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Appendices of *The Dimensions of Morphosyntactic Variation: Whorf, Greenberg and Nichols were right*

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Appendices

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Appendix 1. List of languages with dimension correlates
Appendix 2. List of features

Appendix 1 and Appendix 2 can be found in the files WorldFAMD_Appendix-12.xlsx and WorldFAMD_Appendix-2.xlsx, available at https://osf.io/u9qbe/.

Appendix 3. Extended list of feature associations with first four dimensions

Appendix 3 can be found in the file WorldFAMD_Appendix-3.xlsx, available at https://osf.io/u9qbe/.

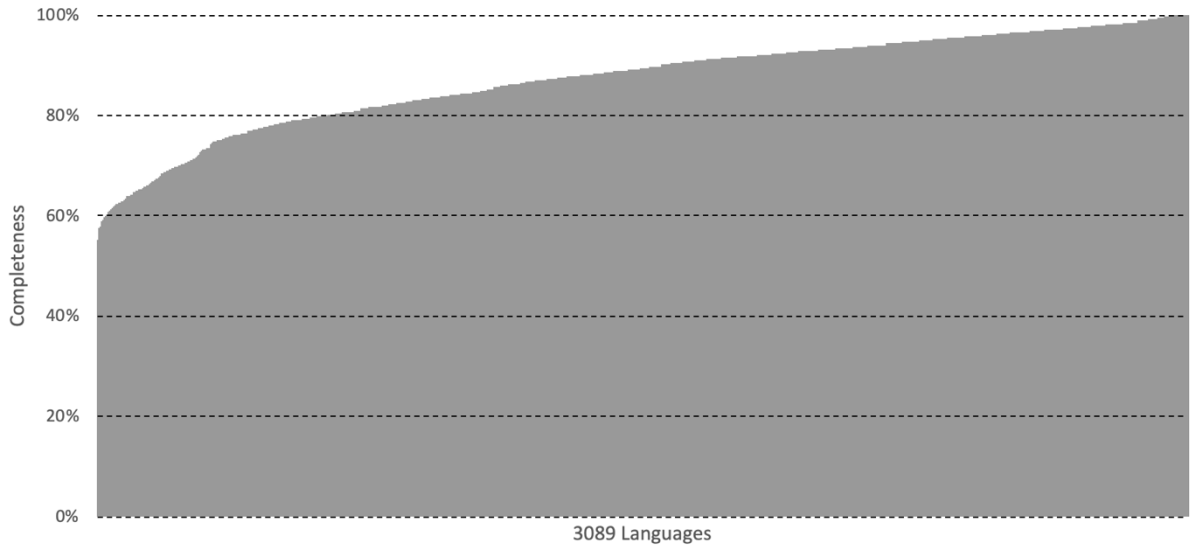


Figure A3: The distribution of data in the database: coding completeness of 3089 languages/varieties across maximally 351 features.

Appendix 4. Comparison of area-controlled, family-controlled and genus-controlled FAMDs

In the body of this paper we examined the data controlling for area, balancing the weighting for both macro-area and modified AUTOTYP area (Section 2). This method is easy to implement, avoiding decisions about relatedness of controversial languages. We tested whether a family-controlled or genus-controlled analysis produced different results, and found that essentially the same features emerge as the drivers of variation, though sometimes in different orders. We also examined a FAMD analysis without controls for area or genealogy, similarly finding very little difference. The number of dimensions that are optimal varies across the different analyses, as shown in Table A4.1, which also described the variance accounted for (in each different analysis) by each dimension.[1]

Dimension	Area	Family	Genus	Ø controls
1	7.7%	7.2%	7.8%	9.4%
2	6.4%	6.5%	6.8%	7.0%
3	4.2%	3.6%	3.9%	4.4%
4	3.9%	2.6%	2.8%	3.9%
5		2.2%	2.1%	
6		1.9%	1.7%	
7			1.6%	

Table A4.1: Dimensions and variance in the different analyses.

The following tables show the correlates of the different dimensions discussed in the body of the paper, and indicate in which dimension they occur with different controls. For instance, VO order is a correlate of Dimension 1 in the area-controlled analysis. It correlates to Dimension 2 in a family-controlled analysis, to both Dimension 1 and Dimension 2 in the genus-controlled analysis, and to Dimension 1 when no weighting is applied. We can see that there is little discrepancy between the different analyses in terms of which features correlate together, though we note that a family-controlled analysis places all of these features as part of Dimension 2, and that in the genus-controlled and

[1] We do not discuss these alternative analyses in great detail here, as they are the topic of a forthcoming paper (in preparation).

unmoderated analyses most of the features listed here occur in more than one dimension (just as, for instance, Gen N order is a correlate of both Dimension 1 and Dimension 4).

	Prepositions	VO	Subordinator-Clause	Prefixal nominative	V Obl	Gen N	Cl Sub	Postpositions	Obl V	Total Case	N Case	SOV
Area	1	1	1	1	1	1,4	1	1	1	1	1	1
Family	2	2	2	3	2	2	2	2	2	2	2	2
Genus	1	1,2	1,2	2,3	1,2	1	1,2	1,2	1	1,3	1	1,2
Ø	1,3	1	1,3	2	1	1	1,3	1	1	1	1	1

Table A4.2: Correlates of Dimension 1.

The features that correlate with Dimension 2 in the area-controlled analysis tend to be part of the first dimension for the other analyses, but we also find some features correlating in the lower dimensions. Again, all of the features that showed associations with dimensions in the area-controlled analysis appear in the alternative analyses.

	Balanced	SVO	Total tenses	Possessive affixes	Causatives	Applicatives	Incorporation	Modality affixes	Verbal synthesis	Total agreement
Area	2	2	2	2	2	2	2	2	2	2
Family	1	2	2	1	1,5	1,4	1,4	2	1	1,3
Genus	1	1	1,7	2,3	2,3,5	2,6	2	1	1	2,3
Ø	1	1,3	1	2,3	2	2	2,3	1	1	2,4

Table A4.3: Correlates of Dimension 2.

The features that correlate with Dimension 3 across the different controls similarly find parallels in the analyses with other controls, but for this set of features we find

some that are not prominent in most of the analyses. Relative Pronouns, for instance, feature in the unweighted analyses, but not in either of the phylogenetically controlled analyses. While clusivity contrasts are relevant for the unweighted analysis and the genus-weighted analysis, it does not feature in the family-weighted analysis.

	Gender	Obligatory plural	Gender in 3SG	Accusative verbs	Gender in 3PL	Relative pronouns	Suffixal nominative	Ergativity	VOS	Clusivity	Clause-initial negation
Area	3	3	3	3	3	3,4	3	3	3	3	3,4
Family	4	4	4	4			(4)	6	1		1
Genus	3,4	4	4	4			4	5	2,3	2	2,3
Ø	3	3	3	3	3	3	1	1	2,4	2,3	2

Table A4.4: Correlates of Dimension 3.

The features associated with the fourth dimension are replicated in the other analyses, though, as with the features associated with the third dimension, we see more features that are not prominent in one or more of the alternative analyses, and more variability in terms of which dimension they are found in.

	VSO	Clause-initial negation	Numeral Noun	Initial wh-quesitons	Adjecdtive Noun	Genitive Noun	Relative Pronoun	Clause-final negation	Inalienability	Prefixal accusative	Noun Numeral	SV
Area	4	3,4	4	4	4	2,4	3,4	4	4	4	4	4
Family	1	1	3	1	(3)	2		1		3	3	
Genus	2,3	2,3	3,7	2	3	(2)	4	3			3,7	2,3,7
Ø	2,4	2	4	2,4	1,4	1	3	4	2	2,4	4	2

Table A4.5: Correlates of Dimension 4.

Very few novel features emerged as significant in the higher dimensions of the alternative analyses. Table A4.6 lists the features that are found in at least two analyses; Table A4.7 offers a partial list of features occurring in just one analysis. We see the order of demonstratives and nouns features in the genus-weighted and un-weighted analyses, as doesthe position of Tense-Aspect-Mood affixes on the verb. Other verbal morphology accounts for the rest of the 'new' features, including the appearance of Philippine-type voice systems, and the possibility for double applicative or double causative constructions, but only in the genus-weighted analysis. In that analysis tonal morphology appears, including tonal marking of TAM categories, or marking agreement on the verb.

	Negative affixes on verb	**Interrogative verb forms**	**Noun Demonstrative**	**TAM suffixes**	**Philippine-style voice**
Area					
Family	2	6			
Genus		1	1	1	3
Ø	1		1	1	4

Table A4.6: Additional features with strong associations emerging from the alternative analyses.

Dimension	**Family**	**Genus**	**Ø controls**
1			Dem Noun
2		Double applicatives TAM prefixes	
3	Number-sensitive suppletive verb forms Passives		Tense-sensitive suppletive verb forms
4		Tonal morphology	
5		Double causatives	
6			
7		Tonal agreement on verbs	

Table A4.7: Additional features with strong associations in one of the alternative analyses.

Appendix 5. Explication of FAMD analyses of macro-areas

This appendix reports in more detail the results of the analyses that were reported in summary in 3.3. In each case only a selection of the features that are most strongly associated with a particular dimension are shown.

A5.1. Africa

Features characterising the extremities of Dimensions 1 – 8 in the African FAMD.

Direction	Feature	r^2
High	SOV order	0.68
	Oblique precedes verb	0.62
	Postpositions	0.55
	Number of cases	0.51
	Genitive precedes noun	0.49
	Plural suffixes on nouns	0.48
	Subject agreement suffixes	0.46
	Prefixing	0.44
	Object agreement prefixes	0.49
	Prepositions	0.52
	Oblique follows verb	0.57
Low	SVO order	0.63

Table 5.1.1: African Dimension 1.

Direction	Feature	r^2
High	Morphological causatives	0.50
	Total agreement positions	0.43
	Accusative verb alignment	0.41
	Negative affix on verbs	0.41
	Negator follows subject	0.32
Low	Negative particle	0.34

Table 5.1.2: African Dimension 2.

Direction	Feature	r^2
High	Predicate-subject	0.67
	VSO order	0.48
	Clause-initial negation	0.40
	Object verb agreement suffix	0.19
	Clusivity contrasts	0.18
	Gender	0.14
	Gender in 3SG pronoun	0.14
Low	SV order	0.67

Table 5.1.3: African Dimension 3.

Direction	Feature	r^2
High	Head marking	0.16
	Relative pronouns	0.16
	Accusative verb alignment	0.13
	Double causatives	0.12
	VOS order	0.14
	Incorporation	0.15
Low	Superapplicatives	0.22

Table 5.1.4: African Dimension 4.

Direction	Feature	r^2
High	Infixes	0.23
	Incorporation	0.23
	Demonstrative precedes noun	0.18
	Relative pronouns	0.12
	Superapplicatives	0.11
	Adjective follows noun	0.09
	Relative clause follows noun	0.10
Low	Demonstrative follows noun	0.11

Table 5.1.5: African Dimension 5.

Direction	Feature	r^2
High	Ergative verb alignment	0.24
	Ergative pronominal alignment	0.14
	Applicatives	0.13
	Clusivity contrasts	0.10
	VSO order	0.08
Low	Gender in first or second person pronouns	0.11

Table 5.1.6: African Dimension 6.

Direction	Feature	r^2
High	Third agreement position on verbs	0.11
	Double negation	0.11
	Numerals precede nouns	0.11
	Adjectives follow nouns	0.09
	Possessive suffixes	0.12
Low	Incorporation	0.14

Table 5.1.7: African Dimension 7.

Direction	Feature	r^2
High	Ergativity	0.22
	VSO order	0.11
	Total tense distinctions	0.06
	Possessive suffixes	0.07
	Third agreement position on verbs	0.11
Low	Possessive classes	0.12

Table 5.1.8: African Dimension 8.

Dimension	Variance accounted for?
1	10.8%
2	7.9%
3	4.7%
4	3.0%
5	2.1%
6	1.8%
7	1.6%
8	1.6%

Table A5.1.9: Variance in the data accounted for by the first eight dimensions of the Africa analysis.

A5.2. Australia

Features characterising the extremities of Dimensions 1 – 4 in the Australian FAMD.

Direction	Feature	r^2
High	Prefixal agreement for subject and object	0.71
	Fused arguments in verbal agreement	0.56
	Incorporation	0.55
	Gender	0.54
	Bound clusivity contrasts	0.51
	Accusative pronominal alignment	0.36
	Dependent marking	0.45
	Suffixing	0.45
Low	Ergativity	0.50

Table 5.2.1: Australian Dimension 1.

Direction	Feature	r^2
High	VOS order	0.39
	PNG-affixes forming pronouns	0.29
	Object suffix agreement	0.25
	Demonstrative precedes noun	0.16
	Obliques precede verb	0.14
Low	SOV order	0.29

Table 5.2.2: Australian Dimension 2.

Direction	Feature	r^2
High	Applicative types	0.55
	Causative~Applicative syncretism	0.32
	Causatives	0.23
	Past tense	0.10
Low	Verb agreement for subject and object	0.08

Table 5.2.3: Australian Dimension 3.

Direction	Feature	r^2
High	Demonstrative precedes noun	0.12
	Negator follows verb	0.11
	Incorporation	0.11
	Ergative alignment	0.12
	Final subordinating suffix	0.14
Low	Agreement	0.14

Table 5.2.4: Australian Dimension 4.

Dimension	Variance accounted for?
1	13.2%
2	4.8%
3	3.7%
4	3.5%

Table A5.2.5: Variance in the data accounted for by the first four dimensions of the Australia analysis.

A5.3. Eurasia

Features characterising the extremities of Dimensions 1 – 4 in the Eurasian FAMD.

Direction	Feature	r^2
High	Genitive follows noun	0.64
	Prepositions	0.60
	VO order	0.58
	Oblique follows verb	0.55
	Gender in 3SG pronouns	0.53
	Relative clauses follow nouns	0.52
	Relative clauses precede nouns	0.55
	Genitive precedes noun	0.56
	Final subordination	0.58
	SOV order	0.58
	Postpositions	0.59
Low	Oblique precedes verb	0.60

Table 5.3.1: Eurasian Dimension 1.

Direction	Feature	r^2
High	Verbal synthesis	0.44
	Tense marking	0.44
	Nominative verb agreement	0.39
	Morphological causatives	0.39
	Number of cases	0.37
	Numeral classifiers	0.36
	Symmetrical subordination	0.55
Low	Isolating	0.64

Table 5.3.2: Eurasian Dimension 2.

Direction	Feature	r^2
High	Number of applicatives	0.39
	Double applicatives	0.35
	Subject agreement prefixes	0.32
	Dative subjects	0.22
	Relative pronouns	0.23
Low	Accusative pronominal alignment	0.39

Table 5.3.3: Eurasian Dimension 3.

Direction	Feature	r^2
High	Number of applicatives	0.33
	Have verb	0.28
	Incorporation types	0.24
	Perfect formed with have	0.21
	Double applicatives	0.18
	Asymmetrical negative clauses	0.15
	Null copular verb in nominal predicate clauses	0.15
Low	Possession formed with a locative possessor	0.17

Table 5.3.4: Eurasian Dimension 4.

Dimension	Variance accounted for?
1	12.7%
2	10.2%
3	7.0%
4	4.8%

Table A5.3.5: Variance in the data accounted for by the first four dimensions of the Eurasian analysis.

A5.4. Pacific

Features characterising the extremities of Dimensions 1 – 3 in the Pacific FAMD.

Direction	Feature	r^2
High	SOV order	0.77
	Suffixal case	0.70
	Obliques precede verbs	0.69
	Postpositions	0.65
	Clusivity contrasts	0.53
	Initial subordination	0.64
	VO order	0.72
Low	Prepositions	0.73

Table 5.4.1: Pacific Dimension 1.

Direction	Feature	r^2
High	Dependent marking	0.39
	VS order	0.36
	Initial negation	0.33
	Negator follows subject	0.25
	Prefixal nominative agreement	0.33
Low	SV order	0.37

Table 5.4.2: Pacific Dimension 2.

Direction	Feature	r^2
High	Total agreement positions	0.54
	Possessive affixes on nouns	0.29
	Applicatives	0.28
	Accusative verb alignment	0.27
	Polar question particles	0.06
Low	Isolating	0.21

Table 5.4.3: Pacific Dimension 3.

Dimension	Variance accounted for?
1	14.8%
2	6.1%
3	4.5%

Table A5.4.4: Variance in the data accounted for by the first three dimensions of the Pacific analysis.

A5.5. North America

Features characterising the extremities of Dimensions 1 – 3 in the North American FAMD.

Direction	Feature	r^2
High	Prepositions	0.62
	Initial negation	0.58
	VSO order	0.54
	Initial subordination	0.45
	Genitive follows noun	0.45
	Final subordination	0.47
	Genitive precedes noun	0.48
	Oblique precedes verb	0.52
	Postpositions	0.63
Low	SOV order	0.75

Table 5.5.1: North America Dimension 1.

Direction	Feature	r^2
High	Agreement for two arguments	0.40
	Applicatives	0.32
	(multiple associations with types of applicatives)	
	Incorporation	0.17
	Morphological causatives	0.11
Low	Indirect trivalent verbs	0.12

Table 5.5.2: North America Dimension 2.

Direction	Feature	r^2
High	Suffixing	0.44
	Dependent marking	0.36
	Number of cases	0.32
	Nominative suffix agreement	0.22
	Possessive prefixes	0.16
	Object agreement prefixes	0.34
	Subject agreement prefixes	0.38
Low	Prefixing	0.44

Table 5.5.3: North America Dimension 3.

Dimension	Variance accounted for?
1	10.4%
2	6.0%
3	5.8%

Table A5.5.4: Variance in the data accounted for by the first three dimensions of the North American analysis.

A5.6. South America

Features characterising the extremities of Dimensions 1 – 4 in the South American FAMD.

Direction	Feature	r^2
High	VO order	0.50
	Possessive prefix	0.40
	Initial subordination	0.39
	Nominative agreement prefix	0.35
	Verb initial order	0.29
	Oblique precedes verb	0.34
	Final subordination	0.41
	Postpositions	0.45
	Suffixal core case marking	0.46
Low	SOV order	0.57

Table 5.6.1: South American Dimension 1.

Direction	Feature	r^2
High	Applicatives	0.38
	Morphological causatives	0.28
	Object suffix on verbs	0.26
	VSO order	0.24
	Clause-final negation	0.18
	SV order	0.22
Low	Balanced 'subordinate' clauses	0.28

Table 5.6.2: South American Dimension 2.

Direction	Feature	r^2
High	Subject and object agreement	0.32
	Clusivity contrasts in bound morphology	0.23
	Polar question particles	0.21
	Plural prefixes on nouns	0.15
	Initial Wh question words	0.15
Low	VS order	0.16

Table 5.6.3: South American Dimension 3.

Direction	Feature	r^2
High	Plural suffixes on nouns	0.24
	Accusative alignment on verbs	0.22
	Negator precedes verb	0.21
	Negative suffix on verbs	0.19
	Symmetrical subordination	0.21
Low	Active alignment on verbs	0.22

Table 5.6.4: South American Dimension 4.

