References

- Aitchison, L., Corradi, N., & Latham, P. E. (2016). Zipf's law arises naturally when there are underlying, unobserved variables. *PLOS Computational Biology*, *12*(12), e1005110.
- Altmann, G. (1980). Prolegomena to Menzerath's law. *Glottometrika*, 2(2), 1–10. Bezerra, B. M., Souto, A. S., Radford, A. N., & Jones, G. (2011). Brevity is not always a virtue in primate communication. *Biology Letters*, 7(1), 23–25.
- Brants, T., & Franz, A. (2006). Web 1T 5-gram Version 1 (2006). *Linguistic Data Consortium, Philadelphia*.
- Clink, D. J., Ahmad, A. H., & Klinck, H. (2020). Brevity is not a universal in animal communication: evidence for compression depends on the unit of analysis in small ape vocalizations. *Royal Society Open Science*, 7(4), 200151.
- Clink, D. J., & Lau, A. R. (2020). Adherence to Menzerath's law is the exception (not the rule) in three duetting primate species. *Royal Society Open Science*, 7(11), 201557.
- Clink, D. J., Tasirin, J. S., & Klinck, H. (2020). Vocal individuality and rhythm in male and female duet contributions of a nonhuman primate. *Current Zoology*, 66(2), 173–186.
- Egghe, L. (2007). Untangling Herdan's law and Heaps' law: Mathematical and informetric arguments. *Journal of the American Society for Information Science and Technology*, 58(5), 702–709.
- Fedurek, P., Zuberbühler, K., & Semple, S. (2017). Trade-offs in the production of animal vocal sequences: insights from the structure of wild chimpanzee pant hoots. *Frontiers in Zoology*, *14*(1), 50.
- Ferrer-I-Cancho, R., & Forns, N. (2010). The self-organization of genomes. *Complexity*, 15(5), 34–36.
- Ferrer-I-Cancho, R., & Hernández-Fernández, A. (2013). The failure of the law of brevity in two new world primates. Statistical caveats. *Glottotheory*, 4(1), 45–55.
- Ferrer-I-Cancho, R., Hernández-Fernández, A., Lusseau, D., Agoramoorthy, G., Hsu, M. J., & Semple, S. (2013). Compression as a universal principle of animal behavior. *Cognitive Science*, *37*(8), 1565–1578.
- Fögen, T. (2014). Animal communication. In G. L. Campbell (Ed.), *The Oxford Handbook of Animals in Classical Thought and Life* (pp. 216–232). Oxford University Press.
- Golston, C. (2018). Phi-features in animal cognition. *Biolinguistics*, 12, 055–098.
- Gultekin, Y. B., Hildebrand, D. G. C., Hammerschmidt, K., & Hage, S. R. (2021). High plasticity in marmoset monkey vocal development from infancy to adulthood. *Science Advances*, 7(27), eabf2938.
- Gurevitch, J., Koricheva, J., Nakagawa, S., & Stewart, G. (2018). Meta-analysis

- and the science of research synthesis. *Nature*, 555(7695), 175–182.
- Gustison, M. L., & Bergman, T. (2017). Divergent acoustic properties of gelada and baboon vocalizations and their implications for the evolution of human speech. *Journal of Language Evolution*, 2(1), 20–36.
- Gustison, M. L., Semple, S., Cancho, R. Ferrer-i, & Bergman, T. J. (2016). Gelada vocal sequences follow Menzerath's linguistic law. *Proceedings of the National Academy of Sciences*, 113(19), E2750–E2758.
- Gustison, M. L., Tinsley Johnson, E., Beehner, J. C., & Bergman, T. J. (2019). The social functions of complex vocal sequences in wild geladas. *Behavioral Ecology and Sociobiology*, 73(1), 14.
- Heaps, H. S. (1978). *Information retrieval, computational and theoretical aspects.*Academic Press.
- Heesen, R., Hobaiter, C., Cancho, R. Ferrer-i, & Semple, S. (2019). Linguistic laws in chimpanzee gestural communication. *Proceedings of the Royal Society B*, 286(1896), 20182900.
- Herdan, G. (1960). Type-token mathematics. Mouton.
- Herdan, G. (1964). Quantitative linguistics. Butterworth.
- Hobaiter, C., & Byrne, R. W. (2014). The meanings of chimpanzee gestures. *Current Biology*, 24(14), 1596–1600.
- Hockett, C. F. (1959). Animal "languages" and human language. *Human Biology*, 31(1), 32–39.
- Hockett, C. F. (1960). The origin of speech. Scientific American, 203, 89–96.
- Huang, M., Ma, H., Ma, C., Garber, P. A., & Fan, P. (2020). Male gibbon loud morning calls conform to Zipf's law of brevity and Menzerath's law: insights into the origin of human language. *Animal Behaviour*, *160*, 145-155
- Kanwal, J., Smith, K., Culbertson, J., & Kirby, S. (2017). Zipf's law of abbreviation and the principle of least effort: Language users optimise a miniature lexicon for efficient communication. *Cognition*, *165*, 45–52.
- Kershenbaum, A., Demartsev, V., Gammon, D. E., Geffen, E., Gustison, M. L., Ilany, A., & Lameira, A. R. (2021). Shannon entropy as a robust estimator of Zipf's law in animal vocal communication repertoires. *Methods in Ecology and Evolution*, *12*(3), 553–564.
- Kornai, A. (2002). How many words are there? Glottometrics, 4, 61–86.
- Levshina, N., & Moran, S. (2021). Efficiency in human languages: Corpus evidence for universal principles. *Linguistics Vanguard*, 7(S3).
- Liebal, K., Slocombe, K. E., & Waller, B. M. (2022). The language void 10 years on: multimodal primate communication research is still uncommon. *Ethology Ecology & Evolution*, *34*(3), 274–287.
- McCowan, B., Doyle, L. R., & Hanser, S. F. (2002). Using information theory to assess the diversity, complexity, and development of communicative repertoires. *Journal of Comparative Psychology*, *116*(2), 166–172.

