

Pathways of prehistoric demographic expansion model typological  
diversity in the Americas

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Questions regarding spatial effects on language have received increased attention in quantitative areal typology. Most relevant work has focused on questions of contact. Here, we explore possible reflexes of prehistoric demographic (and hence, linguistic) expansion in linguistic structure.

We put this work into the context of the persisting, unresolved question of language relationships, in particular “deep” ones, in the Americas - two continents that were settled relatively recently by humans, but that at the same time present exuberant structural and genealogical diversity.

Urban et al. (2019) observed a striking north-south gradient in typological structure across western Meso- and South America, a macro-scale pattern that had not been observed before. In this presentation, we explore the idea that such gradients reflect and retrace expansion paths of human dispersal (see also Nichols 2015, Nichols and Peterson 1996 for interpretations of typological distributions as indicative of prehistoric demography in the Americas). We explore this particular idea by looking at the 177 typological features from Urban et al. (2019); however, the sample has been expanded significantly to 102 languages that cover the entire western Americas from the Pacific Northwest to Tierra del Fuego.

To model expansion we use a version of Gaussian Processes (Guzmán Naranjo and Becker 2021, Guzmán Naranjo and Mertner 2022) called non-stationary GPs. This type of model is made up of two components. One non-linear component captures spatial dependencies (i.e. contact) between observations, and a linear component captures the expansion from the origin.

For the non-linear component we use topographic distances between languages (Guzmán Naranjo and Jäger 2023). Topographic distances are the shortest distance between two points taking geographic features like mountain ranges into account. For the linear component we calculated the topographic distance from Bering Strait to each modern language location following known paths of prehistoric dispersal (Posth et al. 2018; Moreno-Mayar et al. 2018). Additionally, to control for family bias we use a phylogenetic term in the model.

Our results show a clear linguistic cline for the Americas from North to South in about half of the features in our data in addition to, and independent of, some general language contact trends. We argue that these results represent evidence that expansion events can leave a mark in the languages involved.

## References:

- Guzmán Naranjo, Matías and Laura Becker (2021), Statistical bias control in typology. *Linguistic Typology*, 26(3), 605-670.
- Guzmán Naranjo, Matías and Miri Mertner (2023), Estimating areal effects in typology: a case study of african phoneme inventories. *Linguistic Typology*, 27(2), 455-480.
- Guzmán Naranjo Matías and Gerhard Jäger (2023), Euclidean, the crow, the wolf and the pedestrian: distance metrics for linguistic typology. *Open Res Europe* 2023, 3(104).
- Moreno-Mayar, J. Víctor, Lasse Vinner, Peter de Barros Damgaard, Constanza de la Fuente, Jeffrey Chan, Jeffrey P. Spence, Morten E. Allentoft, Tharsika Vimala, Fernando Racimo, Thomaz Pinotti, Simon Rasmussen, Ashot Margaryan, Miren Iraeta Orbegozo, Dorothea Mylopotamitaki, Matthew Wooller, Clement Bataille, Lorena Becerra-Valdivia, David Chivall, Daniel Comeskey, Thibaut Devière, Donald K. Grayson, Len George, Harold Harry, Verner Alexandersen, Charlotte Primeau, Jon Erlandson, Claudia Rodrigues-Carvalho, Silvia Reis, Murilo Q. R. Bastos, Jerome Cybulski, Carlos Vullo, Flavia Morello, Miguel Vilar, Spencer Wells, Kristian Gregersen, Kasper Lykke Hansen, Niels Lynnerup, Marta Mirazón Lahr, Kurt Kjaer, André Strauss, Marta Alfonso-Durruty, Antonio Salas, Hannes Schroeder, Thomas Higham, Ripan S. Malhi, Jeffrey T. Rasic, Luiz Sousa, Fabricio R. Santos, Anna-Sapfo Malaspinas, Martin Sikora, Rasmus Nielsen, Yun S. Song, David J. Meltzer, and Eske Willerslev (2018), Early human dispersals within the Americas. *Science* 362 (6419), 1128.
- Nerbonne John, Wilbert Heeringa, and Peter Kleiweg (1999), Comparison and classification of dialects, in Proceedings of the Ninth Conference on European Chapter of the Association for Computational Linguistics, EACL '99, 281–282.
- Nichols, Johanna, and David A. Peterson (1996), The Amerind personal pronouns. *Language* 72, 336-371.
- Nichols, Johanna (2015), How America was colonized: Linguistic evidence, in Michael David Frachetti and Robert N. Spengler (eds.), (2015), *Mobility and Ancient Society in Asia and the Americas*, New York: Springer, 117-126.
- Posth, Cosimo, Nathan Nakatsuka, Iosif Lazaridis, Pontus Skoglund, Swapan Mallick, Thiseas C. Lamnidis, Nadin Rohland, Kathrin Nägele, Nicole Adamski, Emilie Bertolini, Nasreen Broomandkhoshbacht, Alan Cooper, Brendan J. Culleton, Tiago Ferraz, Matthew Ferry, Anja Furtwängler, Wolfgang Haak, Kelly Harkins, Thomas K. Harper, Tabita Hünemeier, Ann Marie Lawson, Bastien Llamas, Megan Michel, Elizabeth Nelson, Jonas Oppenheimer, Nick Patterson, Stephan Schiffels, Jakob Sedig, Kristin Stewardson, Sahra Talamo, Chuan-Chao Wang, Jean-Jacques Hublin, Mark Hubbe, Katerina Harvati, Amalia Nuevo Delaunay, Judith Beier, Michael Francken, Peter Kaulicke, Hugo Reyes-Centeno, Kurt Rademaker, Willa R. Trask, Mark Robinson, Said M. Gutierrez, Keith M. Prufer, Domingo C. Salazar-García, Eliane N. Chim, Lisiane Müller Plumm Gomes, Marcony L. Alves, Andersen Liryo, Mariana Inglez, Rodrigo E. Oliveira, Danilo V. Bernardo, Alberto Barioni, Veronica Wesolowski, Nahuel A. Scheifler, Mario A. Rivera, Claudia R. Plens, Pablo G. Messineo, Levy Figuti, Daniel Corach, Clara Scabuzzo, Sabine Eggers, Paulo DeBlasis, Markus Reindel, César Méndez, Gustavo Politis, Elsa Tomasto-Cagigao, Douglas J. Kennett, André Strauss, Lars Fehren-Schmitz, Johannes Krause, and David Reich (2018), Reconstructing the deep population history of Central and South America. *Cell* 175 (5), 1185-1197.

Urban, Matthias, Hugo Reyes-Centeno, Kate Bellamy and Matthias Pache (2019), The areal typology of western Middle and South America: Towards a comprehensive view. *Linguistics*, 57(6), 1403-1463.