Dimension	Variance accounted for?
1	9.4%
2	6.4%
3	4.7%
4	4.5%

Table A5.6.5: Variance in the data accounted for by the first four dimensions of the South American analysis.

Appendix 6. Macro-areas plotted on the first four dimensions of global variation.

In 3.2.5 we saw the position of North America plotted on the dimension plots that were first introduced in Figure 3 (in 3.1). Here we present the other macro-areas, with brief commentary.

Appendix 6.1. Africa.

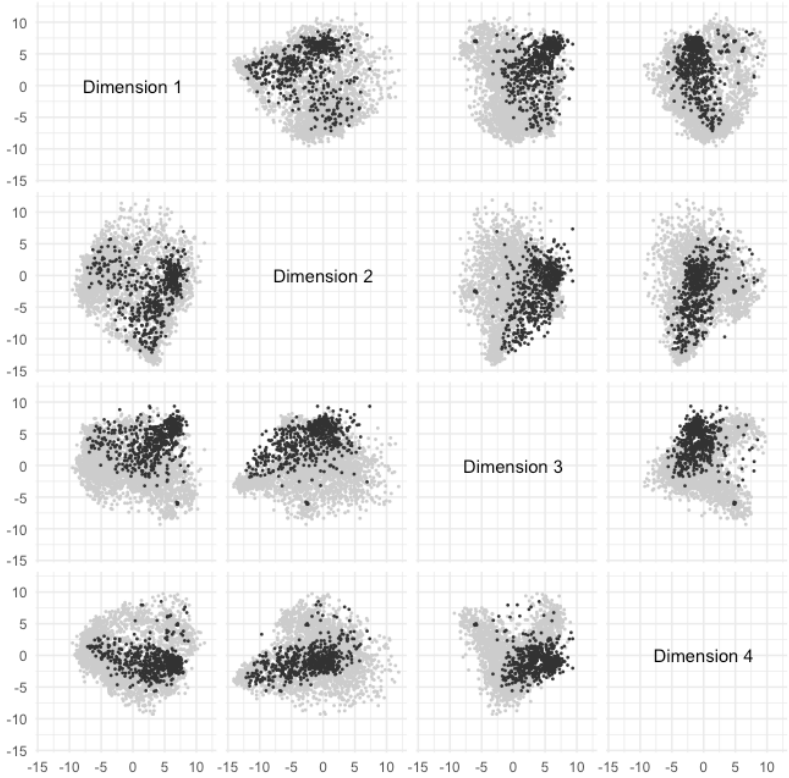


Figure A6.1: The languages of Africa in morphosyntactic space.

The languages of Africa are generally low on Dimension 3; while the Bantu languages form a tight cluster near the top of Dimension 1, the non-Bantu languages spread across most of the typological space defined by Dimensions 1 and 2, with predominantly Afro-Asiatic languages towards the bottom of Dimension 1. In terms of Dimension 4 the majority of African languages occupy a middle position, due to the verb-initial languages spoken north of the Sahara being grouped with Eurasia (see Section 2, and 3.2.1). We can see that, for the languages of Africa, there is considerable correlation between Dimensions 1 and 2 with Dimension 4.

Appendix 6.2. Australia.

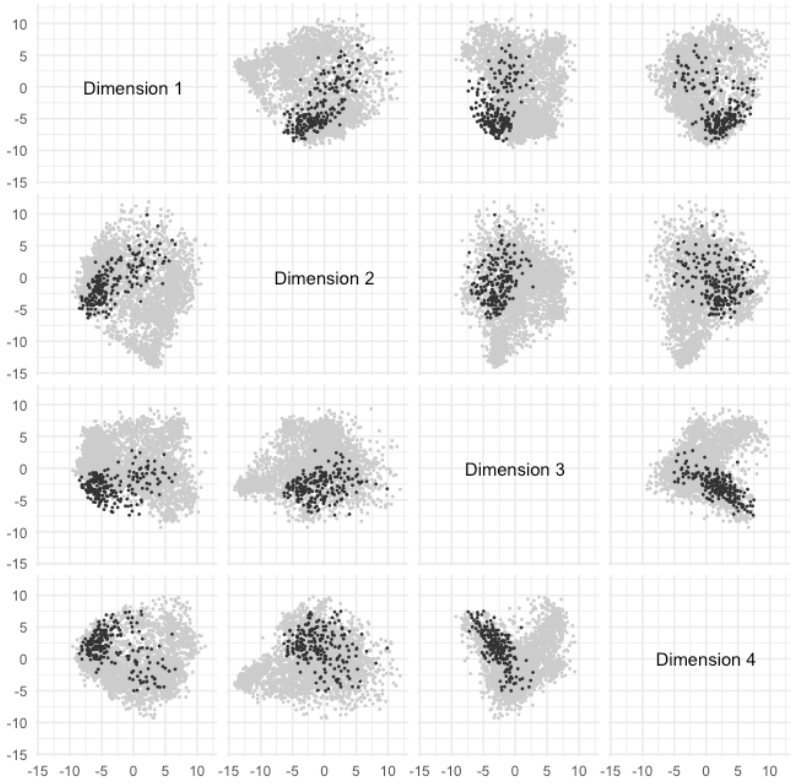


Figure A6.2: The languages of Australia in morphosyntactic space.

We have seen the typological position of the Pama-Nyungan languages that occupy most of Australia in 3.2.13. In this section the non-Pama-Nyungan languages of northern Australia are added. We can see that the non-Pama-Nyungan languages dramatically extend the typological range of the languages of Australia, occupying

space higher on Dimensions 1, 2, and lower on Dimension 4. In Australia Dimension 1 strongly correlates with Dimension 2, and Dimension 3 strongly correlates with Dimension 4.

Appendix 6.3. Eurasia.

The languages of Eurasia present an oddly fractured profile in certain dimension plots. In any plot involving Dimension 1 or Dimension 2 we can see either an empty interior in a U-shaped pattern of distribution, or else a separate region (occupied by languages from mainland Southeast Asia) with no strong connection to the rest of the languages of Eurasia, typologically. We have seen, in Map 9, that the only concentrations of languages that approximate the isolation of the languages of mainland Southeast Asia are found in West Africa and central Indonesia. In the plot of Dimension 3 vs. Dimension 4 we see a strong correlation between the two dimensions, with the languages of Eurasia avoiding the space low on Dimension 3 and high on Dimension 4, a space occupied by languages of the Circum-Pacific regions.

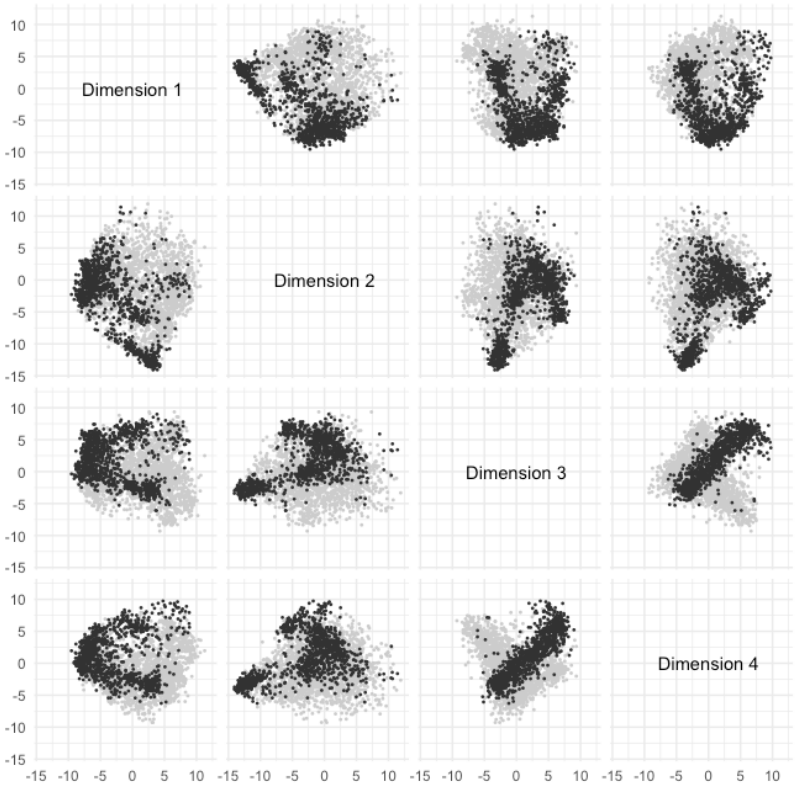


Figure A6.3: The languages of Eurasia in morphosyntactic space.

Appendix 6.4. Pacific.

The languages of the Pacific occupy a large region in typological space, but do not extend to the higher levels of Dimension 2 or Dimension 3. Other regions in which Pacific languages are not found can be detected in Figure A6.4; the space high on Dimension 4 and low on Dimension 1; the space high on Dimension 4 and high on Dimension 3; the space high on Dimension 2 and low on Dimension 3. In the plot of Dimensions 1 and 2 we see an approximate bifurcation, and in the plot of Dimension 3 and Dimension 4 a strong correlation is apparent.

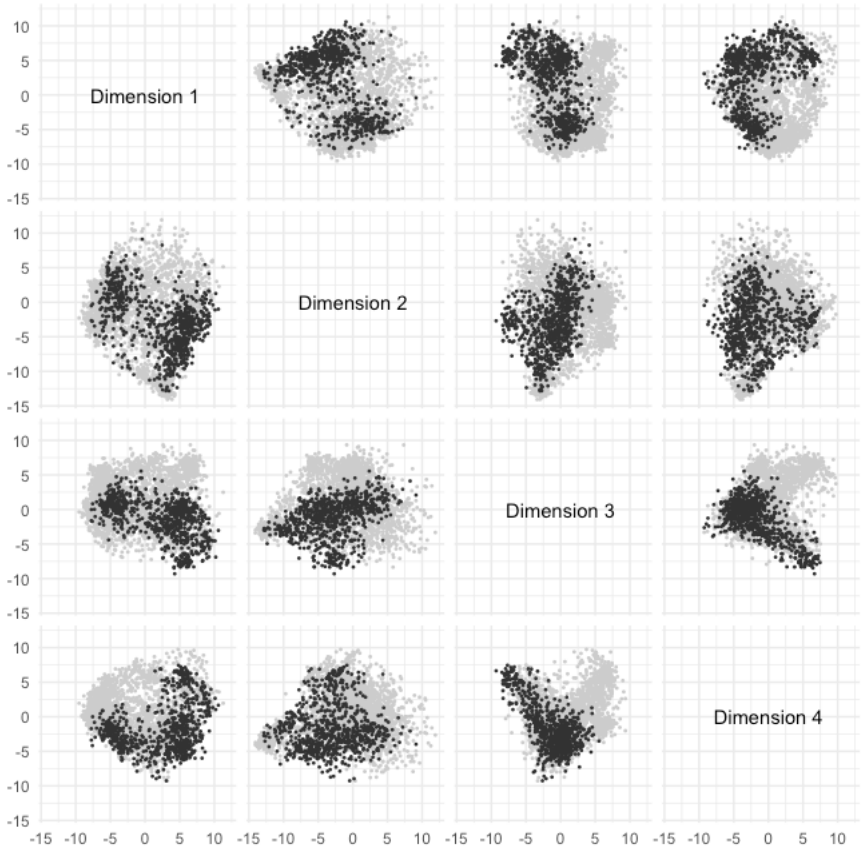


Figure A6.4: The languages of the Pacific in morphosyntactic space.

Appendix 6.5. North America.

This plot has already been described in 3.2.5, and is repeated here purely for the benefit of having all of the macro-areal plots in the same place. We note that Dimension 3 and Dimension 4 show a negative correlation, as with the Pacific.

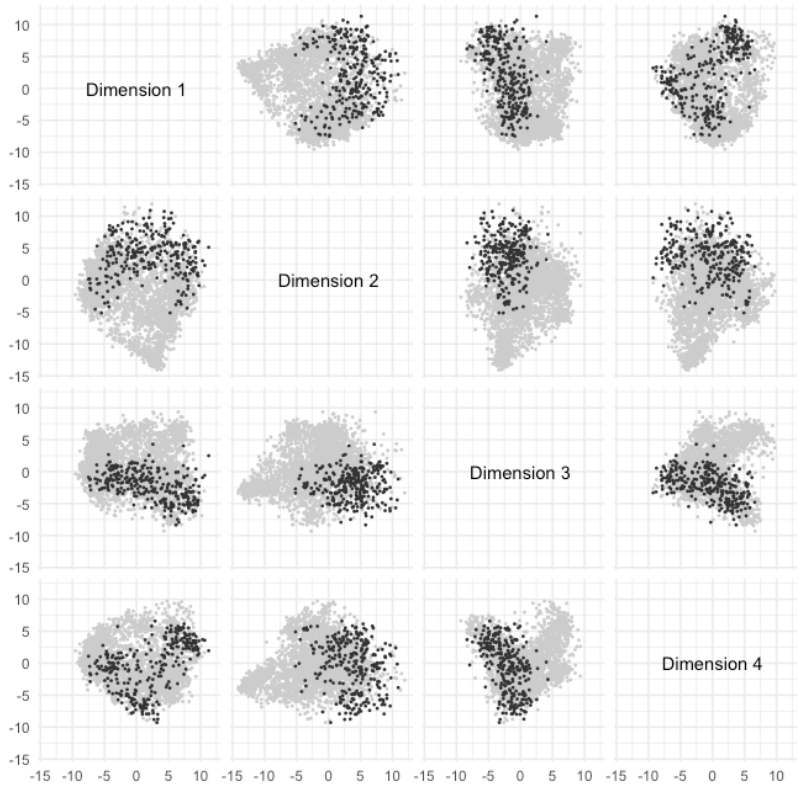


Figure A6.5: The languages of North America in morphosyntactic space.

Appendix 6.6. South America.

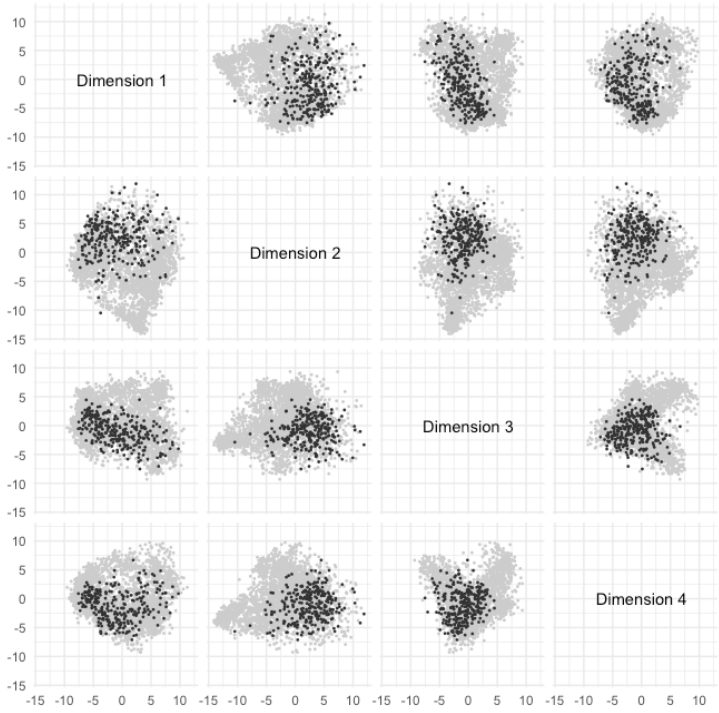
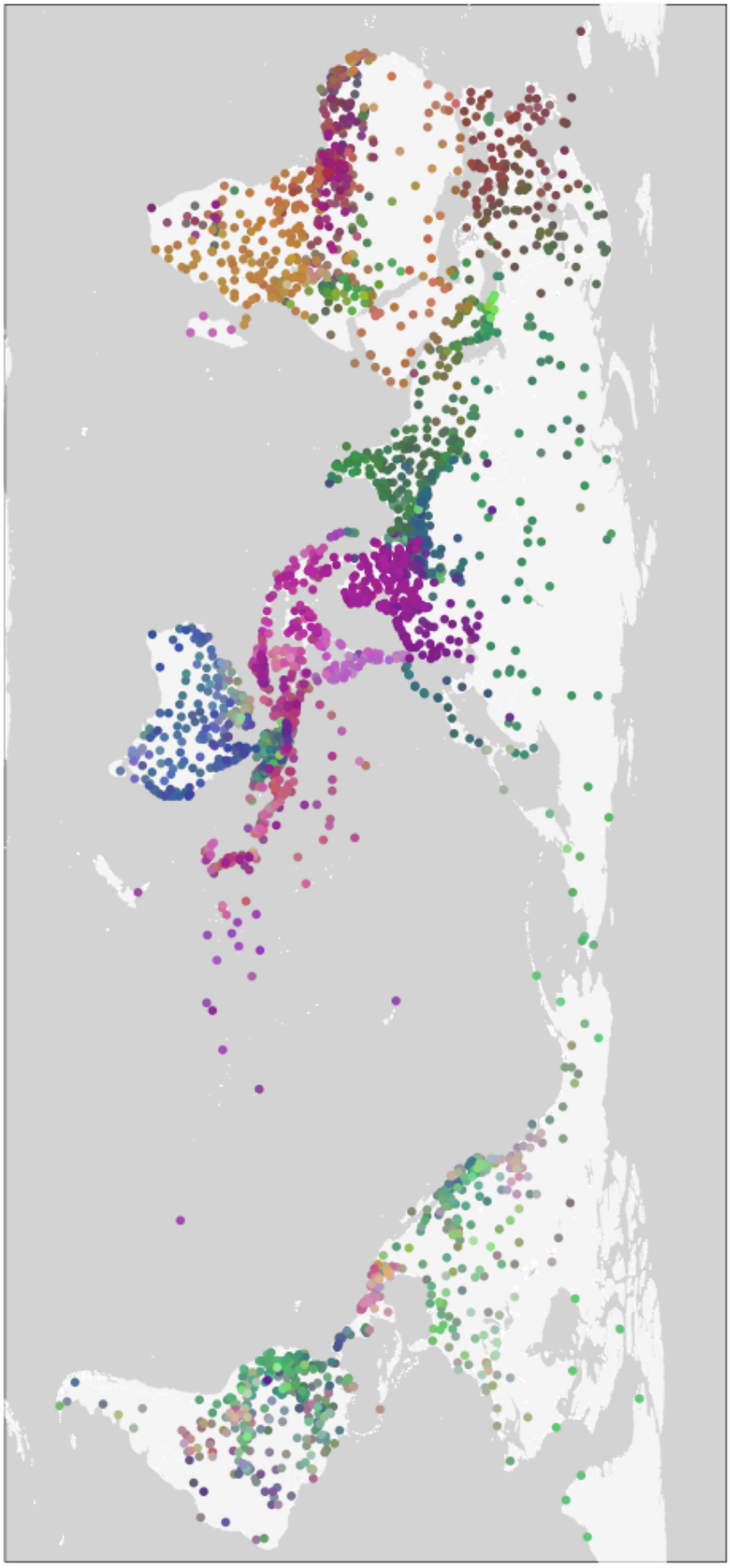


Figure A6.6: The languages of South America in morphosyntactic space.

The languages of South America can be seen as a slightly less peripheral version of the North American languages, slightly higher on Dimensions 3 and 4, and slightly lower on Dimension 1.