- Menzerath, P. (1954). Die Architektonik des deutschen Wortschatzes. F. Dümmler. Nikolaou, C. (2014). Menzerath–Altmann law in mammalian exons reflects the dynamics of gene structure evolution. Computational Biology and Chemistry, 53, 134–143.
- Odom, K. J., Hall, M. L., Riebel, K., Omland, K. E., & Langmore, N. E. (2014). Female song is widespread and ancestral in songbirds. *Nature Communications*, *5*(1), 1–6.
- Piantadosi, S. T. (2014). Zipf's word frequency law in natural language: A critical review and future directions. *Psychonomic Bulletin and Review*, 21(5), 1112–1130.
- Semple, S., Cancho, R. Ferrer-i, & Gustison, M. L. (2021). Linguistic laws in biology. *Trends in Ecology & Evolution*, 37(1), 53–66.
- Semple, S., Hsu, M., Agoramoorthy, G., & Cancho, R. Ferrer-i. (2013). The law of brevity in macaque vocal communication is not an artefact of analysing mean call durations*. *Journal of Quantitative Linguistics*, 20(3), 209–217.
- Semple, S., Hsu, M. J., & Agoramoorthy, G. (2010). Efficiency of coding in macaque vocal communication. *Biology Letters*, 6(4), 469–471.
- Shahzad, K., Mittenthal, J. E., & Caetano-Anollés, G. (2015). The organization of domains in proteins obeys Menzerath-Altmann's law of language. *BMC Systems Biology*, *9*(1), 1–13.
- Sun, F., & Caetano-Anollés, G. (2021). Menzerath–Altmann's law of syntax in RNA accretion history. *Life*, 11(6), 489.
- Valente, D., De Gregorio, C., Favaro, L., Friard, O., Miaretsoa, L., Raimondi, T., Ratsimbazafy, J., Torti, V., Zanoli, A., Giacoma, C., & Gamba, M. (2021). Linguistic laws of brevity: conformity in *Indri indri. Animal Cognition*, 24(4), 897–906.
- Van Schaik, C. (2016). The primate origins of human nature. John Wiley & Sons, Ltd.
- Wacewicz, S., & Żywiczyński, P. (2015). Language evolution: Why Hockett's design features are a non-starter. *Biosemiotics*, 8(1), 29–46.
- Watson, S. K., Heesen, R., Hedwig, D., Robbins, M. M., & Townsend, S. W. (2020). An exploration of Menzerath's law in wild mountain gorilla vocal sequences. *Biology Letters*, *16*(10), 20200380.
- Yu, S., Xu, C., & Liu, H. (2018). Zipf's law in 50 languages: its structural pattern, linguistic interpretation, and cognitive motivation. *arXiv* preprint *arXiv*:1807.01855.
- Zanoli, A., De Gregorio, C., Valente, D., Torti, V., Bonadonna, G., Randrianarison, R. M., Giacoma, C., & Gamba, M. (2020). Sexually dimorphic phrase organization in the song of the indris (*Indri indri*). *American Journal of Primatology*, 82(6), e23132.
- Zipf, G. K. (1936). The psychobiology of language. London: Routledge.
- Zipf, G. K. (1949). Human behavior and the principle of least effort. New York:

Addison-Wesley.