

technical terms that function as building blocks of theories and especially of hypotheses, which require unambiguous formulations so as to meet the fundamental standards of non-triviality and falsifiability. This level is thus essential for science to make progress by conclusively resolving arguments with recourse to empirical data rather than getting stuck on conceptual differences.⁸ The other level, however, is the global level of macroscopic notions, which cannot (without further specification) function as building blocks of specific theories or hypotheses but have a different role, related instead to integrative and classificatory goals.

So, for example, we largely concur with Behme that

[w]hile it may be neither feasible nor beneficial that all language evolution researchers adopt the same definition of 'language' it would be desirable for them to explicitly state which definition they adopt;

(2016: 8)

and with Fitch (2010: 24) that "unspecified use of [...] the word 'language' [...] is probably best avoided". A small but essential caveat is that any theory-specific use of *language* will inevitably remain meronymous, in the sense of always relating only to part of the complex phenomenon. Therefore, in our view it is more productive to push definitions one level down: Leave *language* as an unanalysable prime and provide rigorous definitions of particular *components* or *aspects* of language as they function in specific theories under consideration. One very important advantage is that such a strategy prevents attempts to monopolise the word *language* by a particular theory that would claim unique privileged access to a 'correct' understanding of *language*, something that Chomskyan approaches have been criticised for.

Exactly such was the nature of the FLN/FLB distinction (again, two different distinctions, as we show in Section 3), categorical about the nature of language and expressly formulated to guide language evolution research as an understanding of the language faculty privileged over other theories. Interestingly, however, much fuzzier notions of language seem to have better served the actual language evolution research. Due to the breadth of research interests in language evolution in the last decade, and the intense interdisciplinarity that cuts across many disparate areas of investigation—from computational modelling, to primate communication, to sign linguistics—language evolution thrives on fuzzy definitions of language and finds categorical, top-down approaches too constraining. This idea is reflected in Section 4, which surveys influential lines of research in language evolution, mostly focusing on the most recent trends. In recent years, the bulk of research in this field revolves around the problems of multimodality, the dynamics of cultural transmission, language as a form of social interaction or biological language-readiness. What emerges from this survey is indeed a breadth of the range of these perspectives that precludes their fitting together under any single definition of language.

⁸ We are grateful to two anonymous reviewers for comments that led us to stress this important point.

This is far from surprising if we look to analogies in other notions in science that, like language, are macroscopic, unobservable and unoperationalisable. One example comes from biologists, who tend to avoid top-down approaches to life (and aprioristic definitions of *life*) and focus instead on the study of the building blocks of living beings, regardless of whether they can be found in other domains (e.g., water) or not (the DNA). Only a successful characterization of these building blocks can lead to achieving a comprehensive view of the nature of life (as in systems biology) and its evolution (as in, e.g., evolutionary developmental biology). Similarly, analyses of the use of terms such as *heat* in physics (Lewis & Linn 1996) or *gesture* in primatology (Bourjade et al. 2020) provide arguments for a beneficial and productive role of conceptual diversity, at least when certain conditions are met such as consistent use of a term within a particular approach.

One particularly interesting motivation for why a lack of a single top-down definition of language in language evolution is not as consequential now as it was 20 years ago may be a methodological change in the profile of this field, from theoretical to empirical research (see especially Dediu & de Boer 2016, Fitch 2017, Żywicznyński 2018, Nölle et al. 2020). In 2017, Wacewicz & Żywicznyński wrote:

Language evolution researchers no longer stop at being consumers of empirical data, but rather aim at being providers as well, acquiring data by experimentation, observation, or simulation (and a steadily increasing proportion of these results then feed back into more general discussions on the nature of language [...]). The maturation of language evolution research has been marked by a steady growth in the proportion of empirical ("new data") research relative to theoretical (synthetic) argumentation [...]. In the volume that grew out of the first EVOLANG conference in 1996 (Hurford et al. 1998), all 24 contributions have a decidedly theoretical (synthesising) character, whereas the proceedings of the most recent conference (Roberts et al. 2016) are dominated by empirical research: 123 contributions, as opposed to 25 theoretical. Wacewicz & Żywicznyński (2017: 3)

What follows is that recently, very few publications present comprehensive scenarios of language evolution, and conversely, a vast proportion of studies are more fine-grained, addressing much more specific and narrower Kuhnian "puzzles" such as the efficiency of gestural vs multimodal signals in conveying emotional meanings (Zlatev et al. 2017) or the effect of processed food on the dental configuration and in turn on the production of fricatives (Blasi et al. 2019). A natural consequence is that such specific and bottom-up studies do not directly aim at explaining language evolution *sensu largo*, and so do not need to work with a definition of language *sensu largo*.

An epitome of both the empirical and bottom-up approach is the Causal Hypotheses In Evolutionary Linguistics Database (CHIELD, pronounced 'shield'; Roberts et al. 2020). CHIELD contains crowd-sourced entries for over 400 publications, with over 3,400 causal links between more than 1,700 variables and aims not only at cataloguing hypotheses about language evolution but also making data on them interoperable. As it is unlikely that all 32 authors (much less all 41

contributors to the database) would converge on a single explicit definition of language, CHIELD is possible not *despite* but *because* it deliberately avoids defining language (cf. "A classic example of this is the word 'language' itself, which can be interpreted as anything relating to human communication or only a specific syntactic ability"; Roberts et al. 2020: 3).

