages interact, a simplified form of language, pidgin, may result. In many cases, pidgin lacks the complexity of modern languages, e.g., inflection and subordination. Such a language can also be learned as a native tongue. Furthermore, Wray (2000) discusses speech acts (Austin, 1975, Searle, 1969), including directives and commissives, as a feature shared by primates and humans (citing the original work by Reiss). That is, apes too do things with noises and gestures. Jackendoff (2002) discusses placement of “agent” or “topic” at the beginning of a sentence, which is typical in many languages including pidgin and other simplified languages. Note that agent and topic are quite different concepts: the former being a label for thematic role and the latter, information structure. As a result, the notion of agent must be analyzed as part of semantics, while that of topic must primarily be studied as part of pragmatics. Information structure will be discussed more in detail in Section 4 below.

In addition, we can consider the notion of “inference” as a holistic aspect of human language in the following sense. Inference is a relation between two propositions, where one is a logical consequence of the other. For example, when a person in a room says “it’s nice outside,” he might be implying that we should go out and enjoy the sun. Of course, there could be infinitely many different implications the audience could draw. Although such a relation is extremely complex, each proposition still corresponds to a situation. We can also analyze metaphor as a special case of inference, i.e., from what is said and what is really meant.

Some aspects of “presupposition” can also be considered holistic. Presupposition (ref., Levinson, 1983) is a relation between a speaker and the appropriateness of a sentence in the context. When an entire sentence presupposes a proposition, we again see a relation between propositions. For example, a sentence “the king of France is bald” would presuppose the existence of such a king.

Of course, not all pragmatic phenomena are holistic. For example, the notion of deixis is well developed or grammaticalized (e.g., Hopper and Traugott, 1993) in all human languages; it is already analytic. In contrast, politeness is expressed very differently in different language with varying degrees of grammaticalization; it is not straightforward to map this along the holistic-analytic transition.

As discussed above, modern human language is full of pragmatic phenomena involving the holistic aspect. Thus, this can still be considered in support for the continuity between primitive communication and human language along the line of Wray (2000). Although the use of holistic representation in human language is way more complicated than that in primates, it is interesting to see that humans still heavily depend on the holistic aspect.

### 4. Excavation Part 2: Information Structure

Although we were able to see several pragmatic phenomena as living fossils, we would also question whether these phenomena are any good to explain the holistic-analytic transition. This section introduces the notion of “information structure” as a living fossil and points out that it has several properties relevant for the current discussion.

Information structure is the *informational* contrast between OLD and NEW components in a sentence (ref., Lambrecht, 1994, Vallduví, 1990). The most straightforward case to observe information structure is in a question-answer pair such as the following (where bold face indicates stress on the place name):

(1) Q: Where is the conference held?

A: [It is held]<sub>OLD</sub> [in **Riva del Garda**]<sub>NEW</sub>.

In the response (1A) above, the phrase providing the crucial information corresponding to the *wh*-word in (1Q) is labeled NEW.

Currently, information structure attracts a diverse analyses. There are many ways even to label these components, e.g., “topic” vs. “focus” and “theme” vs. “rheme” instead of OLD vs. NEW. In addition, there are analyses that identify multiple divisions (Vallduví, 1990), not just two categories, graded divisions (Sgall et al., 1986), or even recursive structure (Partee, 1996). However, through careful analysis of linguistic marking and other factors, it is possible to tentatively conclude that languages at least exhibit binomial, non-recursive information-structure divisions, i.e., between OLD and NEW (Komagata, 2003b).

The literature discusses a rich set of properties about information structure. Here, we observe several points that are relevant to this paper. First, information structure deals with informational contrast within a sentence. Thus, it is orthogonal to the semantics in the sense that information structure does not change the propositional meaning of a sentence. Due to this property, we can observe the development of information structure independent of the grammar. This is in contrast to the notion of “agent.” Thus, although “agent” and OLD (“topic”) are occasionally discussed together (Jackendoff, 2002), we must emphasize that these notions work at rather different levels and must be carefully distinguished. In this connection, Maynard Smith and Harper (2003) seems to interpret the role of word order too simply. Second, information structure is important for contextual appropriateness. For example, it would be inappropriate to respond to the question (1Q) with “It is **held** in Riva del Garda.” We often feel the strong effect of contextual appropriateness; bad information structure can give rise to really hard-to-read texts.

