nature of statistical analyses. However, combining a non-mathematical introduction to statistics for psycholinguists with coverage of some more advanced techniques and an introduction of a difficult software package might have proven too ambitious a goal. Each of the three ideas that together gave rise to this book might secure a separate volume on its own. This book would not be enough as an introduction to statistics. It is instead most successful as a practice book to learn R in order to use new statistical techniques – the large amounts of code are useful if you work through the book sat by a computer, cumbersome otherwise. It is most likely to appeal to those who already have some statistical and computing experience, who are aware of the limitations of traditional statistical methods and who are interested in trying out R to run more appropriate analyses of their data. If you fit this bill, this is an excellent book that is worth the effort of working through.

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Reviewed by Grzegorz Krajewski and
Danielle Matthews
Max Planck Child Study Centre,
University of Manchester

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Language is commonly considered a unique human property. Any typically developing child who is surrounded by and interacts with mature speakers acquires the language of the community without any explicit instruction. Acquiring language seems to be so natural that Pinker (1994: 11) claims that language is a human instinct and an evolutionary adaptation. If language is an evolutionary adaptation, then where did it come from and how did it evolve? These core questions are not that simple to answer. Hauser, Chomsky & Fitch (2002) propose that if one starts the inquiry from the common ancestor of primates and humans, then one needs to determine what was inherited from the common ancestor, what has undergone modification, what is qualitatively new and what selectional pressure led to

adaptive change. They posit that answering these questions requires 'a collaborative effort among linguists, biologists, psychologists, and anthropologists' (p. 1570).

Michael Tomasello's latest volume, *Origins of Human Communication*, represents an intriguing interdisciplinary approach to this problem based on a socio-cognitive and cultural account. In this book, Tomasello presents a provocative theory that provides a convincing account for where and how human communication diverged from other primate communication; by addressing novel properties attained by early humans and selectional pressures for adaptive change, he presents a convincing case for how human communication evolved to what it is today. His central argument is that human communication is fundamentally cooperative in nature, and that this cooperative communication, which initially evolved from pointing and through pantomime, was only possible due to a human socio-cognitive and social-motivational infrastructure. This infrastructure then 'acted as a kind of psychological platform on which the various systems of conventional linguistic communication (all 6,000 of them) could be built' (p. 2). Tomasello discusses the evolution of human cooperative communication from four different perspectives: evolution of basic functional motives and socio-cognitive skills, ontogenetic origins, phylogenetic origins and grammar. Building on the foundation of his previous studies, including gestural studies of apes and human infants' and children's early language development, the purpose in his book as stated in the preface is 'to bring all of this together into one coherent account of the evolution and development of human communication' (p. xi). Throughout the book his argument is supported by empirical and experimental data, as well as a wide range of research results, from evolutionary biology to Gricean pragmatics, which in turn provide a strong foundation for his clear and coherent picture of the evolutionary track of human communication.

This book is organized into seven chapters based on his four theoretical themes: socio-cognitive infrastructure, ontogeny, phylogeny and grammar. In chapters 1, 2 and 3, Tomasello mainly focuses on differences in the use of gestures between humans and apes and the socio-cognitive infrastructure of human cooperative communication. Following Grice (1975), Tomasello believes that human communication is fundamentally cooperative. He also believes that the cooperative structure of human communication and the cooperative structure of human social interaction and culture are closely related to each other. His underlying assumption is that if this relation is attributed to a species-unique trait, then this trait may be traced back to earlier forms of human communication. Compared to Bickerton (2003), who searches for clues of earlier forms of human communication in linguistic data, Tomasello believes that language is a system of arbitrary symbols that serve as a code; therefore, it presupposes some pre-existing

form of communication that can be codified (p. 58). Thus, he presumes that early forms of communication must have been unconventionalized and uncoded, and identifies human natural gestures like 'pointing' and 'pantomiming' as being a critical source of the origins of language (p. 59). According to Tomasello, human communication and its evolution stemmed from the first uniquely human forms of gestures that were cooperative in nature and qualitatively different from ape communication. While apes largely use requesting gestures to fulfill their immediate needs like food or play, human communication goes beyond this realm since it is driven by pro-social motivations. Tomasello emphasizes that cooperative communication requires socio-cognitive skills of shared intentionality, which generate joint goals and joint attention. He argues that human natural gestures gain their communicative power from our natural tendency to follow gaze direction and to interpret others' actions based on common conceptual ground.

One of the strengths of Tomasello's theory is that he starts this evolutionary account from gestures, which primates, like humans, commonly produce. By exploring what was inherited from the common ancestor of humans and other primates in chapters 2 and 3, Tomasello achieves a more satisfactory account of language evolution from the beginning without relying on the advent of a developed vocal apparatus required for speech production (Lieberman, 2003) or a genetic requirement, often associated with FOXP2, for vocal language (Lai *et al*., 2000; Pinker, 2003). Tomasello also addresses what is qualitatively novel in human communication in chapter 3 by highlighting species-specific characteristics of shared intentionality and pro-social motivations, furthering his argument for the cooperative nature of human communication.