Consequently, one way of describing language evolution could be to 'bracket' the notion of *language* and rely solely on content-independent, institutional and scientometric criteria such as conferences, journals, laboratories and citation patterns (cf. Bergmann & Dale 2016). This would delineate a collection of bottom-up approaches and researchers that jointly form a 'community of practice' or a *denkkolektiv* (Fleck 1979). This is an interesting approach with some genuine explanatory power; for example, this strategy would address Haspelmath's (2016) question of why *Journal of Language Evolution* publishes research on language change of apparently non-evolutionary character.

Nevertheless, such an approach would seem deeply unsatisfying to the researchers in the field of language evolution, who have a strong sense of unifying research substance, and in particular the unifying aim of explaining the origin of language. This substance is primary to the content-independent factors, in that it provides identity to the field and gives rise to—as opposed to being secondary and merely resultant from—the patterns and networks of personal and institutional connections. It is the basic, common, intuitive understanding of *language*, and basic human curiosity about how it began, that sets the explanatory goal for the field of language evolution as a whole, and thus shapes its research practices and the resulting *denkkollektiv*—rather than vice versa.

This is the other point that follows from our review: although the recently most influential approaches to language evolution are indeed too diverse to be brought together under a common definition of language, they also do overlap to a large extent in terms of key definitional dimensions. As discussed in section 4, these dimensions are in particular the criterial components of language, its modalities, domain-specificity, biological versus cultural profile, (supra)individual character, gradability, species-specificity and primary function. This complex pattern of numerous similarities and sporadic but significant differences is characteristic of a family-resemblance category (Wittgenstein 1953). Most importantly from the point of view of research practice, this family resemblance pattern underwrites fruitful communication between these approaches, leading to cross-fertilisation and opening new research vistas: for example, there is a growing number of studies in the Iterated Learning paradigm that look at different communicative modalities (e.g., Motamedi et al. 2019); as another example, the self-domestication theory, proposed within the Complex Adaptive Systems camp, is now most actively developed by the proponents of the language ready brain (see especially Benítez-Burraco & Progovac 2020). Thus, based on a tacit and fundamentally ineffable notion of language, all these approaches jointly contribute to the development of the field of language evolution.

Acknowledgements

This research was supported by the Polish National Science Centre under grant agreement UMO-2019/34/E/HS2/00248. This work was also supported from the Excellence Initiative—Research University at Nicolaus Copernicus University in Toruń. We are grateful to Marta Sibierska for her valuable comments and to Aleksandra Poniewierska and Aleksandra Szczepańska for their assistance in editing the manuscript.

References

- Aboitiz, Francisco. 2012. Gestures, vocalizations, and memory in language origins. *Frontiers in Evolutionary Neuroscience* 4(2).
- Amici, Federica, Alex Sánchez-Amaro, Carla Sebastián-Enesco, Trix Cacchione, Matthias Allritz, Juan Salazar-Bonet, & Federico Rossano. 2019. The word order of languages predicts native speakers' working memory. *Scientific Reports* 9(1), 1124.
- Arbib, Michael A. 2005. From monkey-like action recognition to human language: An evolutionary framework for neurolinguistics. *Behavioral and Brain Sciences* 28(2), 105–167.
- Arbib, Michael A. 2012. *How the Brain Got Language: The Mirror System Hypothesis*. Oxford: Oxford University Press.
- Arbib, Michael A. 2016. Towards a computational comparative neuroprimatology: framing the language-ready brain. *Physics of Life Reviews* 16, 1–54.
- Arbib, Michael A. 2018. Computational challenges of evolving the language-ready brain: 2. Building towards neurolinguistics. *Interaction Studies* 19(1–2), 22–37.
- Arbib, Michael A, Francisco Aboitiz, Judith M. Burkart, Michale C. Corballis, Gino Coudé, Erin Hecht, Katja Liebal, Masako Myowa-Yamakoshi, James Pustejovsky, Shelby S. Putt, Federico Rossano, Anne E. Russon, P. Thomas Schoenemann, Uwe Seifert, Katerina Semendeferi, Chris Sinha, Dietrich Stout, Virginia Volterra, Sławomir Waciewicz, & Benjamin Wilson. 2018. The comparative neuroprimatology 2018 (CNP-2018) road map for research on how the brain got language. *Interaction Studies* 19, 371–388.
- Armstrong, David F. & Sherman E. Wilcox. 2007. *The Gestural Origin of Language*. Oxford: Oxford University Press.
- Balari, Sergio & Guillermo Lorenzo. 2012. *Computational Phenotypes: Towards an Evolutionary Developmental Biolinguistics*. Oxford: Oxford University Press.
- Balari, Sergio & Guillermo Lorenzo. 2016. Evo-devo of language and cognition. In Laura Nuno de la Rosa & Gerd Müller (eds.), *Evolutionary Developmental Biology*. Cham: Springer.
- Barceló-Coblijn, Lluís. 2012. Evolutionary scenarios for the emergence of recursion. *Theoria et Historia Scientiarum* 9, 171–199.
- Beckner, Clay, Richard Blythe, Joan Bybee, Morten H. Christiansen, William Croft, Nick C. Ellis, John Holland, Jinyun Ke, Diane Larsen-Freeman, & Tom Schoenemann. 2009. Language is a complex adaptive system: Position paper. *Language Learning* 59, 1–26.