Information structure is realized differently in different languages. For example, in spoken English, intonation most prominently marks information structure (Steedman, 2000). That is, there is a specific pitch accent that indicates “Riva del Garda” in (1A) is a part of NEW. In written English, information structure is at least to some extent indicated by word order (Halliday, 1967). For example, choice of active vs. passive voice can be judged based on contextual appropriateness, although it will not be a grammatical judgment. In Czech, however, word order is said to mark information structure much more strongly (Sgall et al., 1986). In Japanese, certain morphological marking is used (Kuno, 1972). For example, OLD component is typically marked by a particle *wa*. The use of this particle is grammaticalized. Thus, incorrect use of the particle will be judged ungrammatical. Thus, depending on the level of grammaticalization, the use of information structure can be considered with respect to contextual appropriateness or grammatical judgment (still context dependent).

As for the Japanese particle *wa*, we have some information about its history. This particle is considered to have originated as a type of contrastive marker about one thousand years ago (Ueno, 1987). That is, a phrase *X-wa*, with phonological prominence within *X*, would imply the existence of *Y*, different from *X*, which does not share the property of *X*. Note that this use of *wa* still continues to this date. Since then, the other function (OLD-marking) must have evolved. Depending on the degree of contrast associated with varying degree of prominence, the use of this particle evolved into a weaker, less and less contrastive case. This case seems to have picked up the function to indicate the OLD component of a sentence. Eventually, the use of *wa* without stress is always associated with the OLD component and the grammaticalization is now complete. It is not clear whether there already was a linguistic element that served as an OLD marker before this development.

Now, one problem that is often overlooked is that identification of OLD and NEW components can be very difficult, esp. in written texts. For example, it would be a challenge to analyze the information structure of each sentence in this paper. Note that we know that information structure is present in written texts because we can observe contextual appropriateness associated with information structure in both spoken and written discourse. This potential problem with information structure is actually the key to understanding information structure. For example, logic-based approaches that require crisp judgment would be problematic. It may well be the case that the OLD-NEW distinction is relative, e.g., with respect to information-theoretic interpretations (Komagata, 2003a).

Following Jackendoff (2002), this paper views information structure as a living fossil. In addition to what Jackendoff wrote, we have seen additional properties that are useful for this discussion. As we noted, information structure has not developed into a fully recursive structure; thus, it is still in pre-analytic stage, even though it is beyond holistic. Since information structure is orthogonal to propositional semantics, it is possible that information structure exist independent of the grammar associated with propositional component. This allows us to investigate the evolution of information structure by superimposing it to the already analytic grammar. In addition, since information structure is not required to deliver the propositional meaning, it would be acceptable for the two categories, OLD and NEW, to be somewhat vague. We also noted diverse realization and evidence of evolution with respect to information structure.

Compared to the grammatical component, information structure is extremely simple and it may never develop a similarly complex, recursive structure. Nevertheless, information structure could be exhibiting a state of development where the analytic aspect of human language once passed. Although propositional semantics and information structure carry rather different parts of complex meaning, they both contribute to the function of a sentence, i.e., how it affects the listener or the society in general. Thus, the view of information structure here could provide a new way of connecting this pragmatic phenomenon with the evolution of language.

## 5. Reconstruction: The Evolution of Information Structure

This section presents a hypothetical scenario of how information structure might have been evolving. It will be shown that such an analysis could shed some light on the evolution of language as well.

For a holistic signal with no internal structure, there would be no information structure. The entire signal must be sent in the expected way. Suppose that such a signal becomes more complex, e.g., longer and some possibly random variations emerge. Variations may involve intonation, word order, morphology, etc. However, if a certain variation which differs with others in some respect happens to be associated with a certain important aspect of the involved situation, by chance. For example, the special variation might be associated with specific time, location, agent, action, or ease of understanding. This could lead to the development of a signal component associated with the special variation. Note that this scenario is more top-down and focuses on the decomposition of the whole (e.g., Arbib, 2003), but contrasts with the idea that syntax evolved as concatenation of words (e.g., Bickerton, 2003).

Next, suppose that a two-phrase sentence, e.g., a subject-predicate sequence, can be expressed in either phrase order, with no functional distinction initially. However, as the involved concept becomes more complex, the listener may start experience difference in her ability to understand the two distinct ordering. In a context where the listener is already familiar with the subject and expecting new information about it, the listener may be able to understand the utterance better in the subject-predicate order rather than the other way around (Komagata, 2003a). If the listener can understand well, the probability of the speaker repeating the same sentence again would be smaller. In this manner, the information-structure components, OLD and NEW, can emerge as word order through interactive communication in a society.