Firmly arguing his case, Tomasello moves to chapters 4 and 5, where he presents ontogenetic and phylogenetic evidence drawn from a wide array of research studies encompassing early human infants' gestural studies, and evolutionary and social biology. In chapter 4 Tomasello contends that a fully cooperative infrastructure is in place even in prelinguistic gestural communications, and that this continues to serve as a foundation for infants' acquisition and use of linguistic conventions. He concludes that while chimpanzees do have and understand individual intentionality, the critical difference is that they do not have the skills of shared intentionality that are necessary for cooperative communication. This view is further supported in the following chapter, where Tomasello focuses on human phylogeny and human cooperative communication in the evolution of cooperation types. In chapter 5, he argues that human cooperative communication was the outcome of a biological adaptation for collaborative activities and cultural life. Human cognitive skills of shared intentionality and social motivations first emerged within mutually collaborative activities where reciprocating

help could prosper. Later, the mutual cooperation structures were expanded to other contexts where the helper offered help to enhance her own reputation, and this indirect reciprocity created mutual expectation. Sharing feelings and attitudes with others arose as a means for social bonding, which then led to group solidarity and social norms governing cooperative activities, which ultimately helped form socio-cultural groups. Tomasello's argument about how mutualism evolved as an adaptation is fully supported by findings in evolutionary biology, which explore interaction types between individuals in a given environment. The demand of mutual cooperation in early human communication is also discussed by Bickerton (2003), who states that 'hunger and a high risk from predation would have engendered social systems in which individuals were more interdependent than they are in most primate societies' (pp. 83–84).

While Tomasello lists natural gestures as the earliest forms of human communication, he excludes vocalization as a possible source of early human communication. In his evolutionary scenario, vocal conventions emerged only after conventionalized gestures accompanied by some rudimentary syntactic machinery. The transition from conventionalized gestures to vocal conventions is only briefly discussed within one paragraph in chapter 5:

> Our proposal for how the transition came about more specifically is that in the beginning the earliest vocal conventions were emotional accompaniments, or perhaps added sound effects, to some already meaningful action-based gestures—or at least some already meaningful collaborative actions. There was thus at least some redundancy, at least from the point of view of the recipient, in what the communicator was attempting to communicate with the gestures and the vocalizations. As humans gained more voluntary control over their vocalizations, they could have also used some vocal icons (e.g., making the sounds of a leopard), though like visual icons those could only have arisen after the emergence of Gricean communicative intention. But at some point, in some situations, the vocalization came to be functional on its own—perhaps under pressure to communicate at longer distances, or for the communication to be in the public space, and so forth (pp. 231–32).

Tomasello's argument here glosses over several important points. First, it is not clear how vocalization evolved to 'vocal conventions'. In the paragraph above, Tomasello argues that the earliest vocal conventions were emotional accompaniments or added sound effects to some action-based gestures. In this pairing of vocal conventions and gestures, vocal conventions do not seem to be as strictly situation-bound as ape vocalization. In earlier chapters, Tomasello describes the major characteristics of ape vocalization as involuntary, context-dependent and emotionally tied, and he further

argues that 'nonhuman primates do not vocalize flexibly by adjusting to the communicative situation' (pp. 16–17). His characterization of vocal conventions, which are not tightly tied to contexts, may have been the first critical step in the evolution of vocal language. However, Tomasello does not spell out what made this transition possible. Second, it seems to be a weak argument that the transition from fully functioning gestural conventions, which may have existed for a long evolutionary time, to new-born vocal conventions, was simply due to the increased power of voluntary control over vocalization. Several alternative arguments are equally or more plausible. For instance, Goldin-Meadow (2005) hypothesizes that 'language became the province of the oral modality' because of the emergence of segmented structure in the oral modality that allowed the manual modality freedom to co-occur with speech and to capture imagistic aspects of communication along with speech (p. 210). As Goldin-Meadow and her colleagues put forth (Goldin-Meadow, Alibali & Church, 1993), gestures may have taken on an imagistic function, because it allowed people to gain more expressive power and freedom to use their hands to perform other tasks simultaneously. This function-based approach might provide a better account for the transition to vocal conventions in evolution. Lastly, one should note that we still do not know much about vocalization in great apes that might shed light on early forms of vocalization in human communication. The majority of research on vocalization is conducted with monkeys such as vervet monkeys; the vocalization of apes has not been studied in depth, as Tomasello himself acknowledges in the last chapter (p. 329).

In Chapter 6, Tomasello argues that grammar also evolved to match functional pressures to express requesting, informing and sharing information. He suggests that grammar evolved from 'simple' syntax to 'serious' syntax and finally to 'fancy' syntax. Compared to requesting that only involved 'you and me', and 'here and now', informing often requires referents placed elsewhere in time and space. Sharing information further demands event time tracking and referent tracking across events, and the difference in the amount of information necessary for different functional demands determines the complexity of the syntax. His view, greatly differing from that of generative linguists who believe in the innateness of grammar, is that grammar itself is not a biological adaptation but comes from a broader adaptation of social cognition in the context of mutual cooperation. His view also differs from Deacon (1997), who argues that universals in grammar are neither biological nor cultural, but come from constraints that symbols have themselves. Tomasello's view becomes even clearer in chapter 7, where he concludes that 'language is a form of social action constituted by social conventions for achieving social ends, premised in at least some shared understandings and shared purposes among users' (p. 343).

This book contributes significantly to our understanding of language evolution by presenting a plausible, unifying and coherent account for the origin of human communication in the context of the evolution of human social-cognition and culture. Starting an evolutionary theory from the point where human communication diverged from the communication of non-human primates potentially involves more guesswork that may lead to mere speculations. However, Tomasello compiles research findings from related studies in diverse fields, intertwining these findings and his arguments about the interdependence between language and species-specific cooperative ways of living and thinking, while advancing each step with convincing evidence. He faces many of the challenging questions of this field head on – identifying where and how humans separated from the rest of the primates, what made it possible, and what kind of selectional pressures led to the change – providing intriguing and well-argued answers. The book is enjoyable, engaging and thought-provoking. It is highly accessible to both college students interested in the topic and linguists who wish to understand how different research programmes contribute to the field of evolutionary linguistics and where this relatively new field may be heading.

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Reviewed by EUNJU BANG
Program in Applied Linguistics,
Boston University