- Behme, Christina. 2016. Evolution of what? In Sean G. Roberts, Christine Cuskley, Luke McCrohon, Lluís Barceló-Coblijn, Olga Fehér, & Tessa Verhoef (eds.), *The Evolution of Language: Proceedings of the 11th International Conference (EVO LANG11)*. <http://evolang.org/neworleans/papers/140.html>
- Benítez-Burraco, Antonio. 2020. Prehistoric languages and human self-domestication. *Language Dynamics and Change* 10(1), 27–58.
- Benítez-Burraco, Antonio & Cedric Boeckx. 2014. Universal Grammar and biological variation: An evodevo agenda for comparative biolinguistics. *Biological Theory* 9(2), 122–134.
- Benítez-Burraco, Antonio & Cedric Boeckx. 2015. Possible functional links among brain- and skull-related genes selected in modern humans. *Frontiers in Psychology* 6: 794.
- Benítez-Burraco, Antonio & Ljiljana Progovac. 2020. A four-stage model for language evolution under the effects of human self-domestication. *Language & Communication* 73, 1–17.
- Bergen, Benjamin K. 2012. *Louder than Words: The New Science of How the Mind Makes Meaning*. New York: Basic Books.
- Bergmann, Till & Rick Dale. 2016. A scientometric analysis of evolang: Intersections and authorships. In Sean G. Roberts, Christine Cuskley, Luke McCrohon, Lluís Barceló-Coblijn, Olga Fehér, & Tessa Verhoef (eds.), *The Evolution of Language: Proceedings of the 11th International Conference (EVO LANG11)*. <http://evolang.org/neworleans/papers/182.html>
- Berwick, Robert C. & Noam Chomsky. 2016. *Why Only Us: Language and Evolution*. Cambridge, MA: MIT Press.
- Bickerton, Derek. 1990. *Language and Species*. Chicago, IL: University of Chicago Press.
- Blasi, Damián E., Steven Moran, Scott R. Moisk, Paul Widmer, Dan Dediu, & Balthasar Bickel. 2019. Human sound systems are shaped by post-Neolithic changes in bite configuration. *Science* 363(6432).
- Boeckx, Cedric. 2012. The I-language mosaic. In Cedric Boeckx, María del Carmen Horno Chéliz, & José Luis Mendívil Giró (eds.), *Language, from a Biological Point of View: Current Issues in Biolinguistics*, 23–51. Newcastle upon Tyne: Cambridge Scholars.
- Boeckx, Cedric & Antonio Benítez-Burraco. 2014a. Globularity and language-readiness: Generating new predictions by expanding the set of genes of interest. *Frontiers in Psychology* 5(1324), doi: 10.3389/fpsyg.2014.01324.
- Boeckx, Cedric & Antonio Benítez-Burraco. 2014b. The shape of the human language-ready brain. *Frontiers in Psychology* 5(282), doi: 10.3389/fpsyg.2014.00282.
- Bolhuis, Johan J., Ian Tattersall, Noam Chomsky & Robert C. Berwick. 2014. How could language have evolved? *PLoS Biology* 12(8), doi: 10.1371/journal.pbio.1001934.
- Botha, Rudolf P. 2000. Discussing the evolution of the assorted beasts called language. *Language & Communication* 20(2), 149–160.
- Bouchard, Denis. 2013. *The nature and origin of language*. Oxford: Oxford University Press.

