Supplementary Methods (Distance Matrix Creation)

Linguistic distance between countries

Linguistic distance between two countries was calculated as the cultural proximity between all languages spoken within those countries, weighted by speaker percentages. We acquired cultural proximity data by combining the language family trees provided by Glottolog v3.0 (1) into one global language tree (undated and unresolved). We calculated cultural proximity s between two languages j and k as the distance (in number of nodes traversed) of their most recent common ancestor i to the root of the tree, through the formula:

$$s_{jk} = \frac{n_r - n_i}{n_r}$$

where n_r is the maximum path length (in number of nodes traversed) leading to the pan-human root r, and n_i is the maximum path length leading to node i.

Next, we combined these proximities with speaker data from Ethnologue 21 (2) and compared every language spoken within those countries by at least 1 permille of the population, weighted by speaker percentages, through the formula:

$$w_{lm} = \Sigma\Sigma\, p_{lj}\, p_{mk}\, s_{jk}$$

where p_{lj} is the percentage of the population in nation l speaking language j, p_{mk} is the percentage of the population in nation m speaking language k, and s_{jk} is the proximity measure between languages j and k (3).

Geographic distance between countries

Geographic distance was calculated as the geodesic distance between country capital cities (data from the R package *maps,* 4) using the package *geosphere* (5).

References

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