Appendix 7. Larger version of the map combining the first three dimensions

An interactive, version of this map, best viewed with Google Chrome, can be found online at https://skalyan91.github.io/d3-language-maps/globe.html?data=ms-points-2023-noPC-Autotyp. Large downloadable versions of the map can be found at https://osf.io/u9qbe/.



Map A7: Larger version of Map 12.

Appendix 8. Alternative visualisations of dimensions

The colourings in Figure 3 and Map 9 follow combinations of Red, Blue and Green assigned to the first, second and third dimensions, respectively, while in Maps 5 – 8 we saw maps coloured according to a single dimension. In this appendix we present alternative visualisations colouring according to different combinations of dimensions.

A8.1. Colours reflecting Dimensions 1, 2 and 4

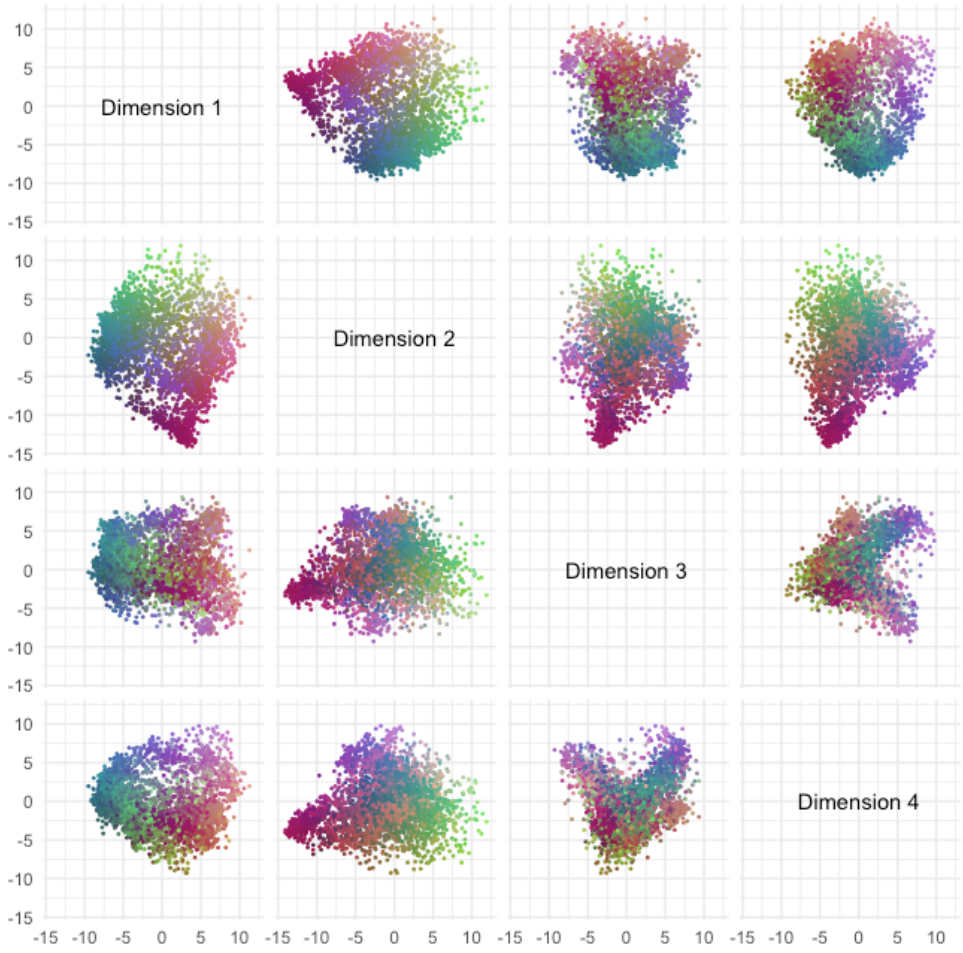
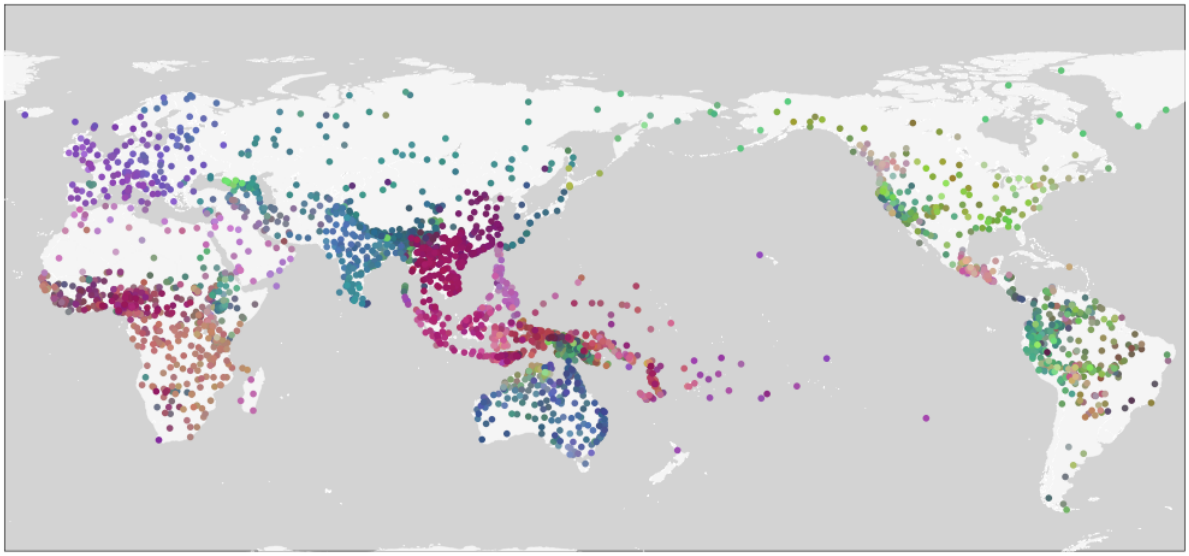


Figure A8.1: Dimension plots coloured for Dimensions 1, 2 and 4.



Map A8.1: Global map coloured for dimensions 1, 2 and 4.

A8.2. Colours reflecting Dimensions 1, 3 and 4

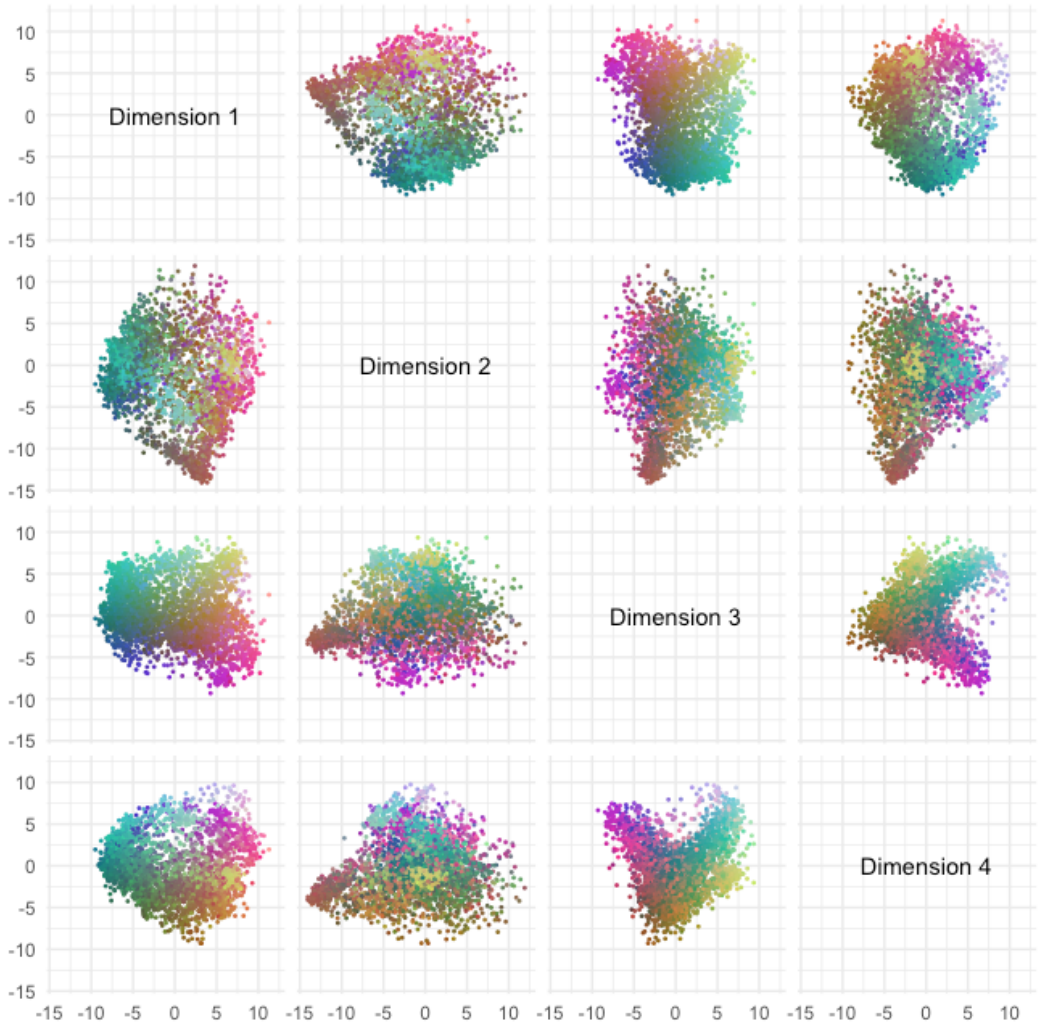
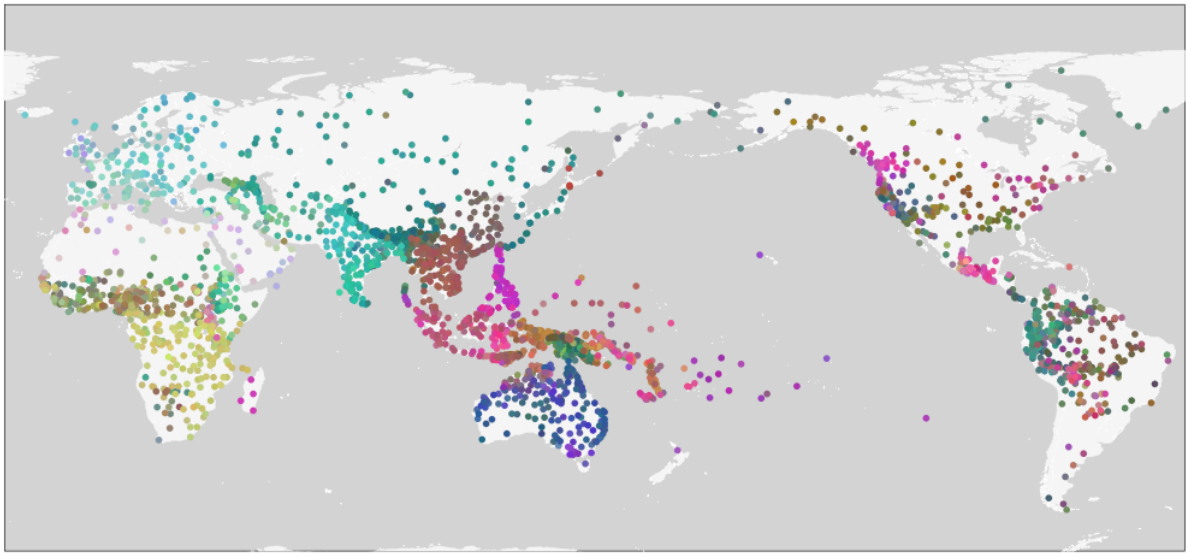


Figure A8.2: Dimension plots coloured for Dimensions 1, 3 and 4.



Map A8.2: Global map coloured for dimensions 1, 3 and 4.

A8.3. Colours reflecting Dimensions 2, 3 and 4

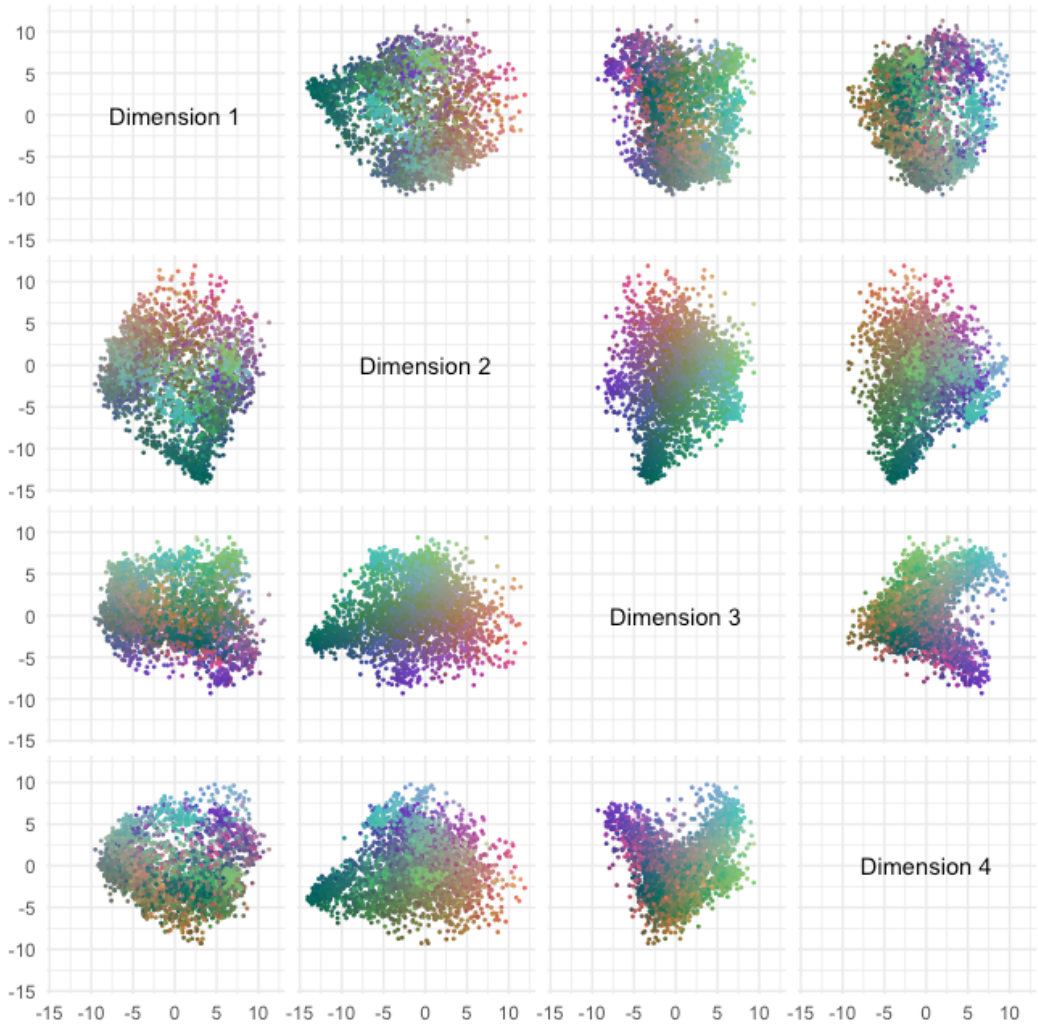
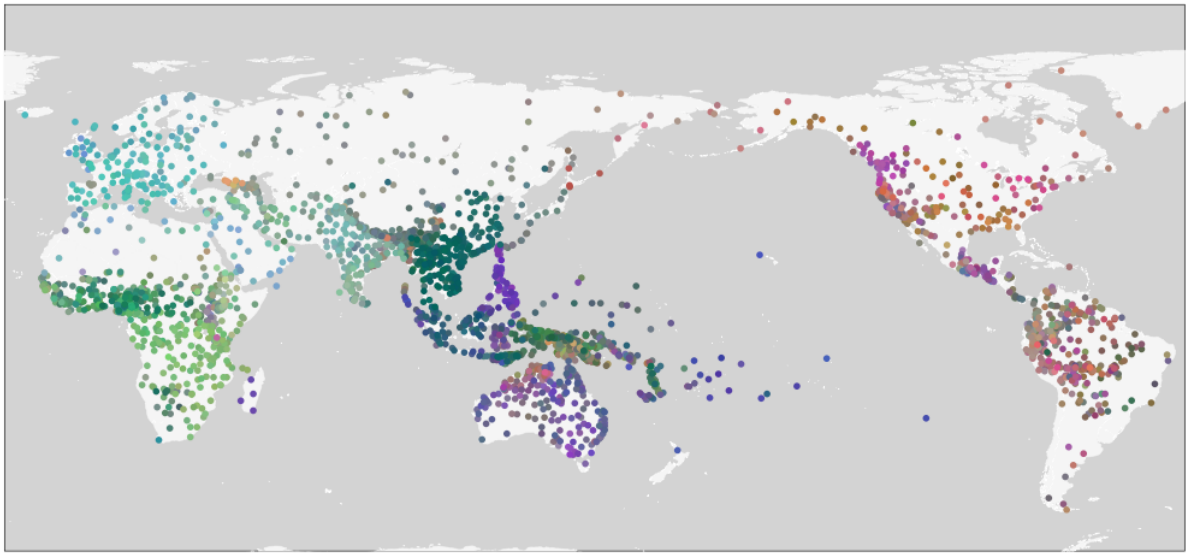


Figure A8.3: Dimension plots coloured for Dimensions 2, 3 and 4.



Map A8.3: Global map coloured for dimensions 2, 3 and 4.