- Bouchard, Denis. 2015. Brain readiness and the nature of language. *Frontiers in Psychology* 6. doi:10.3389/fpsyg.2015.01376
- Bourjade, Marie, Hélène Cochet, Sandra Molesti & Michèle Guidetti. 2020. Is conceptual diversity an advantage for scientific inquiry? A case study on the concept of 'gesture' in comparative psychology. *Integrative Psychological and Behavioral Science*, doi: 10.1007/s12124-020-09516-5.
- Bowling, Daniel L. 2017. The continuing legacy of nature versus nurture in biolinguistics. *Psychonomic Bulletin & Review* 24(1). 140–141.
- Bruner, Emiliano, Giorgio Manzi & Juan L. Arsuaga. 2003. Encephalization and allometric trajectories in the genus Homo: evidence from the Neandertal and modern lineages. *Proceedings of the National Academy of Sciences* 100. 15335–15340.
- Byrne, Richard & Andrew Whiten (eds.). 1988. *Machiavellian intelligence: Social expertise and the evolution of intellect in monkeys, apes and humans*. Oxford: Oxford University Press.
- Cheney, Dorothy L. & Robert M. Seyfarth. 2007. *Baboon metaphysics: The evolution of a social mind*. Chicago: Chicago University Press.
- Christiansen, Morten H. & Simon Kirby. 2003. Language evolution: Consensus and controversies. *Trends in Cognitive Sciences* 7(7). 300–307.
- Christiansen, Morten H. & Nick Chater. 2008. Language as shaped by the brain. *Behavioral and Brain Sciences* 31(5). 489–509.
- Corballis, Michael C. 2013. Gestural theory of the origins of language. In Claire Lefebvre, Bernard Comrie & Henri Cohen (eds.), *New perspectives on the origins of language*, 171–184. Oxford: Oxford University Press.
- Cornish, Hannah. 2010. Investigating how cultural transmission leads to the appearance of design without a designer in human communication systems. *Interaction Studies* 11(1). 112–137.
- Cowie, Fiona. 2008. Innateness and language. *The Stanford Encyclopedia of Philosophy*. <https://plato.stanford.edu/archives/fall2017/entries/innateness-language/>. (21 July, 2020.)
- Croft, William. 2000. *Explaining Language Change: An Evolutionary Approach*. Harlow: Pearson Longman.
- Croft, William. 2011. Language structure in its human context: New directions for the language sciences in the twenty-first century. In Patrick Colm Hogan (ed.), *The Cambridge encyclopedia of the language sciences*, 1–11. Cambridge: Cambridge University Press.
- Darwin, Charles. 1871. *The descent of man: and selection in relation to sex*. London: J. Murray.
- Deacon, Terrence W. 1997. *The Symbolic Species: The Co-Evolution of Language and the Brain*. New York & London: Norton.
- de Boer, Bart. 2000. Self-organization in vowel systems. *Journal of Phonetics* 28. 441–465.
- Dediu, Dan & Bart de Boer. 2016. Language evolution needs its own journal. *Journal of Language Evolution* 1. 1–6.
- Divjak, Dagmar. 2019. *Frequency in language: memory, attention and learning*. Cambridge: Cambridge University Press.

- Donald, Merlin. 1991. *Origins of the modern mind: Three stages in the evolution of culture and cognition*. Cambridge, MA: Harvard University Press.
- Donald, Merlin. 2001. *A mind so rare: The evolution of human consciousness*. New York: Norton.
- Dor, Daniel. 2015. *The Instruction of Imagination: language as a social communication technology*. Oxford: Oxford University Press.
- Dor, Daniel, Chris Knight, Jerome Lewis (eds.). 2014. *The social origins of language*. Oxford: Oxford University Press.
- Dunbar, Robin I. M. 1993. Coevolution of neocortical size, group size and language in humans. *Behavioral and Brain Sciences*. 16(04). 681–694.
- Dunbar, Robin I. M. 1996. *Grooming, gossip, and the evolution of language*. Cambridge, MA: Harvard University Press.
- Ejiri, Keiko & Nobuo Masataka. 2001. Co-occurrences of preverbal vocal behavior and motor action in early infancy. *Developmental Science* 4(1). 40–48.
- Ekman, Paul & Wallace V. Friesen. 1969. The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica* 1(1). 49–98.
- Elman, Jeffrey L. 1999. The emergence of language: A conspiracy theory. In Brian MacWhinney (ed.), *The Emergence of Language*. 1–28. Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Evans, Nicholas & Stephen C. Levinson. 2009. The myth of language universals: Language diversity and its importance for cognitive science. *Behavioral and Brain Sciences* 32(5). 429–448.
- Fitch, Tecumseh W. 2010. *The evolution of language*. Cambridge: Cambridge University Press.
- Fitch, Tecumseh W. 2017. Empirical approaches to the study of language evolution. *Psychonomic Bulletin & Review* 24(1). 3–33.
- Fitch, Tecumseh W., Marc D. Hauser & Noam Chomsky. 2005. The evolution of the language faculty: clarifications and implications. *Cognition* 97(2). 179–210.
- Fleck, Ludwik. 1979. *Genesis and Development of a Scientific Fact*. Chicago: The University of Chicago Press.
- Garrod, Simon, Nicolas Fay, Shane Rogers, Bradley Walker & Nik Swoboda. 2010. Can iterated learning explain the emergence of graphical symbols? *Interaction Studies* 11(1). 33–50.
- Green, Jennifer. 2014. *Drawn from the ground: Sound, sign and inscription in Central Australian sand stories*. Cambridge: Cambridge University Press.
- Grice, Herbert Paul. 1975. Logic and conversation. In Peter Cole & Jerry L. Morgan (eds.), *Syntax and Semantics 3: Speech Acts*, 41–58. New York: Academic Press.
- Gruberger, Michal, Eti Ben-Simon, Yechiel Levkovitz, Abraham Zangen & Talma Hendler. 2011. Towards a neuroscience of mind-wandering. *Frontiers in Human Neuroscience* 5(56), doi: 10.3389/fnhum.2011.00056.
- Gunz, Philipp, Simon Neubauer, Bruno Maureille & Jean-Jacques Hublin. 2010. Brain development after birth differs between neanderthals and modern humans. *Current Biology* 20. R921-R922.
- Gunz, Philipp, Simon Neubauer, Liubov V. Golovanova, Vladimir Doronichev, Bruno Maureille & Jean-Jacques Hublin. 2012. A uniquely modern human pattern of endocranial development. insights from a new cranial