Although it is somewhat intuitive that the OLD-NEW ordering is easier to understand, there are some potential problems. One is with languages with relatively rigid word order already established within its grammar. For example, in English, the basic word order is subject-predicate. What about if the subject is NEW? Even a language like English, there are syntactic mechanisms that change the word order, e.g., VP preposing, which can indeed be used to set up a contextually appropriate information structure. The situation is analogous for so-called verb-initial languages (e.g., Welsh, some Mayan languages). Another potential problem would be the existence of languages that tend to place NEW component before OLD (e.g., Iroquoian, Mithun, 1995). However, these languages too employ various “movement” operation including frequent fronting of adverbial phrases to set the context (Komagata, 2003a). In addition, most of the OLD components placed after the NEW components, e.g., pronouns, contain little information. Thus, even these languages seem to be consistent with the general idea that the OLD-NEW ordering is preferable. The situation is not so clear with spoken English. In addition to the rigid word order, the spoken form also encourages conciseness. As a result, special syntactic constructions such as topicalization and clefts are not desirable. In such a case, OLD/NEW marking may work at a different dimension, e.g., intonation in English, morphology in Japanese.

Here is a general hypothetical case. Just to convey the propositional information, information structure is not necessary; such a situation could correspond to a vacuously holistic situation with respect to (null) information structure. However, for increased readability or contextual appropriateness, this pre-analytic structure of information structure involving (at least) two categories, OLD and NEW, may evolved, employing various linguistic marking. If the presence of information structure had been optional (i.e., early stage), it would be natural that the two emerging categories are not so clear-cut. In this respect, information structure is not fully analytic as the grammar and can be considered still evolving.

If the state of evolution with respect to information structure is as described above, it is certainly not as sophisticated as syntax-directed propositional semantics. The interesting point is that information structure is evolving in parallel to complex semantics. Then, it might be possible to see that syntax/semantics have evolved in an analogous way in parallel to something else, e.g., phonological sequence, noise/gesture combinations. Such a process is consistent with the idea that language evolved in parallel to the use of gestures. For example, in the brain of monkey, there is a region called the “mirror system”, which activates when execute *and* observe certain grasping actions and is located in the area corresponding to Broca’s area in humans (Rizzolatti and Arbib, 1998). A

speculation here is that much like information structure is evolving along with the grammar, the grammar may have evolve along with gestures. And, if the evolution of syntax mirrors the evolution of information structure in this way, we could infer certain possibilities. For example, even grammatical categories might have evolved from only two vague primitive categories; then, difficult to imagine that multiple categories emerge all of sudden in a single holistic utterance (e.g., Wray, 2000).

In this paper, we simply pointed out that the evolution of information structure could mirror an early stage of the evolution of syntax. Although the evolutionary process after the emergence of a few categories is a formidable task (and indeed most researchers on this topic focus on this stage), it would also be possible to hypothesize the evolution beyond that level. For example, Arbib (2003) argues that the increase in the complexity in the mirror system could lead to complex syntax, and Steedman (2004) argues that the requirements for modal and propositional attitude could do the same. Or, it might be the case that the addition of the third party/object to the attention attraction may be behind complex symbolic communication while grammar must be learned through imitation (Tomasello, 2003). It is possible that the key to the next level be recursion (Hauser et al., 2002). Although fairly complex sequences of symbols can be represented by regular expressions, symbol sequences that belong to context-free languages must be dealt with recursion. One real-life application of recursion is navigation, which may be relevant to the development of recursion. For example, when one travels from her base to a certain destination, she needs to remember the way to the destination in a “stack”-like structure. On her way back, she can then retrieve information in reverse order from the stack. With such an ability, one can deal with context-free grammars.

## 6. Conclusion

This paper supports the idea that human language evolved continuously from primitive communication (e.g., Wray, 2000) by reviewing pragmatic phenomena as living fossils. In particular, we recognize information structure as a living fossil, being in a pre-analytic stage, and hypothesize how it might be evolving in parallel to the grammar.

Through the discussion, the paper introduces new insight into language evolution. Once the connection between pragmatics and language evolution is more actively studied, a variety of hypotheses and techniques used in these two areas can be shared. For example, quantitative analyses and simulation, would become available to identifying and analyzing principles in pragmatics and pragmatic principles could be applied to language evolution studies more effectively. The future directions of this project include diachronic study of information structure, computer simulation of evolving information structure and extension of the discussion to another pragmatic notions, e.g., context, and application of the current work to the early stage of language evolution possibly involving the mirror system.

## Acknowledgements

The author would like to thank: Alison Wray for comments on an earlier draft, Chris Bertinato for discussion on relevant topics and complex systems in general, the Dept. of Computer Science, the School of Science, The College of New Jersey for their support, and the reviewers and the participants of the conference for comments. This project is partially supported by The College of New Jersey SOSA Award (2004-2005).