A8.4. Colours reflecting Dimensions 1 and 2

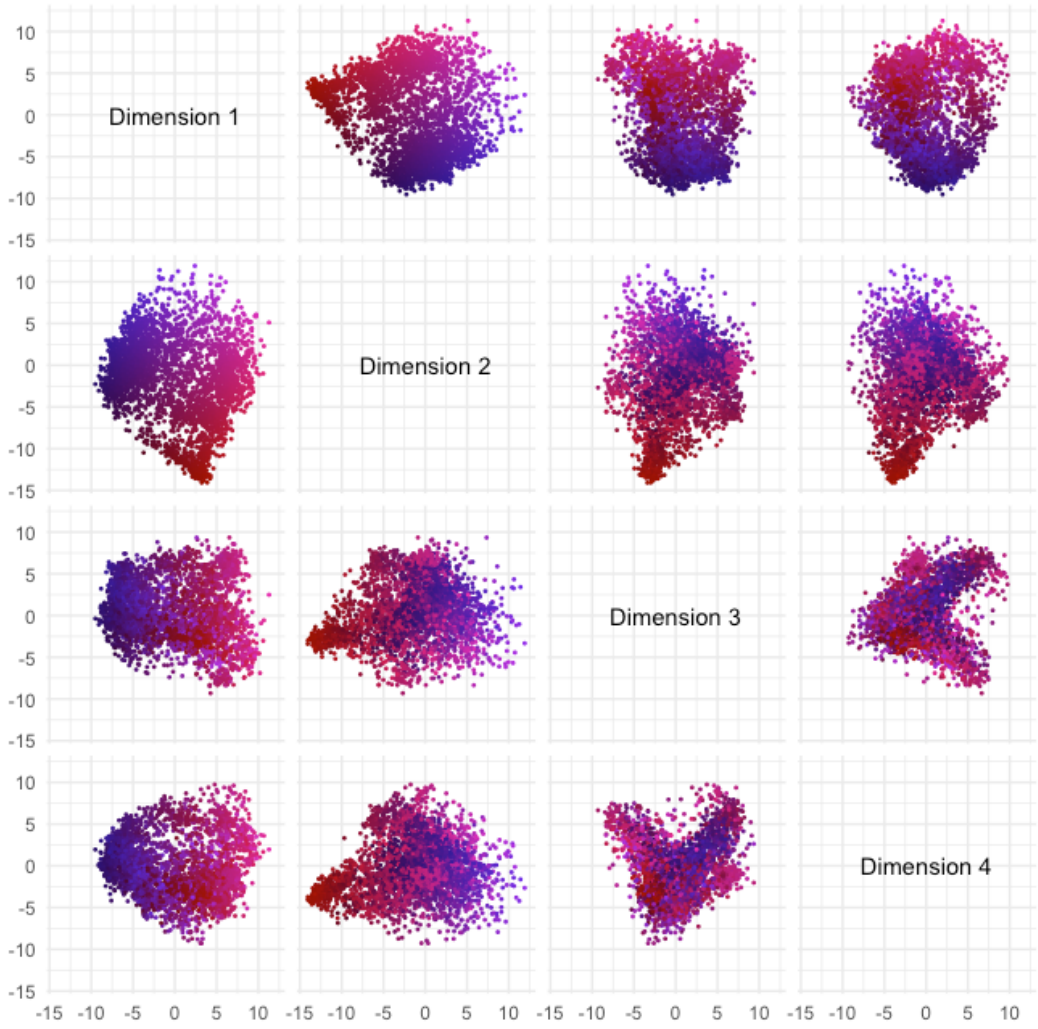
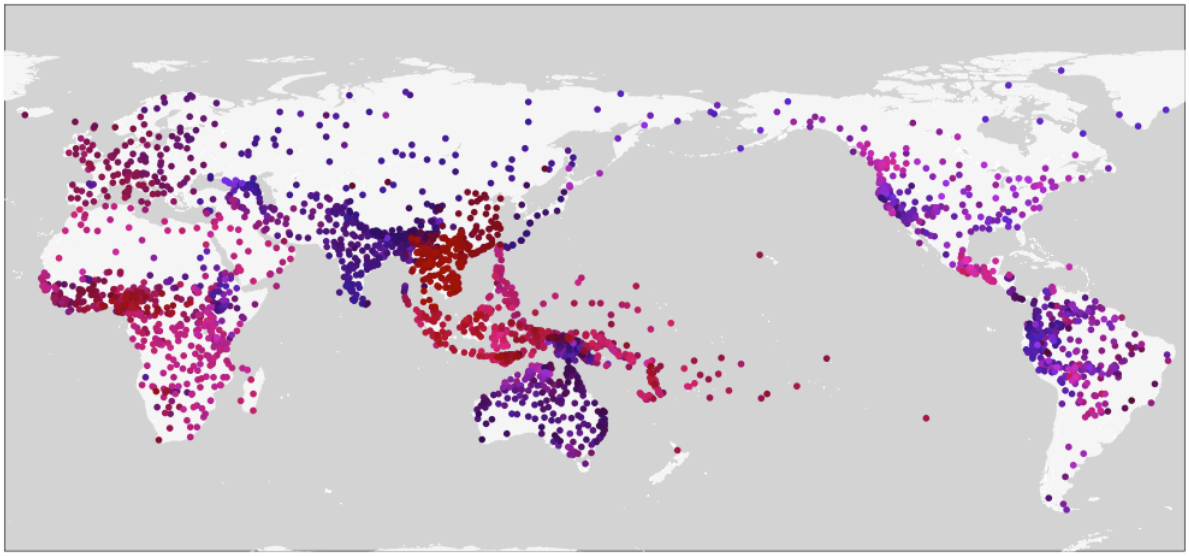


Figure A8.4: Dimension plots coloured for Dimensions 1 and 2



Map A8.4: Global map coloured for dimensions 1 and 2.

A8.5. Colours reflecting Dimensions 1 and 3

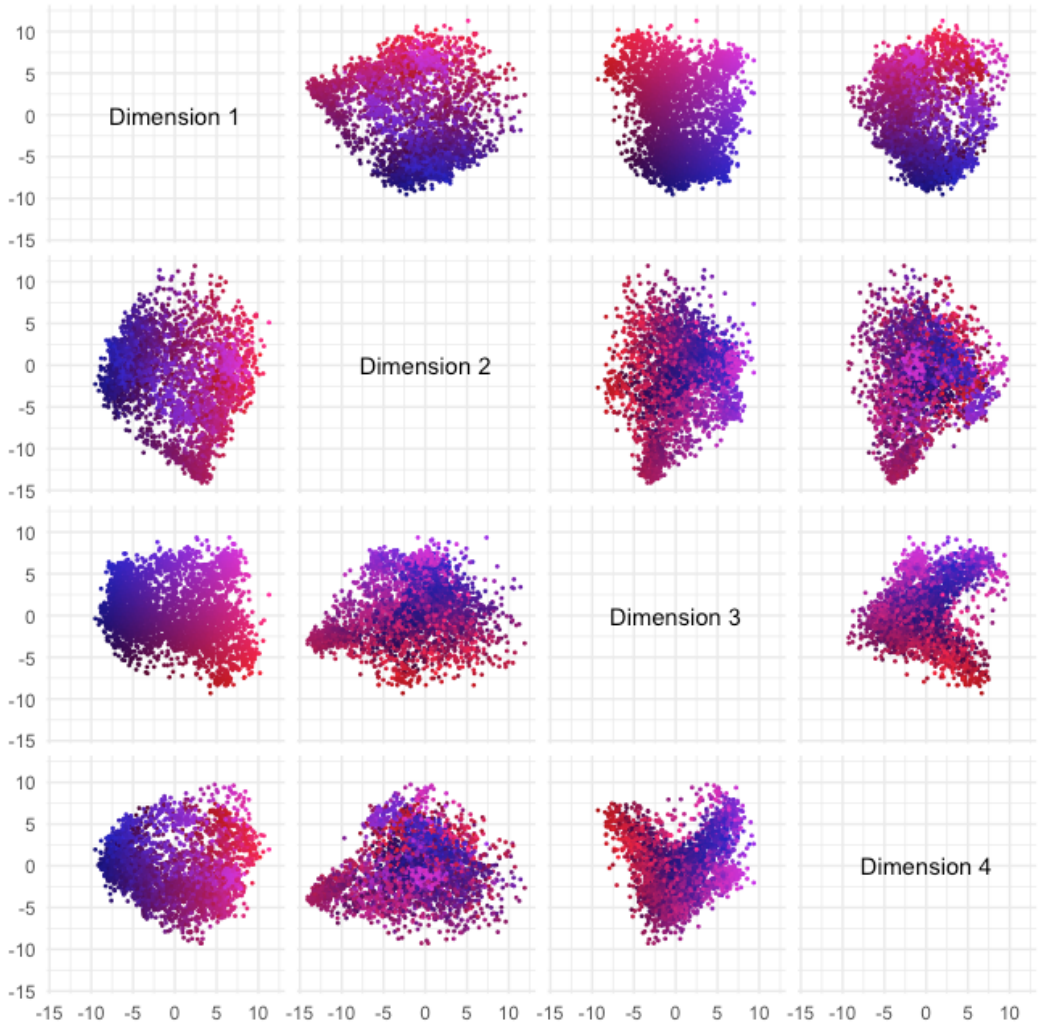
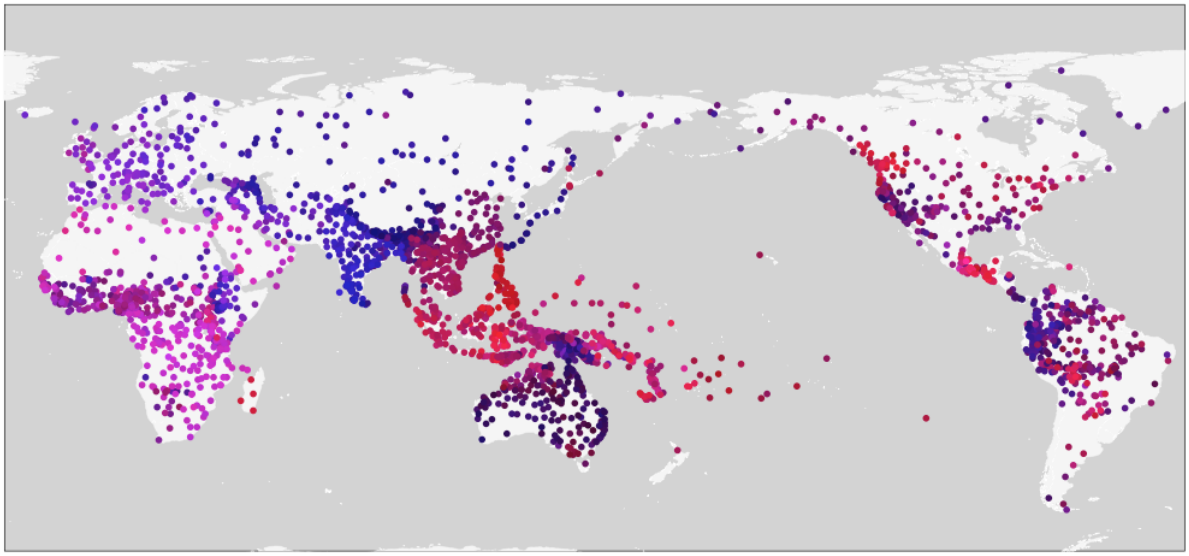


Figure A8.1: Dimension plots coloured for Dimensions 1 and 3.



Map A8.1: Global map coloured for dimensions 1 and 3.

A8.6. Colours reflecting Dimensions 1 and 4

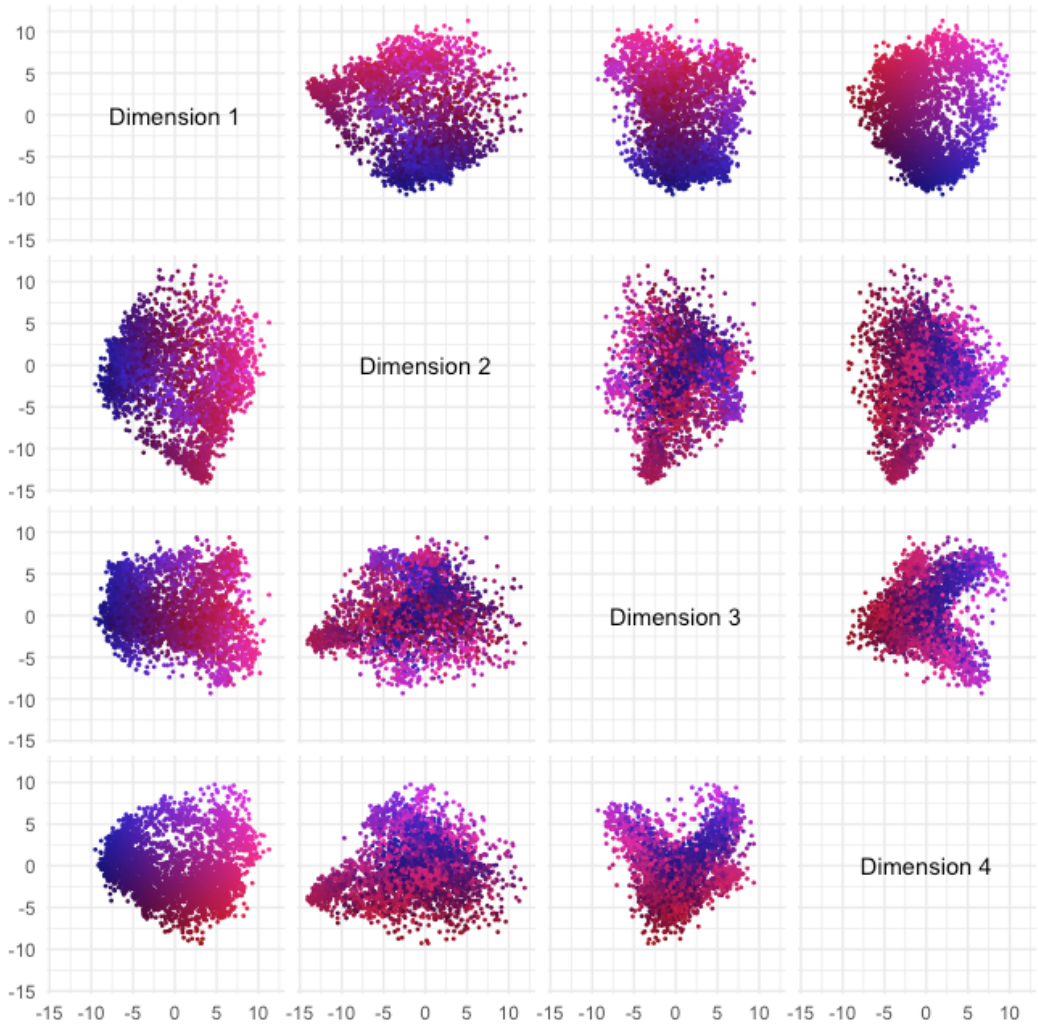
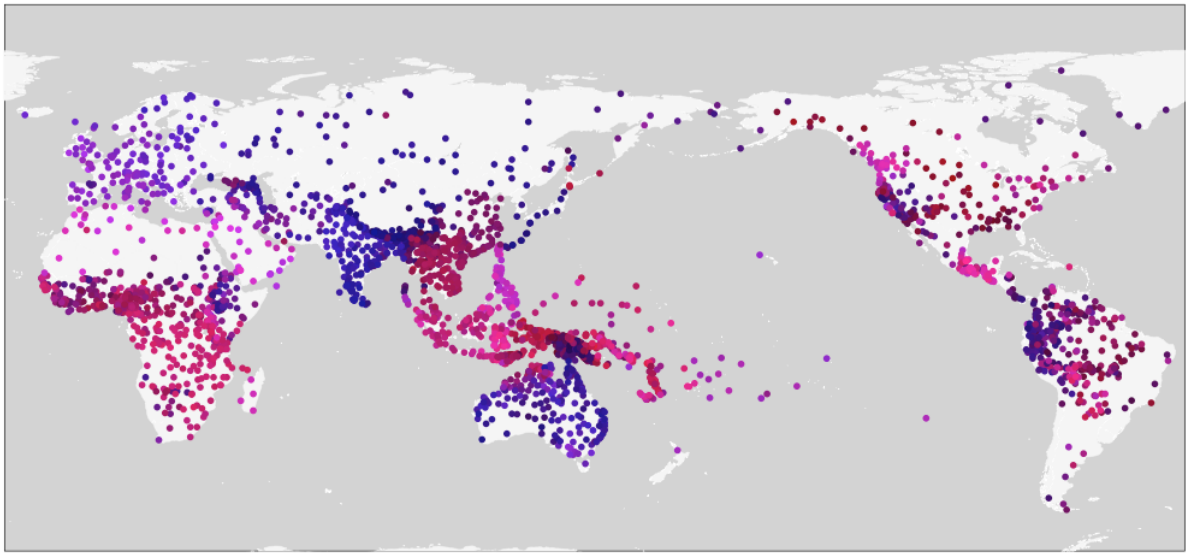


Figure A8.1: Dimension plots coloured for Dimensions 1 and 4.



Map A8.1: Global map coloured for dimensions 1 and 4.

A8.7. Colours reflecting Dimensions 2 and 3

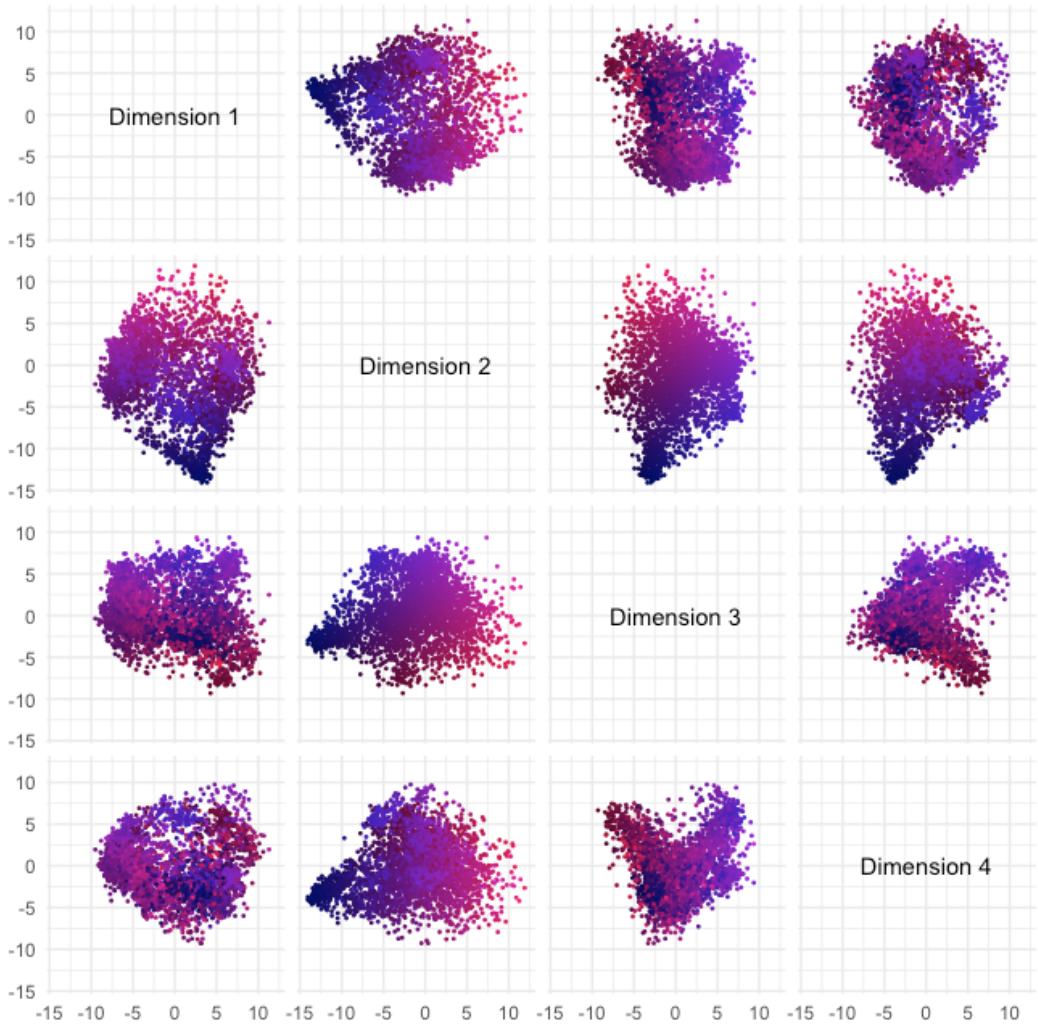
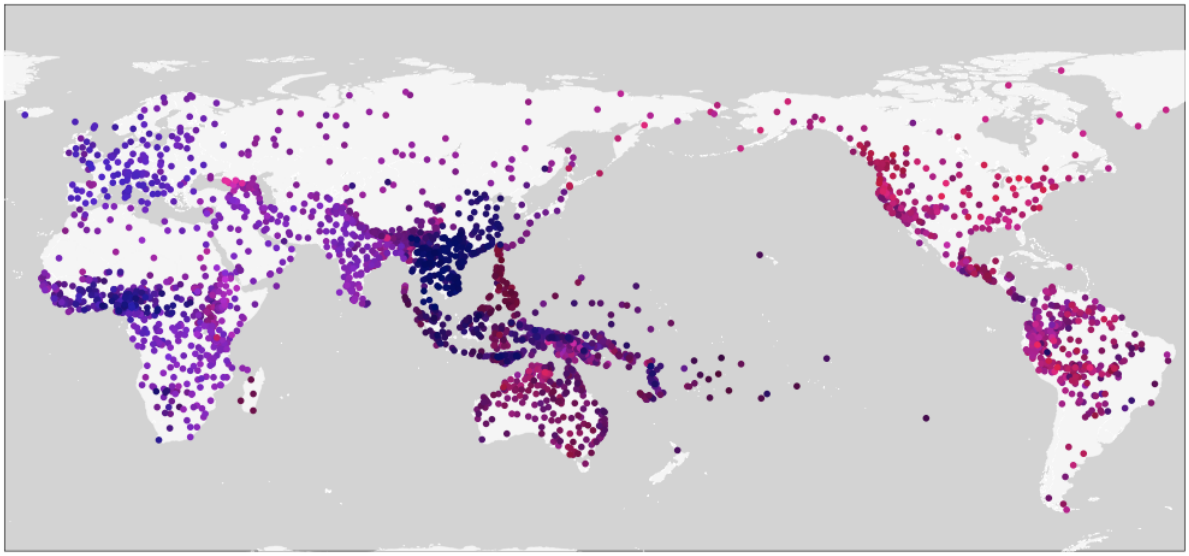


Figure A8.1: Dimension plots coloured for Dimensions 2 and 3.