- reconstruction of the Neandertal newborn from Mezmaiskaya. *Journal of Human Evolution* 62. 300–313.
- Haspelmath, Martin. 2016. The evolution (or diachrony) of "language evolution". <http://dlc.hypotheses.org/894>. (21 July, 2020.)
- Haspelmath, Martin. 2020. Human linguisticity and the building blocks of languages. *Frontiers in Psychology* 10. 3056. doi: 10.3389/fpsyg.2019.03056.
- Hauser, Marc, Noam Chomsky & Tecumseh Fitch. 2002. The faculty of language: What is it, who has it, and how did it evolve? *Science* 298. 1569–1579.
- Hauser, Marc, David Barner & Tim O'Donnell. 2007. Evolutionary linguistics: A new look at an old landscape. *Language Learning and Development* 3(2). 101–132.
- Hecht, Erin E., David A. Gutman, Todd M. Preuss, Mar M. Sánchez, Lisa A. Parr & James K. Rilling. 2013. Process versus product in social learning: comparative diffusion tensor imaging of neural systems for action execution-observation matching in macaques, chimpanzees, and humans. *Cortex* 23. 1014–1024.
- Hilpert, Martin. 2013. *Constructional Change in English: Developments in Allomorphy, Word Formation, and Syntax*. Cambridge: Cambridge University Press.
- Hewes, Gordon Winant. 1977. Language origin theories. In Duane M. Rumbaugh (ed.), *Language learning by a chimpanzee: The Lana project*, 3–53. New York: Academic Press.
- Hrdy, Sarah Blaffer. 2009. *The woman that never evolved*. Cambridge, MA: Harvard University Press.
- Hurford, James R. 1989. Biological evolution of the Saussurean sign as a component of the language acquisition device. *Lingua* 77(2). 187–222.
- Hurford, James R. 2003. The language mosaic and its evolution. In Morten H. Christiansen & Simon Kirby (eds.), *Language Evolution* 3, 38–57. Oxford: Oxford University Press.
- Hurford, James R. 2007. *The Origins of Meaning: Language in the Light of Evolution, Vol. 1*. Oxford: Oxford University Press.
- Hurford, James R. 2012. *The Origins of Grammar: Language in the Light of Evolution, Vol. 2*. Oxford: Oxford University Press.
- Hurford, James R., Michael Studdert-Kennedy & Chris Knight (eds.). 1998. *Approaches to the evolution of language: social and cognitive bases*. Cambridge: Cambridge University Press.
- Jackendoff, Ray. 2002. *Foundations of Language: Brain, Meaning, Grammar, Evolution*. Oxford: Oxford University Press.
- Jackendoff, Ray. 2010. Your theory of language evolution depends on your theory of language. in Richard K. Larson, Viviane Déprez & Hiroko Yamakido (eds), *The evolution of human language: Biolinguistic perspectives*, 63–72. Cambridge: Cambridge University Press.
- Jackendoff, Ray & Steven Pinker. 2005. The nature of the language faculty and its implications for evolution of language (Reply to Fitch, Hauser, and Chomsky). *Cognition* 97(2). 211–225.
- Johansson, Sverker. 2005. *Origins of language: Constraints on hypotheses*. John Benjamins Publishing.

- Karmiloff-Smith, Annette. 2009. Nativism versus neuroconstructivism: Rethinking the study of developmental disorders. *Developmental Neurocognition* 45. 56–63.
- Kendon, Adam. 1980. Gesticulation and speech: Two aspects of the process of utterance. In Mary Ritchie Key (ed.), *The Relationship of verbal and nonverbal communication*, 207–227. The Hague & New York: Mouton.
- Kendon, Adam. 1990. *Conducting interaction: Patterns of behavior in focused encounters*. Cambridge: Cambridge University Press.
- Kendon, Adam. 2004. *Gesture: Visible action as utterance*. Cambridge: Cambridge University Press.
- Kendon, Adam. 2008. Signs for language origins? *The Public Journal of Semiotics* 2(2). 2–29.
- Kendon, Adam. 2011. Some modern considerations for thinking about language evolution: A discussion of the evolution of language by Tecumseh Fitch. *The Public Journal of Semiotics* 3(1). 79–108.
- Kendon, Adam. 2014a. Semiotic diversity in utterance production and the concept of 'language.' *Philosophical Transactions of the Royal Society B: Biological Sciences* 369(1651). doi:10.1098/rstb.2013.0293
- Kendon, Adam. 2014b. The "poly-modalic" nature of utterances and its relevance. In Daniel Dor, Chris Knight & Jerome Lewis (eds.), *The social origins of language*, 67–76. Oxford: Oxford University Press.
- Kendon, Adam. 2017. Reflections on the "gesture-first" hypothesis of language origins. *Psychonomic Bulletin & Review* 24(1). 163–170.
- Kinsella, Anna R. 2009. *Language evolution and syntactic theory*. Cambridge: Cambridge University Press.
- Kirby, Simon. 2012. Language is an adaptive system: The role of cultural evolution in the origins of structure. In Maggie Tallerman & Kathleen R. Gibson (eds.), *The Oxford Handbook of Language Evolution*, 589–604. Oxford: Oxford University Press.
- Kirby, Simon, Hannah Cornish & Kenny Smith. 2008. Cumulative cultural evolution in the laboratory: An experimental approach to the origins of structure in human language. *Proceedings of the National Academy of Sciences* 105(31). 10681–10686.
- Kirby, Simon, Mike Dowman & Thomas L. Griffiths. 2007. Innateness and culture in the evolution of language. *Proceedings of the National Academy of Sciences* 104(12), 5241–5245.
- Kirby, Simon, Tom Griffiths & Kenny Smith. 2014. Iterated learning and the evolution of language. *Current Opinion in Neurobiology* 28. 108–114.
- Kurcz, Ida. 2004. Communicative competence and theory of mind. *Psychology of Language and Communication* 8(2). 5–18.
- Larsen-Freeman, Diane. 2017. Complexity theory: The lessons continue. In Lourdes Ortega & ZhaoHong Han (eds.), *Complexity Theory and Language Development: In celebration of Diane Larsen-Freeman*, 11–50. Amsterdam, Philadelphia: John Benjamins.
- Levinson, Stephen C. 2006. On the human "interaction engine". In Nick J. Enfield & Stephen C. Levinson (eds.), *Roots of Human Sociality*. 39–69. Oxford: Berg.