## References

- Arbib, Michael A. 2003. The Evolving Mirror System: A Neural Basis for Language Readiness. In *Language evolution*, eds. Morten H. Christiansen and Simon Kirby, 182-200. Oxford: Oxford University Press.
- Austin, J. L. 1975. *How to do things with words (originally in 1962 from Clarendon Press)*, 2d ed. Cambridge, MA: Harvard University Press.
- Bickerton, Derek. 1981. *Roots of language*. Ann Arbor, MI: Karoma.
- Bickerton, Derek. 1990. *Language and species*. Chicago: University of Chicago Press.
- Bickerton, Derek. 2003. Symbol and Structure: A Comprehensive Framework for Language Evolution. In *Language evolution*, eds. Morten H. Christiansen and Simon Kirby, 77-93. Oxford: Oxford University Press.
- Christiansen, Morten H. and Kirby, Simon. 2003. *Language evolution*. Oxford: Oxford University Press.
- Halliday, Michael A. K. 1967. Notes on Transitivity and Theme in English (Part II). *Journal of Linguistics* 3:199-244.
- Hauser, Marc D., Chomsky, Noam, and Fitch, W. Tecumseh. 2002. The Faculty of Language: What Is It, Who Has It, and How Did It Evolve? *Science* 298(5598):1569-1583.
- Hopper, Paul J. and Traugott, Elizabeth Closs. 1993. *Grammaticalization*. Cambridge: Cambridge University Press.

- Jackendoff, Ray. 2002. *Foundations of language: brain, meaning, grammar, evolution*. Oxford: Oxford University Press.
- Komagata, Nobo. 2003a. Contextual Effects on Word Order: Information Structure and Information Theory. In *Modeling and Using Context: 4th International and Interdisciplinary Conference CONTEXT 2003*, eds. Patrick Blackburn, Chiara Ghidini, Roy M. Turner, and Fausto Giunchiglia, 190-203. Berlin: Springer-Verlag.
- Komagata, Nobo. 2003b. Information Structure in Subordinate and Subordinate-Like Clauses. *Journal of Logic, Language and Information* 12(3):301-318.
- Kuno, Susumu. 1972. Functional Sentence Perspective: A Case Study from Japanese and English. *Linguistic Inquiry* 3(3):269-320.
- Lambrecht, Knud. 1994. *Information structure and sentence form: topic, focus, and the mental representations of discourse referents*. Cambridge: Cambridge University Press.
- Levinson, Stephen C. 1983. *Pragmatics*. Cambridge: Cambridge University Press.
- Maynard Smith, John and Harper, David. 2003. *Animal signals*. Oxford: Oxford University Press.
- Mithun, Marianne. 1995. Morphological and prosodic forces shaping word order. In *Word Order in Discourse*, eds. Pamela Downing and Michael Noonan. Amsterdam: John Benjamins.
- Partee, Barbara H. 1996. Allegation and local accommodation. In *Discourse and meaning: papers in honor of Eva Hajičová*, eds. Barbara H. Partee and Petr Sgall, 65-86. Amsterdam: John Benjamins.
- Rizzolatti, Giacomo and Arbib, Michael A. 1998. Language within our grasp. *Trends in Neurosciences* 21(5):188-194.
- Searle, John R. 1969. *Speech acts: an essay in the philosophy of language*. Cambridge: Cambridge University Press.
- Sgall, Petr, Hajičová, Eva, and Panevova, Jarmila. 1986. *The meaning of the sentence in its semantic and pragmatic aspects*. Dordrecht: D. Reidel.
- Steedman, Mark. 2000. Information structure and the syntax-phonology interface. *Linguistic Inquiry* 31(4):649-689.
- Steedman, Mark. 2004. Where Does Compositionality Come From? (<ftp://ftp.cogsci.ed.ac.uk/pub/steedman/affordances/aaifall04.pdf>). In *2004 AAAI Fall Symposium*.
- Tomasello, Michael. 2003. On the Different Origins of Symbols and Grammar. In *Language evolution*, eds. Morten H. Christiansen and Simon Kirby, 94-110. Oxford: Oxford University Press.
- Ueno, Noriko Fujii. 1987. Functions of the Theme Marker *Wa* from Synchronic and Diachronic Perspectives. In *Perspectives on Topicalization: The Case of Japanese 'WA'*, eds. John Hinds and Shoichi Iwasaki, 221-263. Amsterdam: John Benjamins.
- Vallduví, Enric. 1990. The informational component, Ph.D. thesis, University of Pennsylvania.
- Wray, Alison. 2000. Holistic Utterances in Protolanguage: The Link from Primates to Humans. In *The Evolutionary emergence of language: social function and the origins of linguistic form*, eds. Chris Knight, Michael Studdert-Kennedy, and James R. Hurford, 285-302. Cambridge: Cambridge University Press.