Map A8.1: Global map coloured for dimensions 2 and 3.

A8.8. Colours reflecting Dimensions 2 and 4

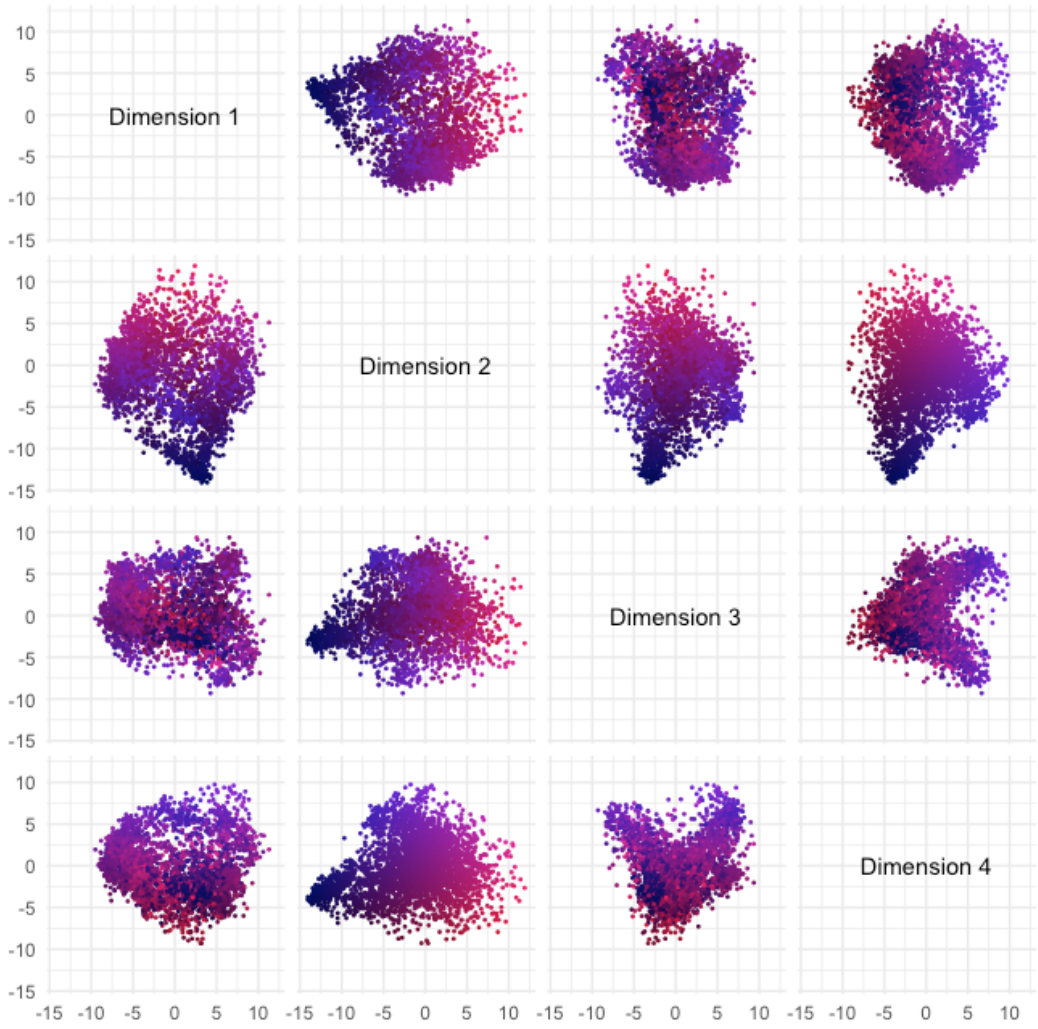
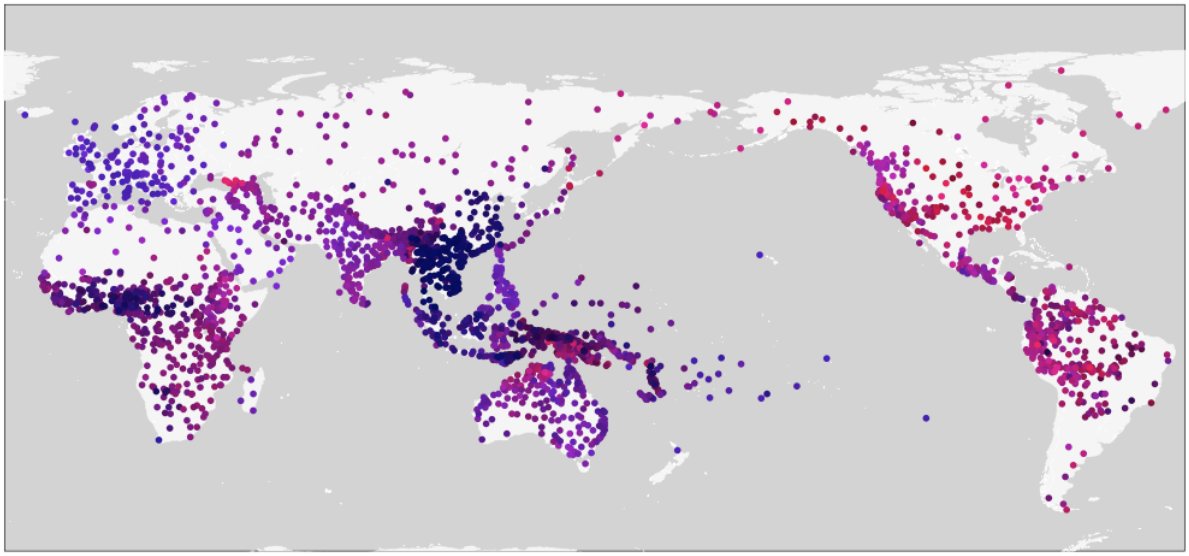


Figure A8.1: Dimension plots coloured for Dimensions 2 and 4.



Map A8.1: Global map coloured for dimensions 2 and 4.

A8.9. Colours reflecting Dimensions 3 and 4

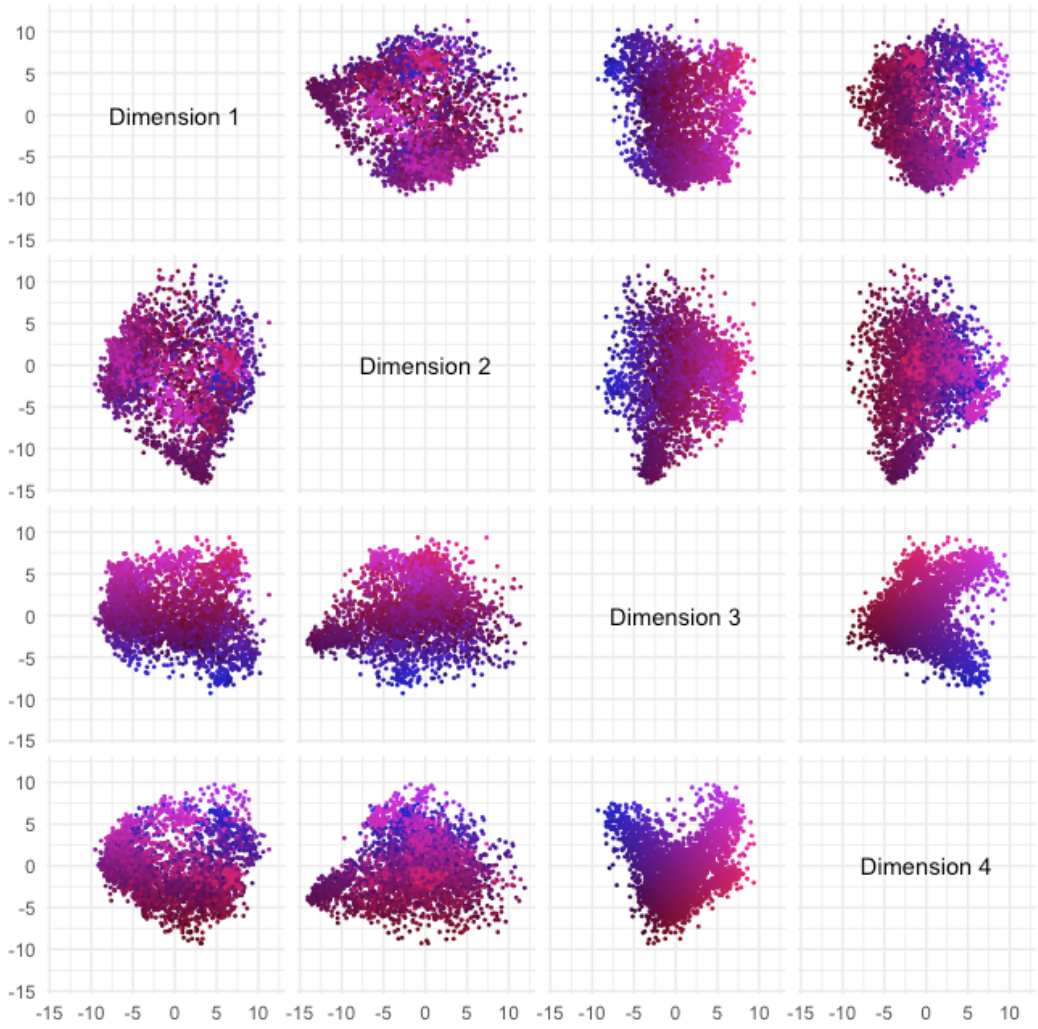
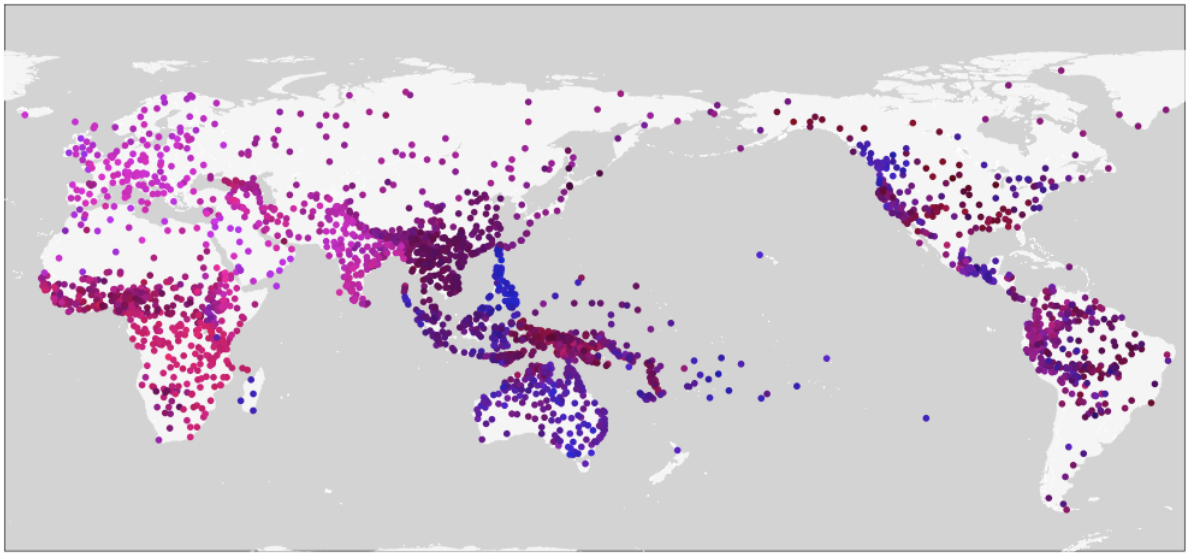


Figure A8.1: Dimension plots coloured for Dimensions 3 and 4.



Map A8.1: Global map coloured for dimensions 3 and 4.

Appendix 9. Maps and plots of features contributing to the different dimensions

In 3.1 a number of different features were identified as contributing to the different dimensions that define typological variation. Here we present dimension plots illustrating the distribution of the different features that were reported in 3.1.1, 3.1.2, 3.1.3 and 3.1.4 in typological space, along the two dimensions for which they show the greatest correlations, and maps showing the geographical distribution of these features.

A9.1 Features associated with Dimension 1

Dimension plots of features with strong associations with Dimension 1.
(all plots show V1 vs V2 except 'Nominative agreement by prefix', which plots V1 vs V3).

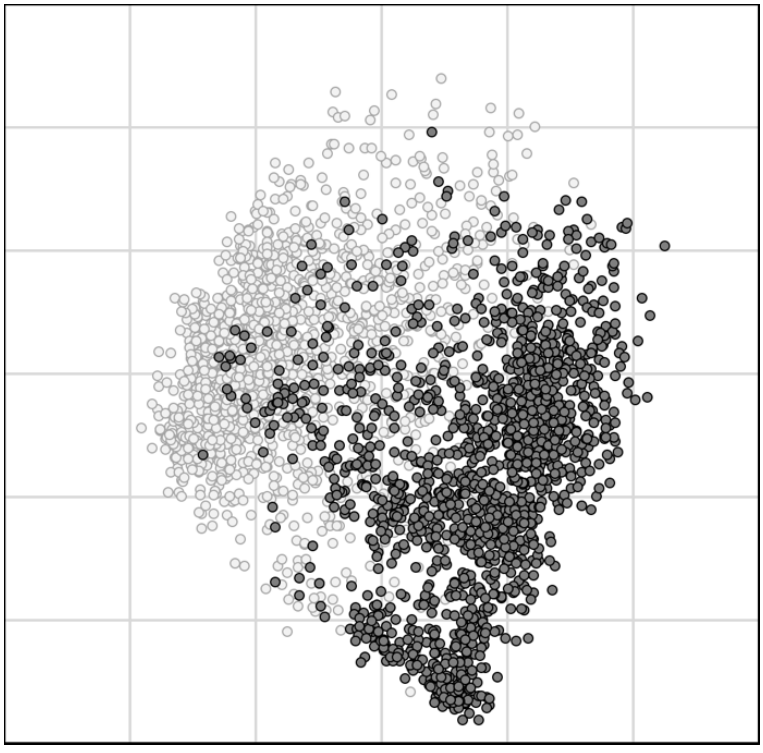


Figure A9.1.1: Prepositions in Dimenesions 1 and 2 ($r^2 = 0.50$).

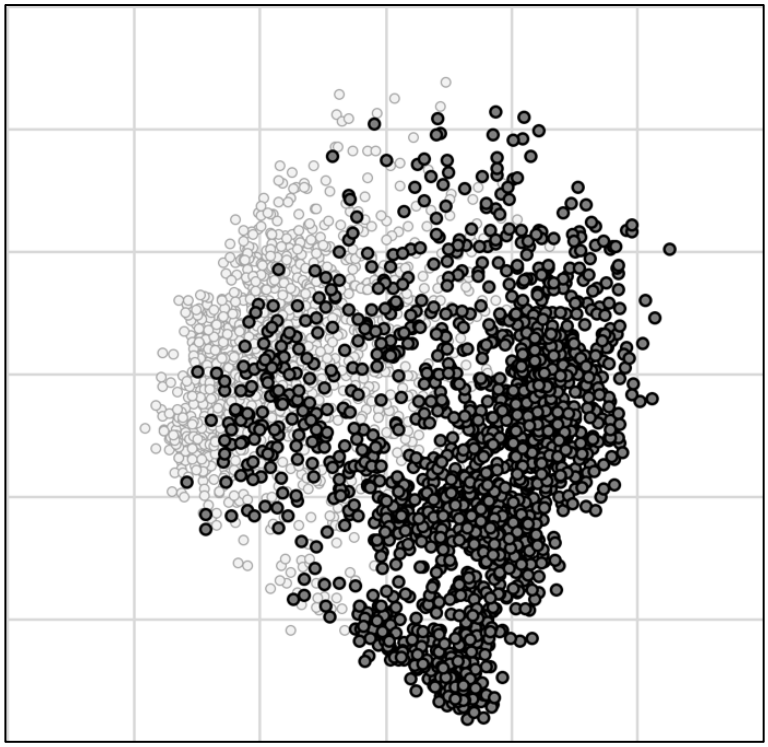


Figure A9.1.2: VO order in Dimensions 1 and 2 ($r^2 = 0.42$).

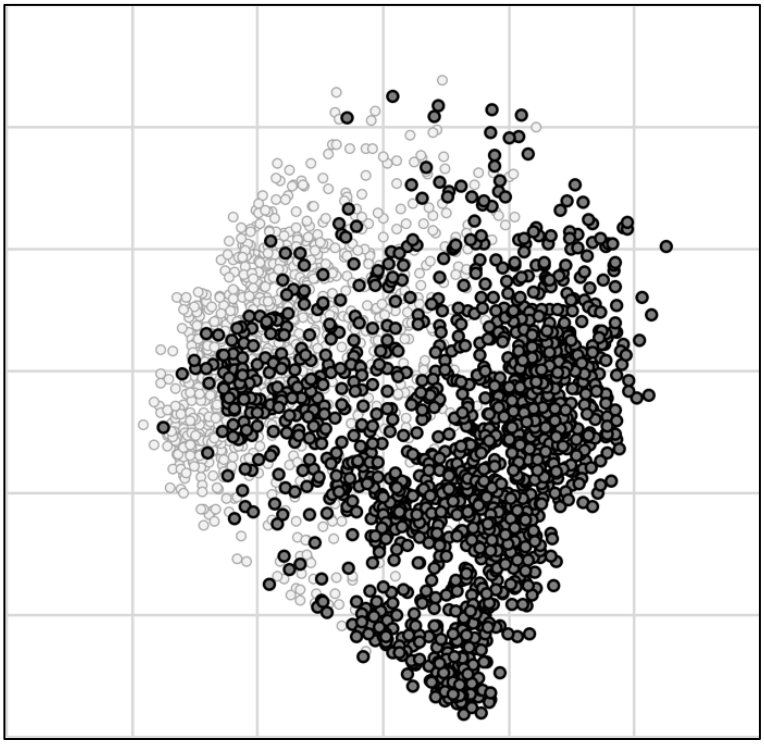


Figure A9.1.3: Initial subordination in Dimensions 1 and 2 ($r^2 = 0.41$).