- Levinson, Stephen C., & Judith Holler. 2014. The origin of human multi-modal communication. *Philosophical Transactions of the Royal Society B: Biological Sciences* 369(1651). 20130302.
- Lewandowska-Tomaszczyk, Barbara. 2008. Czym jest język? Dzisiejsze kontrowersje w paradygmatach generatywnych i kognitywnych. In Piotr Stalmaszczyk (ed.), *Metodologie językoznawstwa: współczesne tendencje i kontrowersje*, 9–26. Kraków: Lexis.
- Lewis, Eileen L. & Marcia C. Linn. 1996. Where is the heat? A response to David Pushkin. *Journal of Research in Science Teaching* 33. 335–337.
- Lohmann, Heidemarie & Michael Tomasello. 2003. The role of language in the development of false belief understanding: A training study. *Child Development* 74(4). 1130–1144.
- Little, Hannah, Kerem Eryilmaz & Bart de Boer 2017. Signal dimensionality and the emergence of combinatorial structure. *Cognition* 168. 1–15.
- Lupyan, Gary & Rick Dale. 2010. Language structure is partly determined by social structure. *PLoS One* 5. e8559.
- MacNeilage, Peter F. 2008. *The origin of speech*. Oxford & New York: Oxford University Press.
- Martins, Pedro Tiago, Evelina Leivada, Antonio Benítez-Burraco & Cedric Boeckx. 2016. Biological pluralism in service of biolinguistics. In Koji Fujita & Cedric Boeckx (eds.), *Advances in biolinguistics: The human language faculty and its biological basis*, 153–169. New York: Routledge.
- McNeill, David. 1992. *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press.
- McNeill, David. 2012. *How language began: Gesture and speech in human evolution*. Cambridge: Cambridge University Press.
- Mead, George H. 1974. *Mind, Self and Society*, edn. with introduction by Charles W. Morris. Chicago: University of Chicago Press.
- Mendívil-Giró, José-Luis. 2019. Did language evolve through language change? On language change, language evolution and grammaticalization theory. *Glossa* 4(1), <https://www.glossa-journal.org/articles/10.5334/gjgl.895/>.
- Mesoudi, Alex. 2011. *Cultural evolution: how Darwinian theory can explain human culture and synthesize the social sciences*. University of Chicago Press.
- Miller, Earl K. & Timothy J. Buschman. 2013. Cortical circuits for the control of attention. *Current Opinion in Neurobiology* 23. 216–222.
- Motamedi, Yasamin, Marieke Schouwstra, Kenny Smith, Jennifer Culbertson & Simon Kirby. 2019. Evolving artificial sign languages in the lab: From improvised gesture to systematic sign. *Cognition* 192. 103964.
- Neubauer, Simon, Philipp Gunz, Jean-Jacques Hublin. 2010. Endocranial shape changes during growth in chimpanzees and humans: a morphometric analysis of unique and shared aspects. *Journal of Human Evolution* 59. 555–566.
- Nölle, Jonas, Stefan Hartmann & Peter Tinitis. 2020. Language evolution research in the year 2020. *Language Dynamics and Change* 10(1). 3–26.
- Okanoya, Kazuo. 2007. Language evolution and an emergent property. *Current Opinion in Neurobiology* 17(2). 271–276.
- Parker, Anna R. 2006. Evolving the narrow language faculty: was recursion the pivotal step? *The Evolution of Language*. 239–246.

- Pinker, Steven & Ray Jackendoff. 2005. The faculty of language: what's special about it? *Cognition* 95(2). 201–236.
- Pleyer, Michael & James Winters. 2014. Integrating cognitive linguistics and language evolution research. *Theoria et Historia Scientiarum* 11. 19–43.
- Pleyer, Michael & Stefan Hartmann. 2019. Constructing a consensus on language evolution? Convergences and differences between biolinguistic and usage-based approaches. *Frontiers in Psychology: Language Sciences*. doi:10.3389/fpsyg.2019.02537
- Poeppel, David. 2012. The maps problem and the mapping problem: Two challenges for a cognitive neuroscience of speech and language. *Cognitive Neuropsychology* 29. 34–55.
- Poeppel, David & David Embick. 2005. Defining the relation between linguistics and neuroscience. In Anne Cutler (ed.), *Twenty-first Century Psycho-linguistics: Four Cornerstones*, 103–120. Hillsdale: Lawrence Erlbaum.
- Pomerantz, Anita. 1984. Agreeing and disagreeing with assessments: Some features of preferred/dispreferred turn shapes. In Maxwell Atkinson & John Heritage (eds.), *Structures of Social Action: Studies in Conversation Analysis*, 57–101. Cambridge: Cambridge University Press.
- Richerson, Peter J. & Robert Boyd. 2005. *Not by genes alone: how culture transformed human evolution*. Chicago: University of Chicago Press.
- Ritt, Nikolaus. 2004. *Selfish Sounds and Linguistic Evolution: A Darwinian Approach to Language Change*. Cambridge: Cambridge University Press.
- Roberts, Seán G., Christine Cuskley, Luke McCrohon, Lluís Barceló-Coblijn, Olga Fehér & Tessa Verhoef (eds.). 2016. *The Evolution of Language: Proceedings of the 11th International Conference (EVOLANG11)*. doi:10.17617/2.2248195
- Roberts, Seán G., Anton Killin, Angarika Deb, Catherine Sheard, Simon J. Greenhill, Kaius Sinnemäki, José Segovia-Martín, Jonas Nölle, Aleksandrs Berdicevskis, Archie Humphreys-Balkwill, Hannah Little, Christopher Opie, Guillaume Jacques, Lindell Bromham, Peeter Tunits, Robert M. Ross, Sean Lee, Emily Gasser, Jasmine Calladine, Matthew Spike, Stephen Francis Mann, Olena Shcherbakova, Ruth Singer, Shuya Zhang, Antonio Benítez-Burraco, Christian Kliesch, Ewan Thomas-Colquhoun, Hedvig Skirgård, Monica Tamariz, Sam Passmore, Thomas Pellard & Fiona Jordan. 2020. CHIELD: the causal hypotheses in evolutionary linguistics database. *Journal of Language Evolution*. doi:10.1093/jole/lzaa001
- Samuels, Bridget. 2009. The third factor in phonology. *Biolinguistics* 3(2–3). 355–382.
- Saussure, Ferdinand de. 1916. *Cours de linguistique générale*. Paris: Payot.
- Scott-Phillips, Thomas C. 2015. *Speaking our minds: Why human communication is different, and how language evolved to make it special*. Houndmills: Palgrave Macmillan.
- Scott-Phillips, Thomas C. & Simon Kirby. 2010. Language evolution in the laboratory. *Trends in cognitive sciences* 14(9). 411–417.
- Smith, Kenny, Simon Kirby & Henry Brighton. 2003. Iterated learning: A framework for the emergence of language. *Artificial Life* 9. 371–386.
- Smith, Kenny. 2018. The cognitive prerequisites for language: insights from iterated learning. *Current Opinion in Behavioral Sciences* 21. 154–160.

- Smith, Maynard John & Eörs Szathmáry. 1995. *The major transitions in evolution*. Oxford & New York: W.H. Freeman Spektrum.
- Smith, Kenny & Elizabeth Wonnacott. 2010. Eliminating unpredictable variation through iterated learning. *Cognition* 116(3). 444–449.
- Sonesson, Göran. 1997. The ecological foundations of iconicity. In Irmengard Rauch & Gerald Carr (eds.), *Semiotics Around the World: Synthesis in Diversity*, 739–742. Berlin & New York: Mouton de Gruyter.
- Sperber, Dan & Deirdre Wilson. 1986. *Relevance: Communication and cognition*. Cambridge, MA: Harvard University Press.
- Steels, Luc. 2000. Language as a complex adaptive system. In Marc Schoenauer, Kalyanmoy Deb, Günter Rudolph, Xin Yao, Evelyne Lutton, Juan Julian Merelo & Hans-Paul Schwefel (eds.), *Parallel Problem Solving from Nature*, 17–26. Berlin, Heidelberg: Springer.
- Számadó, Szabolcs & Eörs Szathmáry. 2006. Selective scenarios for the emergence of natural language. *Trends in Ecology & Evolution* 21(10). 555–561.
- Tallerman, Maggie & Kathleen R. Gibson (eds.). 2012. *The Oxford Handbook of Language Evolution*. Oxford: Oxford University Press.
- Thomas, James & Simon Kirby. 2018. Self domestication and the evolution of language. *Biology & Philosophy* 33(1). 9.
- Tincoff, Ruth & Marc D. Hauser. 2006. Cognitive basis for language evolution in nonhuman primates. In Keith Brown (ed.), *The encyclopedia of language & linguistics*, 533–538. 2nd edn. Amsterdam: Elsevier.
- Tinits, Peter, Jonas Nölle & Stefan Hartmann. 2017. Usage context influences the evolution of overspecification in iterated learning. *Journal of Language Evolution* 2(2). 148–159.
- Tomasello, Michael. 1999. *The cultural origins of human cognition*. Cambridge, MA: Harvard University Press.
- Tomasello, Michael. 2003. On the different origins of symbols and grammar. In Morten H. Christiansen & Simon Kirby (eds.), *Language Evolution*, 94–110. Oxford University Press.
- Tomasello, Michael. 2006. Why don't apes point? In Nick J. Enfield & Stephen C. Levinson (eds.), *Roots of human sociality: Culture, cognition and interaction*, 506–524. Oxford: Berg.
- Tomasello, Michael. 2008. *Origins of human communication*. Cambridge, MA: MIT Press.
- Tomasello, Michael. 2009. The usage-based theory of language acquisition. In Edith Laura Bavin (ed.), *The Cambridge Handbook of Child Language*, 69–87. Cambridge: Cambridge University Press.
- Tomasello, Michael. 2019. *Becoming human: A theory of ontogeny*. Cambridge, MA: Belknap Press.
- Tomasello, Michael & Malinda Carpenter. 2007. Shared intentionality. *Developmental Science* 10(1). 121–125.
- Tomasello, Michael, Ann Cale Kruger & Hilary Horn Ratner. 1993. Cultural learning. *Behavioral and Brain Sciences* 16(3). 495–511.
- Tomasello, Michael, Malinda Carpenter, Josep Call, Tanya Behne & Henrike Moll. 2005. Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences* 28(5). 675–691.