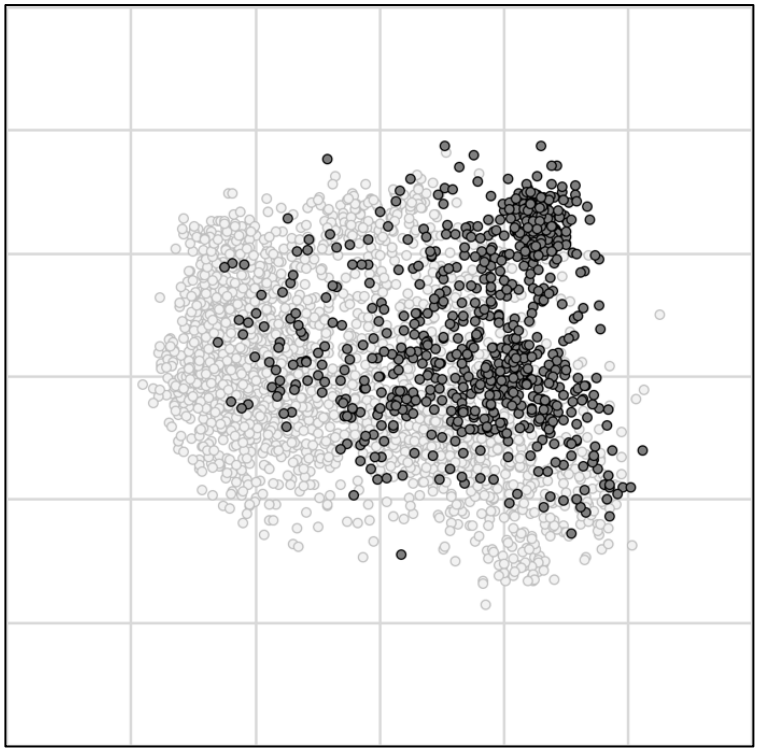


Figure A9.1.4: Nominative agreement by prefix in Dimensions 1 and 3 ($r^2 = 0.32$).

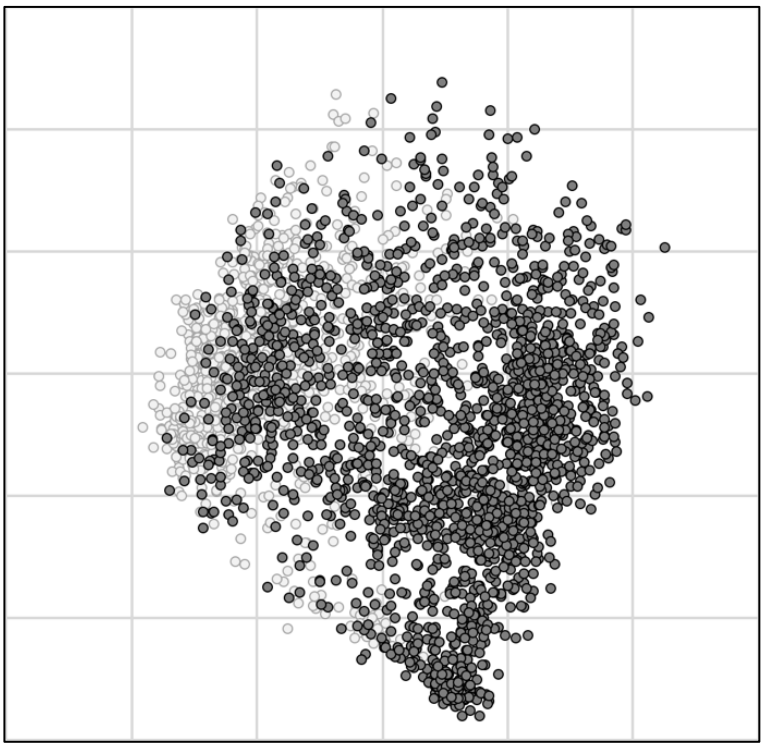


Figure A9.1.5: V Oblique order in Dimensions 1 and 2 ($r^2 = 0.31$).

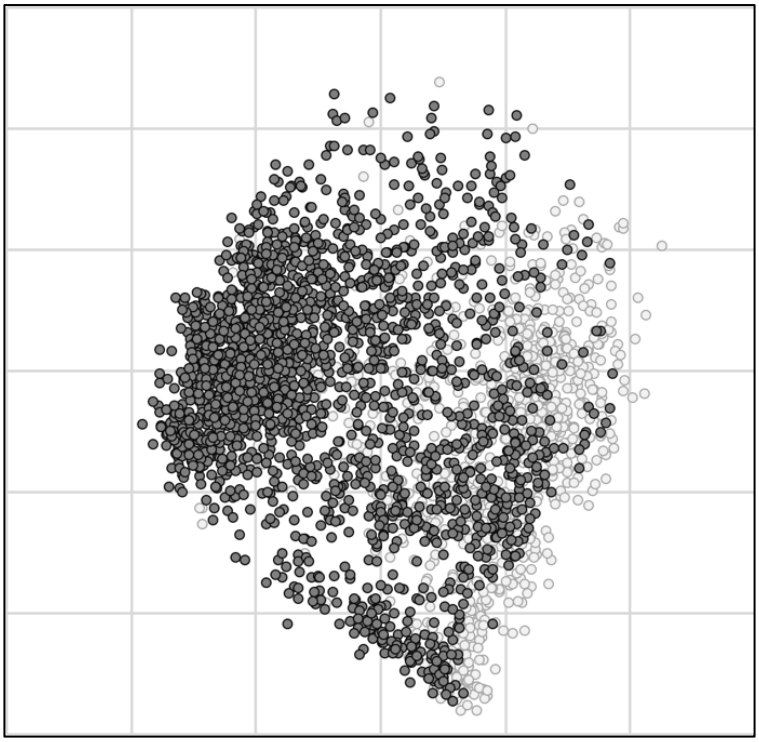


Figure A9.1.6: Genitive N order in Dimensions 1 and 2 ($r^2 = 0.31$).

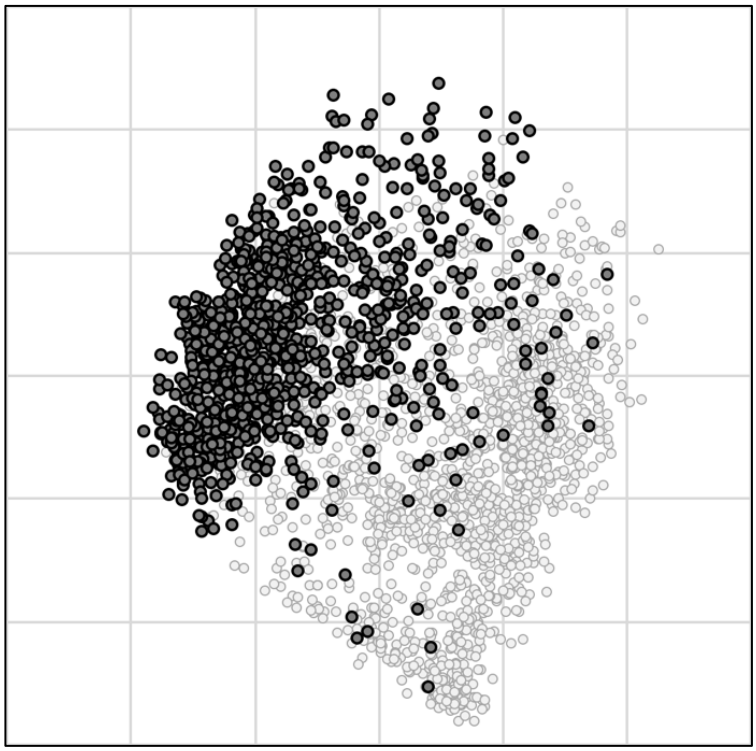


Figure A9.1.7: Subordination by suffix in Dimensions 1 and 2 ($r^2 = 0.39$).

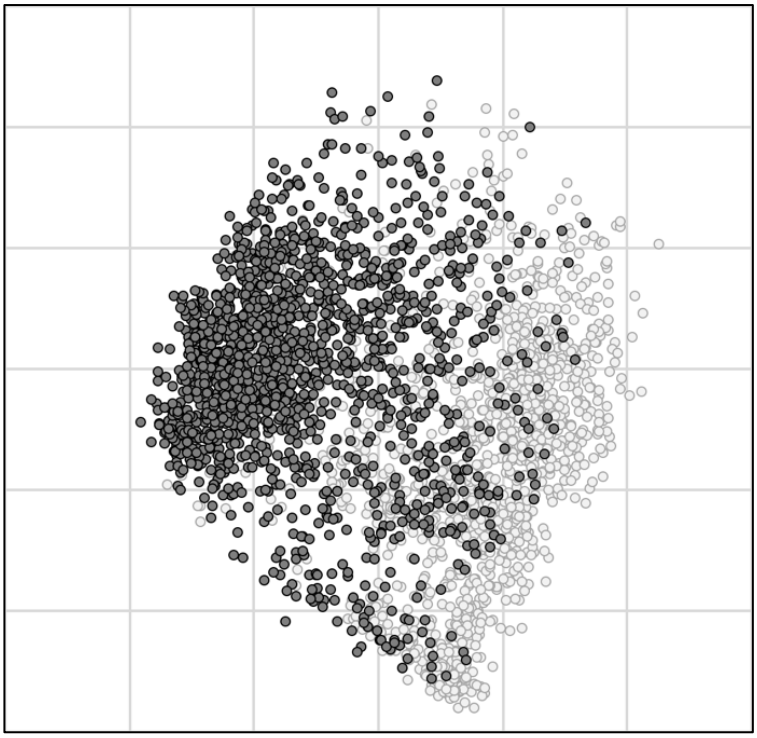


Figure A9.1.8: Postpositions in Dimensions 1 and 2 ($r^2 = 0.42$).

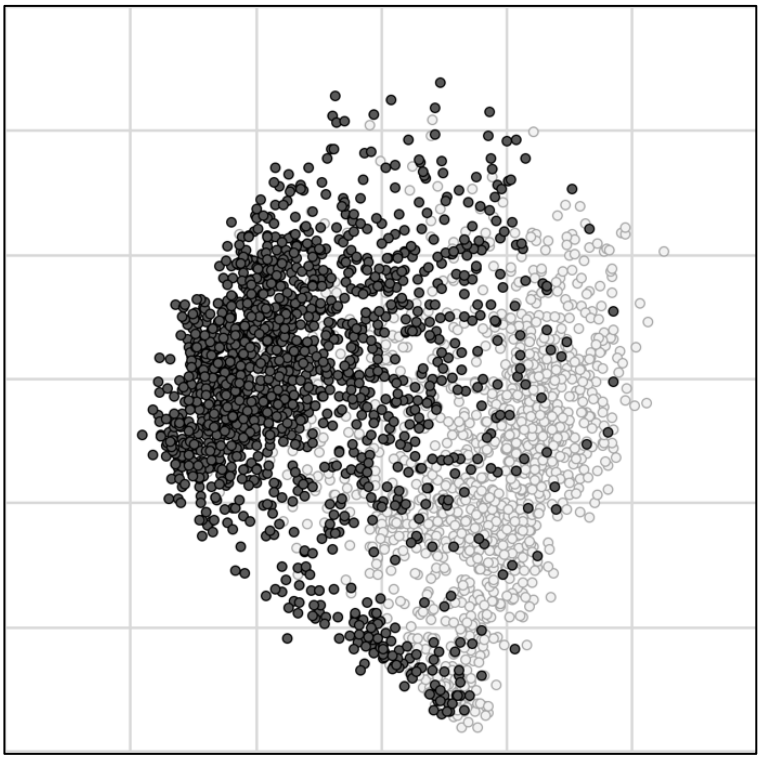


Figure A9.1.9: Oblique V order in Dimensions 1 and 2 ($r^2 = 0.45$).

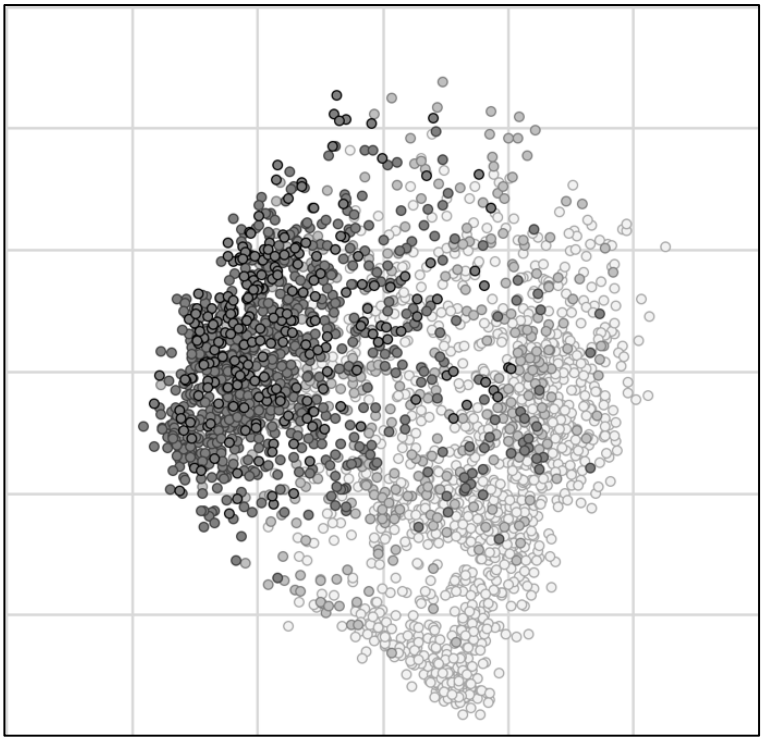


Figure A9.1.10: Number of cases in Dimensions 1 and 2 ($r^2 = 0.49$).

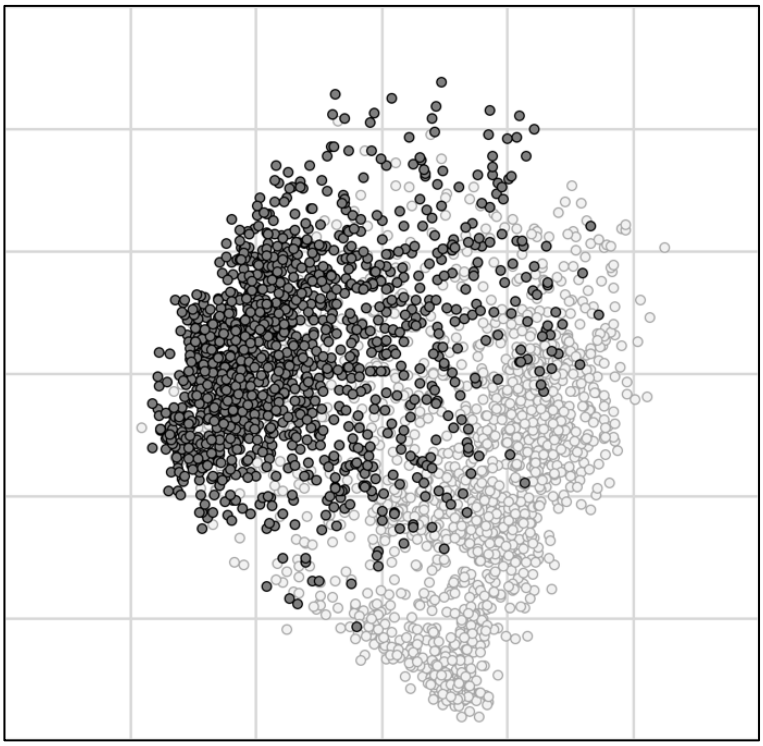


Figure A9.1.11: Postnominal case in Dimensions 1 and 2 ($r^2 = 0.50$).