- Trijp, Remi van. 2011. Can iterated learning explain the emergence of case marking in language? *Proceedings of the 23rd Benelux Conference on Artificial Intelligence (BNAIC 2011), Volume 1*. 288–295.
- Tuomela, Raimo. 2007. *The philosophy of sociality: The shared point of view*. Oxford: Oxford University Press.
- Verhoef, Tessa, Simon Kirby & Bart de Boer. 2014. Emergence of combinatorial structure and economy through iterated learning with continuous acoustic signals. *Journal of Phonetics* 43. 57–68.
- Vigliocco, Gabriella, Pamela Perniss & David Vinson. 2014. Language as a multimodal phenomenon: implications for language learning, processing and evolution. *Philosophical Transactions of the Royal Society B: Biological Sciences* 369(1651). 1–7. <https://royalsocietypublishing.org/doi/10.1098/rstb.2013.0292>. (24 July, 2020.)
- Wacewicz, Sławomir. 2007. Debata Hauser, Chomsky, Fitch – Pinker i Jackendoff. Nowoczesny spór o pochodzenie ludzkiej zdolności językowej. In Szymon Wróbel (ed.), *Modularność umysłu*, 79–94. Kalisz: WPA UAM.
- Wacewicz, Sławomir. 2012. The narrow faculty of language: What is it, who has it, and how is it defined? *Theoria et Historia Scientiarum* 9. 217–229.
- Wacewicz, Sławomir & Przemysław Żywiczyński. 2017. The multimodal origins of linguistic communication. *Language & Communication* 54. 1–8.
- Wescott, Roger W. 1991. Defining Language. In Walburga von Raffler-Engel, Jan Wind & Abraham Jonker (eds.), *Studies in Language Origins: Volume 2*. John Benjamins Publishing. 77–84.
- Willems, Roel M., Asli Özyürek & Peter Hagoort. 2007. When language meets action: The neural integration of gesture and speech. *Cerebral Cortex* 17(10). 2322–2333.
- Wittgenstein, Ludwig 1953. *Philosophical Investigations*. Translated by Elisabeth Anscombe. Oxford: Basil Blackwell.
- Wróbel, Szymon. 2012. Rethinking language faculty: Has language evolved for other than language related reasons? *Theoria et Historia Scientiarum* 9, 201–216.
- Zlatev, Jordan. 2008. From proto-mimesis to language: Evidence from primatology and social neuroscience. *Journal of Physiology-Paris* 102(1–3), 137–151.
- Zlatev, Jordan. 2014. Human uniqueness, bodily mimesis and the evolution of language. *Humana. Mente Journal of Philosophical Studies* 7(27), 197–219.
- Zlatev, Jordan. 2016. Preconditions in human embodiment for the evolution of symbolic communication In Gregor Etzelmüller & Christian Tewes (eds.), *Embodiment in Evolution and Culture*, 151–174. Tübingen: Mohr Siebeck.
- Zlatev, Jordan. 2019. Mimesis theory, learning and polysemiotic communication. In Michael Peters (ed.), *Encyclopedia of Educational Philosophy and Theory*. Dordrecht: Springer.
- Zlatev, Jordan, Sławomir Wacewicz, Przemysław Żywiczyński, & Joost van de Weijer. 2017. Multimodal-first or pantomime-first? Communicating events through pantomime with and without vocalization. *Interaction Studies* 18(3), 465–488.

- Zlatev, Jordan, Przemysław Żywiczyński & Sławomir Wacewicz. 2020. Pantomime as the original human-specific communication system. *Journal of Language Evolution* 5(2), 156–174. doi:10.1093/jole/lzaa006
- Żywiczyński, Przemysław. 2018. *Language Origins: From Mythology to Science*. Berlin: Peter Lang.
- Żywiczyński, Przemysław & Jordan Zlatev. In press. The role of gesture in debates on the origins of language. In Alan Cienki (ed.), *Handbook of Gesture Studies*. Cambridge: Cambridge University Press.

Article in press