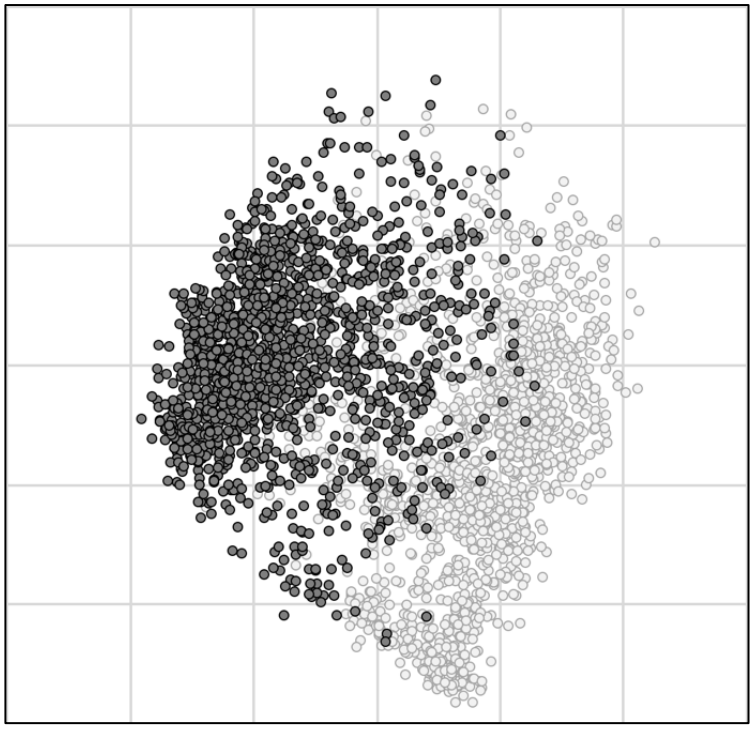
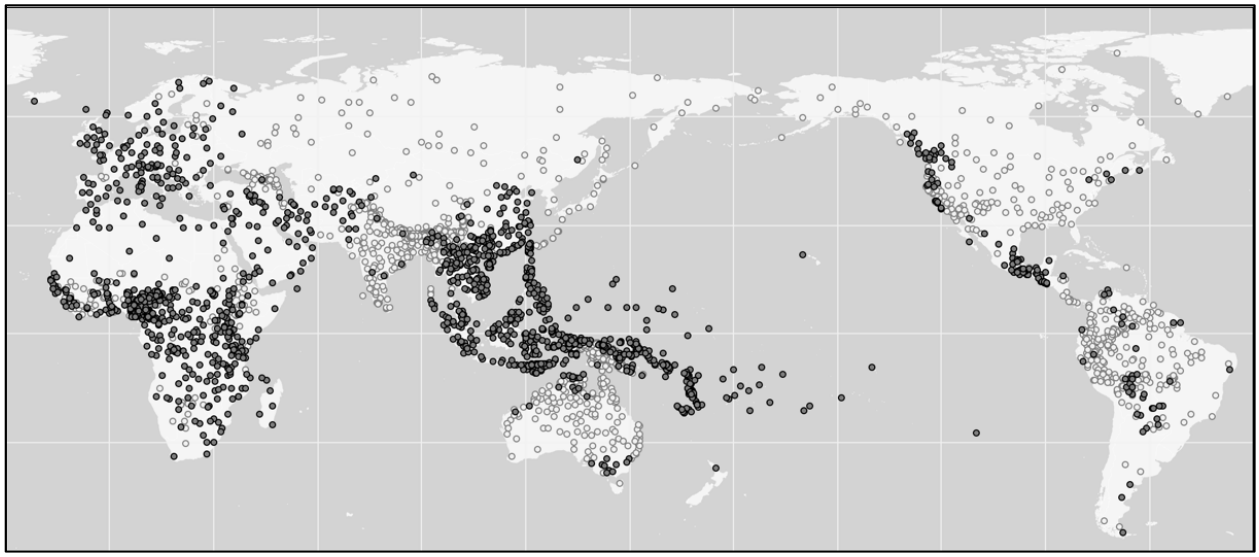
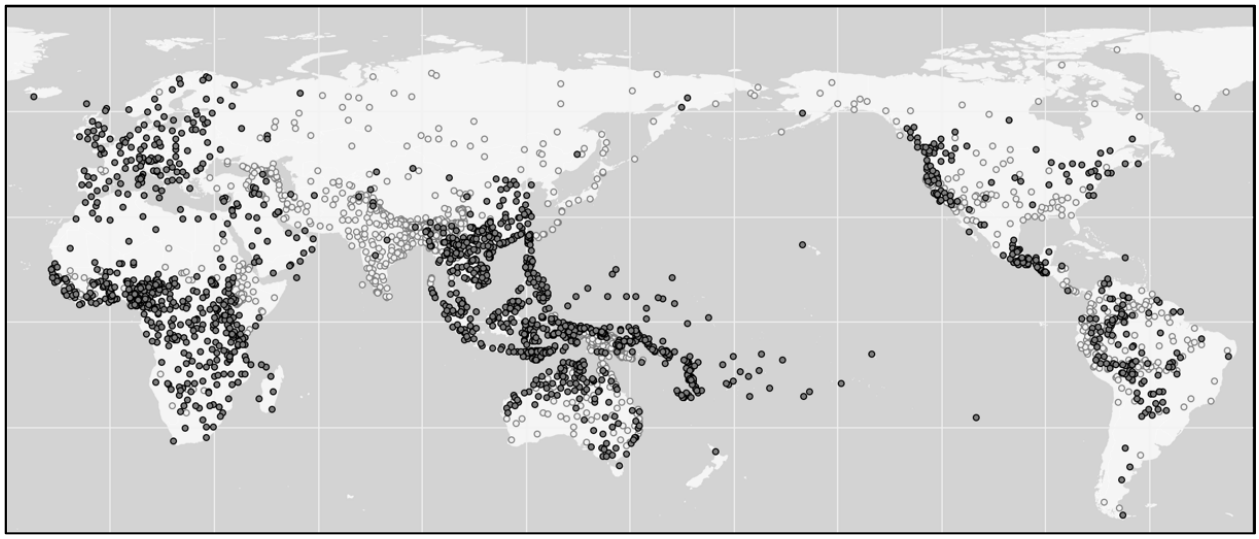


Figure A9.1.12: SOV order in Dimensions 1 and 2 ($r^2 = 0.53$).

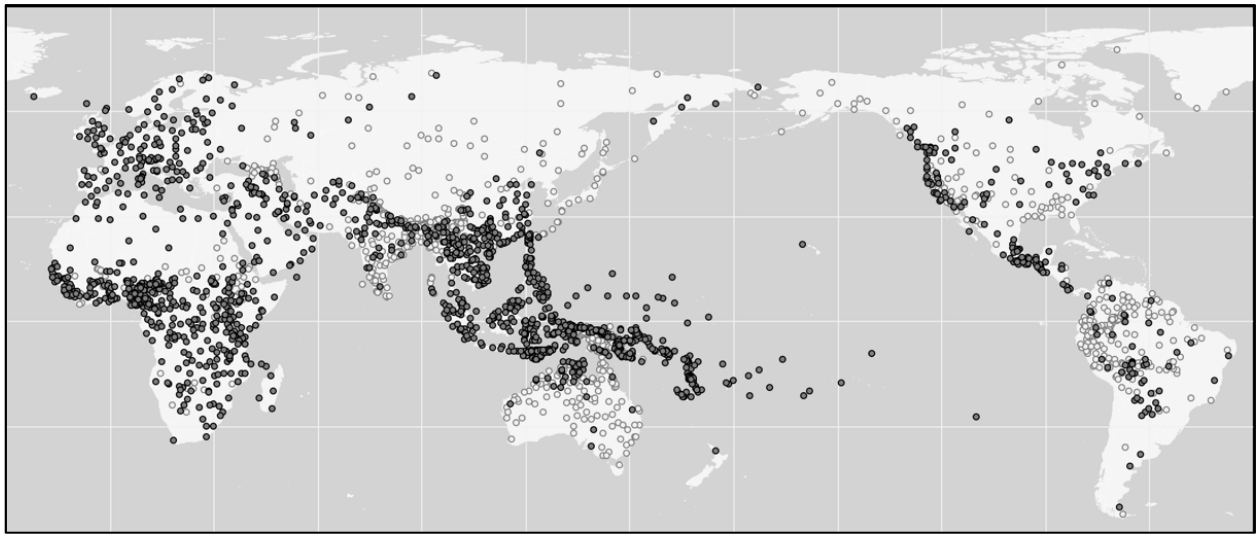
Maps of features with strong associations with Dimension 1.



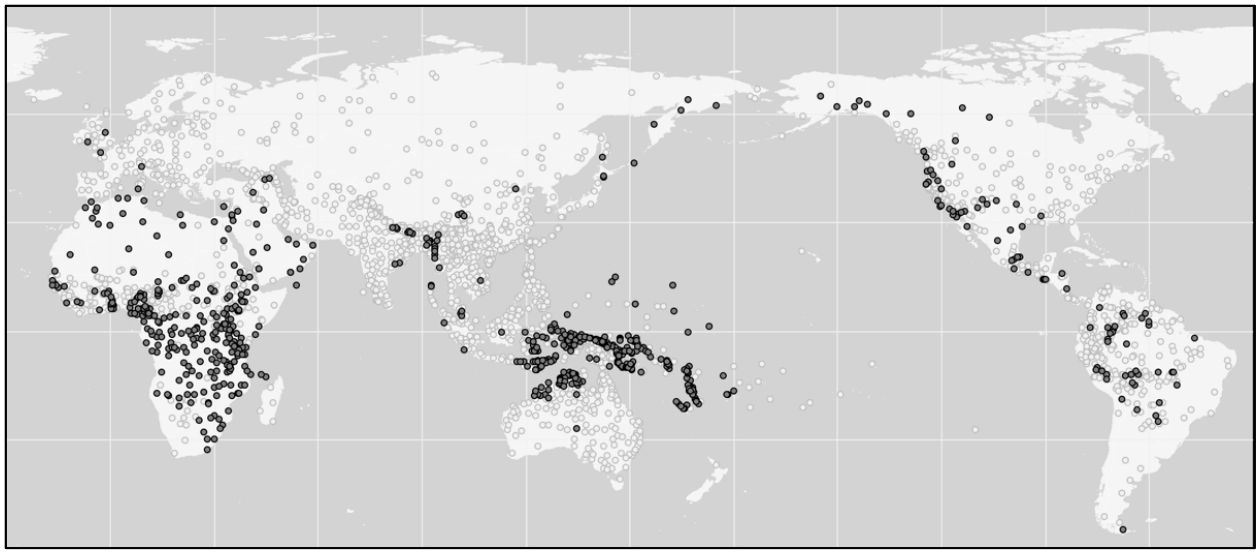
Map A9.1.1: Prepositions.



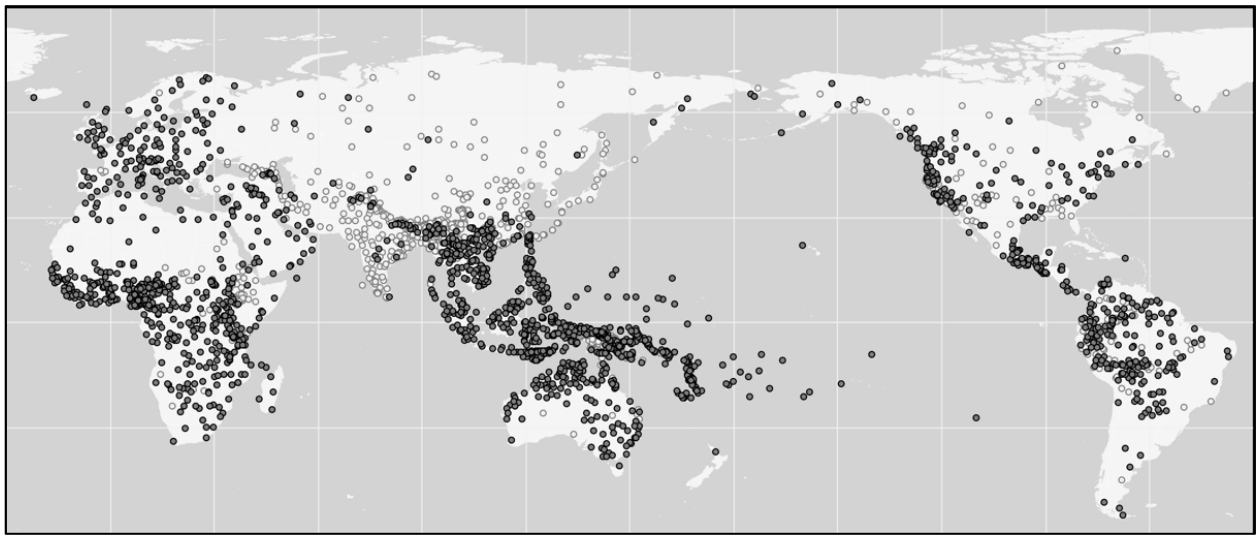
Map A9.1.2: VO order.



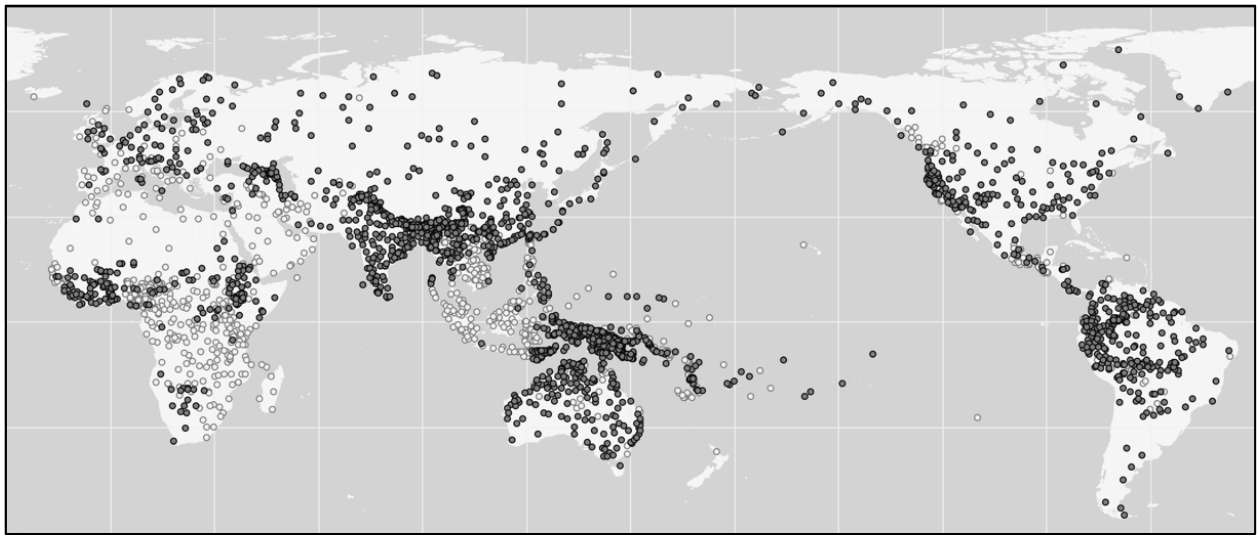
Map A9.1.3: Initial subordination.



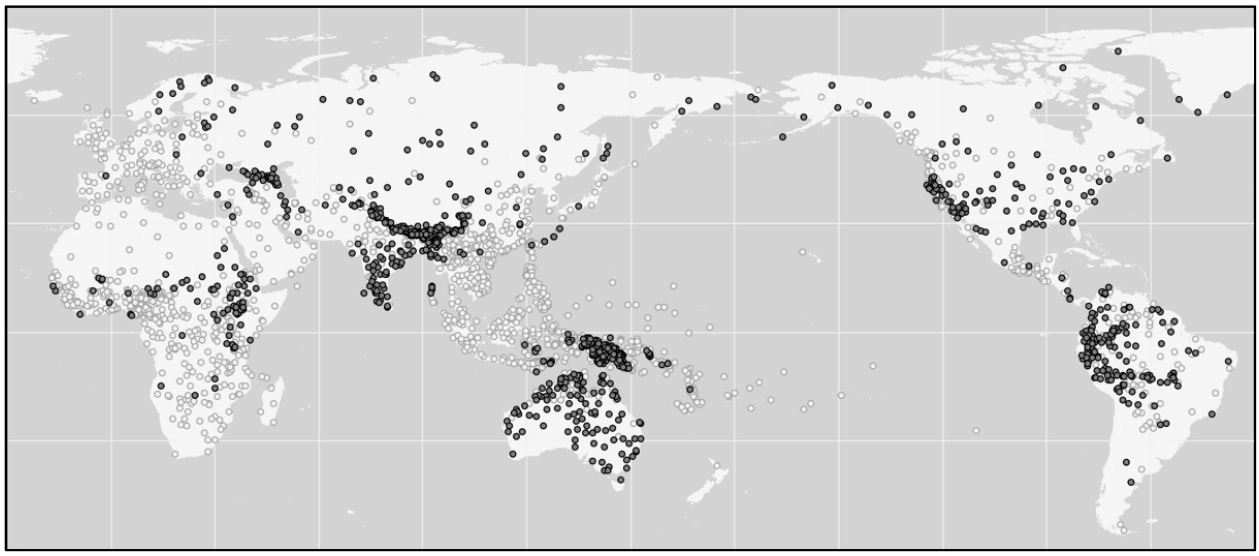
Map A9.1.4: Nominative agreement by prefix.



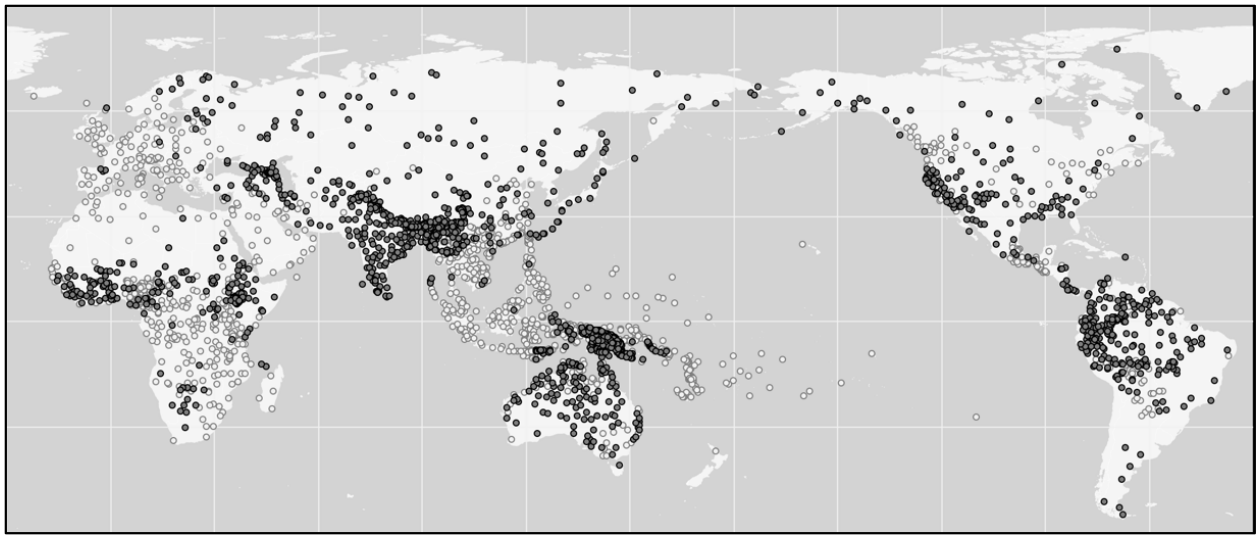
Map A9.1.5: V Oblique order.



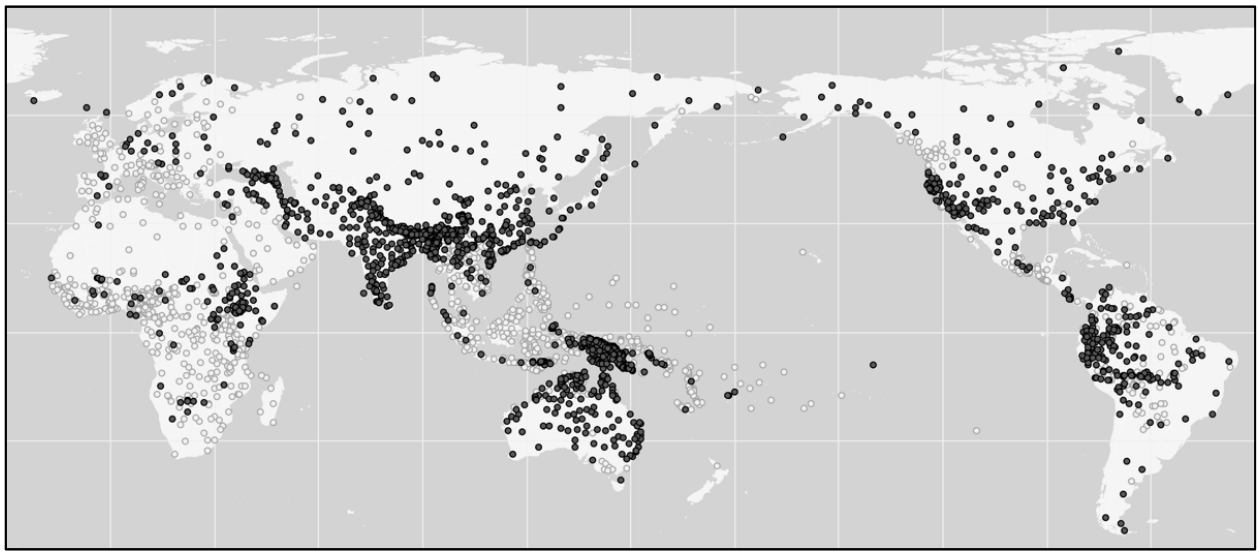
Map A9.1.6: Genitive N order.



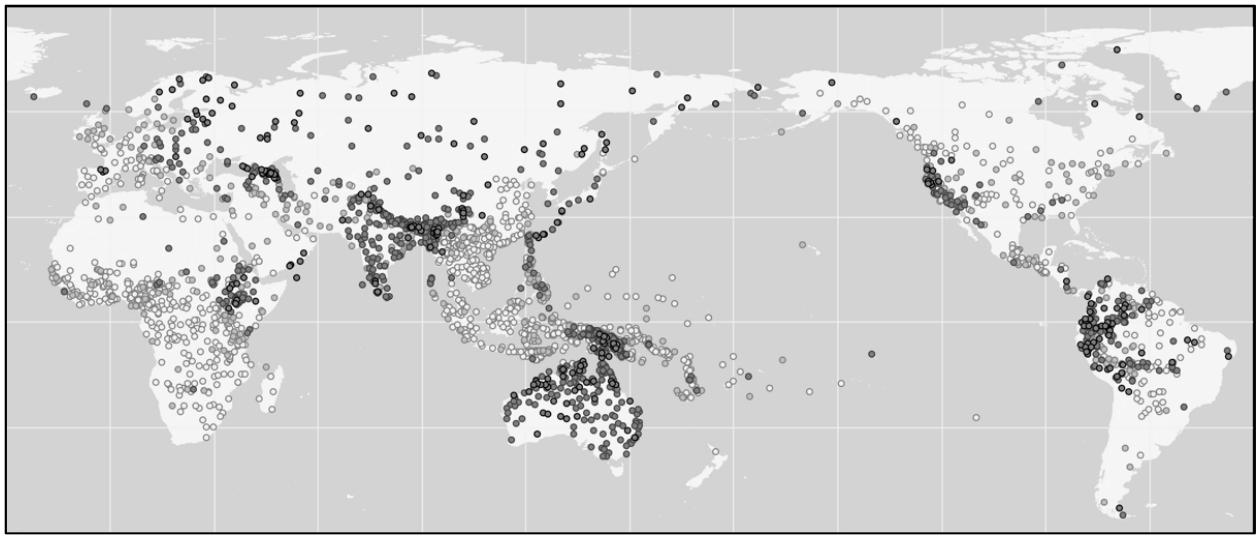
Map A9.1.7: Subordination by suffix.



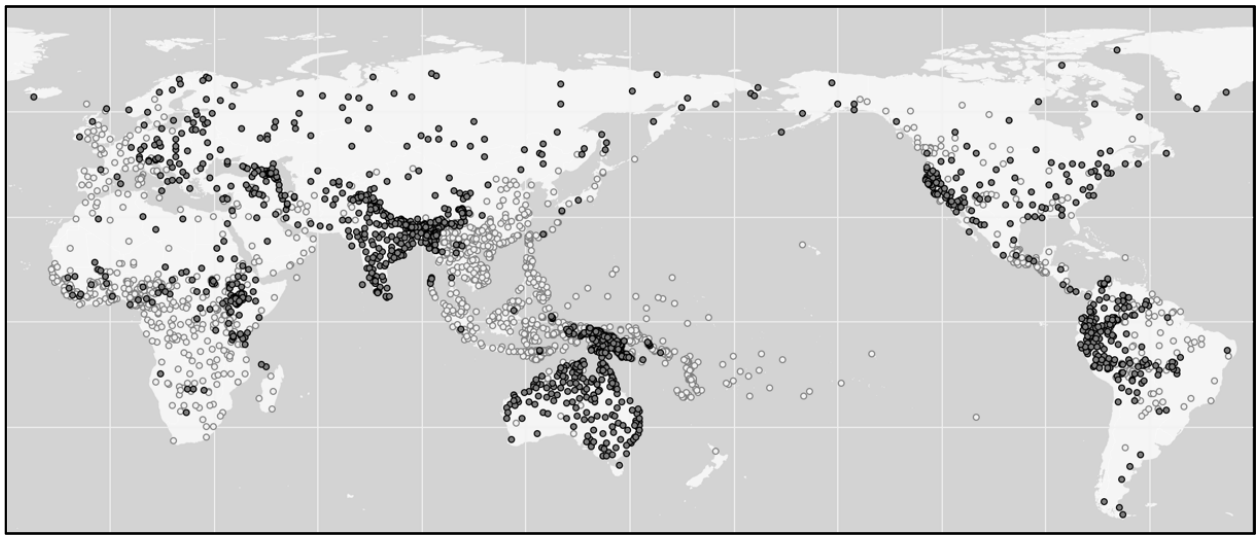
Map A9.1.8: Postpositions.



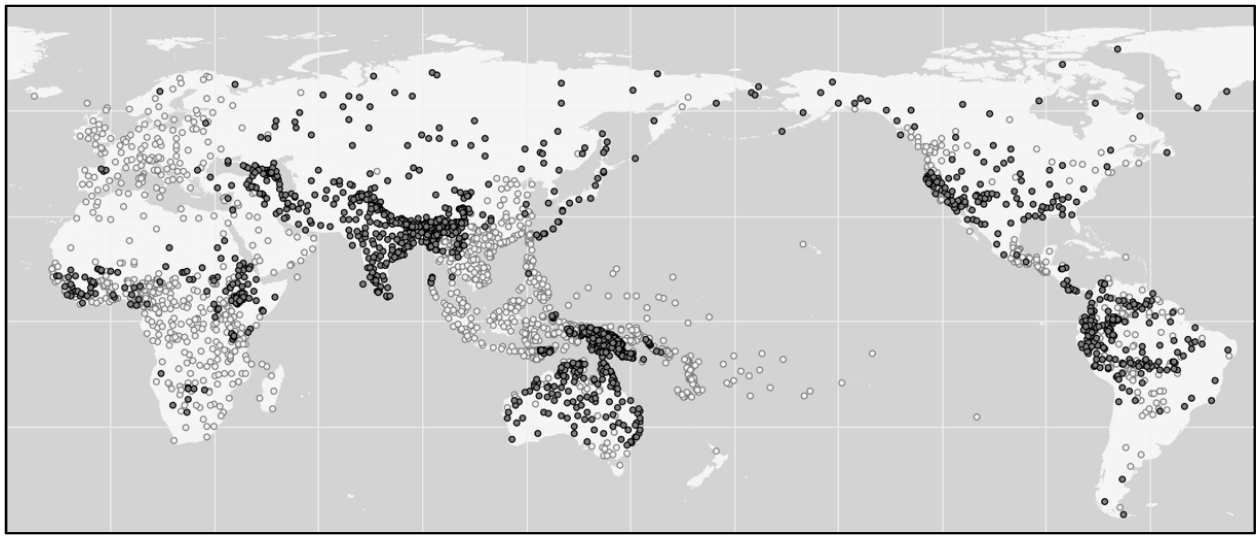
Map A9.1.9: Oblique V order.



Map A9.1.10: Number of cases.



Map A9.1.11: Postnominal case.



Map A9.1.12: SOV order.

A9.2 Features associated with Dimension 2

Dimension plots of features with strong associations with Dimension 2.
Pairs of dimensions listed for each chart.

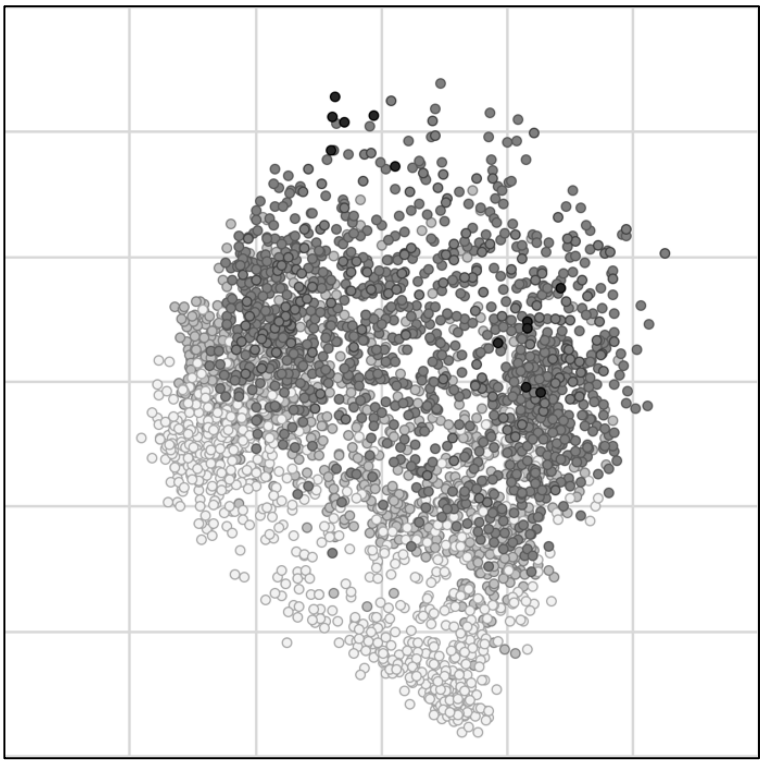


Figure A9.2.1: Total verbal agreement positions in Dimensions 2 and 3 ($r^2 = 0.37$).

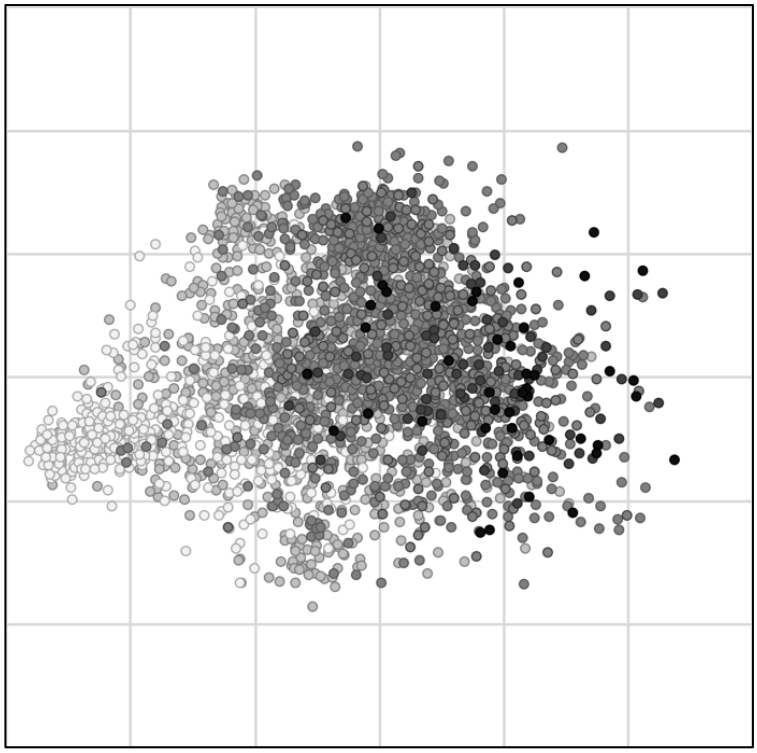


Figure A9.2.2: Total verbal inflectional synthesis in Dimensions 2 and 3 ($r^2 = 0.34$).

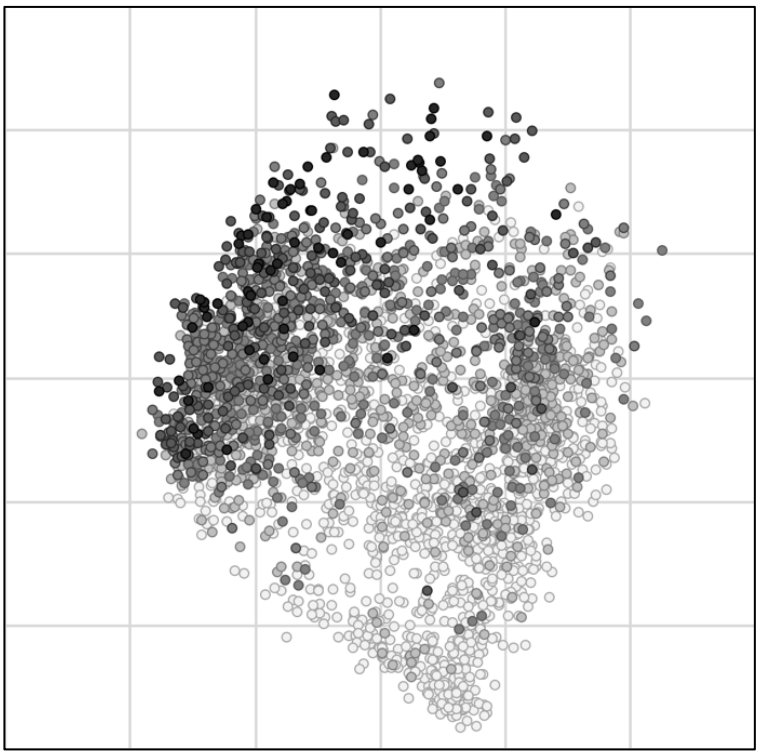


Figure A9.2.3: Total Modality affixes in Dimensions 1 and 2 ($r^2 = 0.30$).

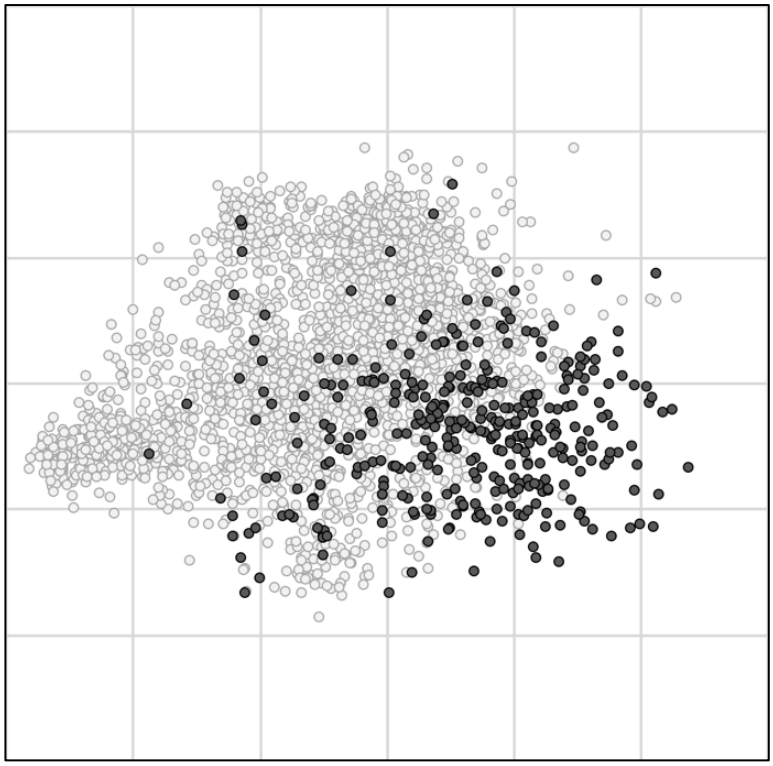


Figure A9.2.4: Incorporation in Dimensions 2 and 3 ($r^2 = 0.22$).

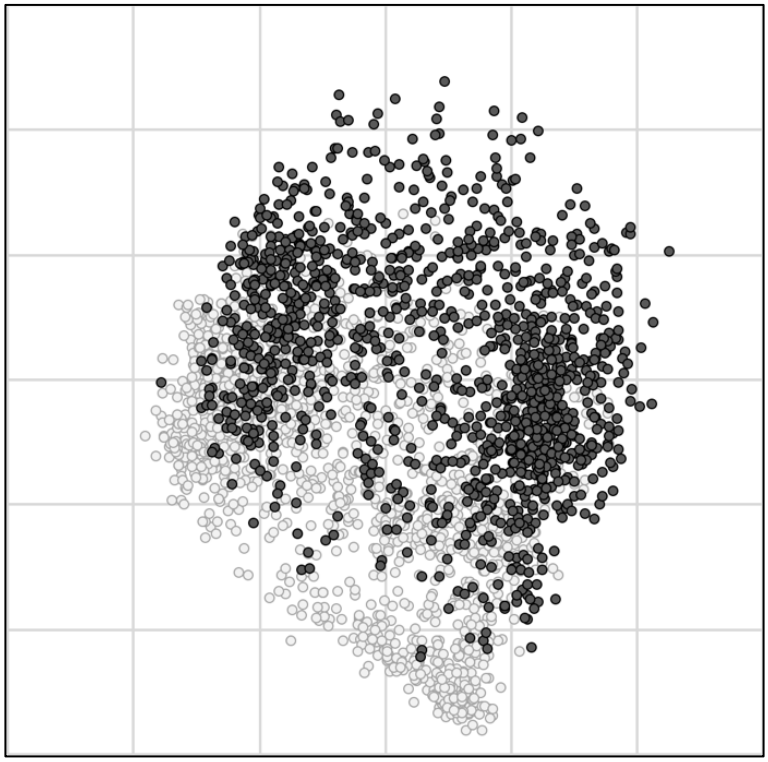


Figure A9.2.5: Applicatives in Dimensions 1 and 2 ($r^2 = 0.20$).

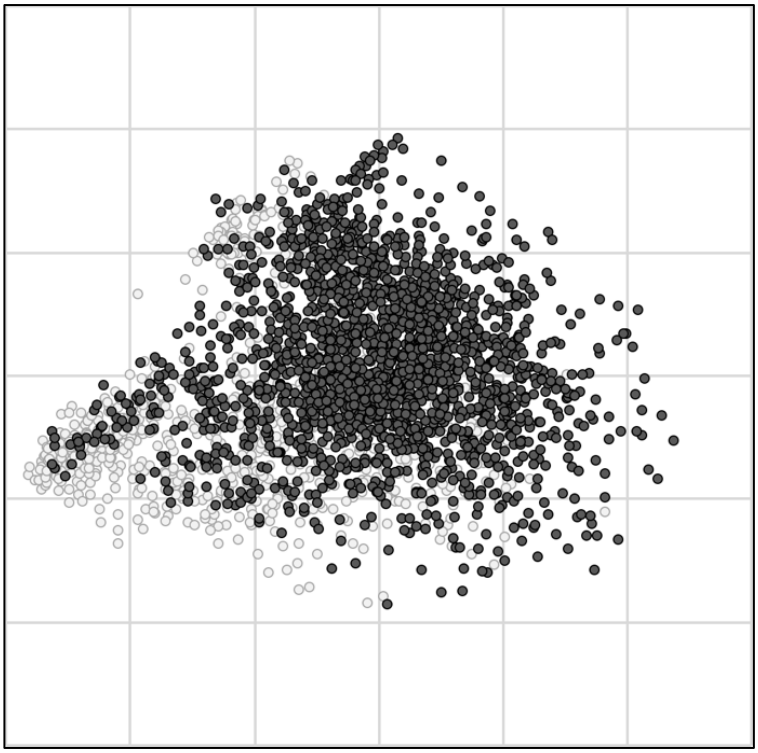


Figure A9.2.6: Morphological causatives in Dimensions 2 and 4 ($r^2 = 0.16$).

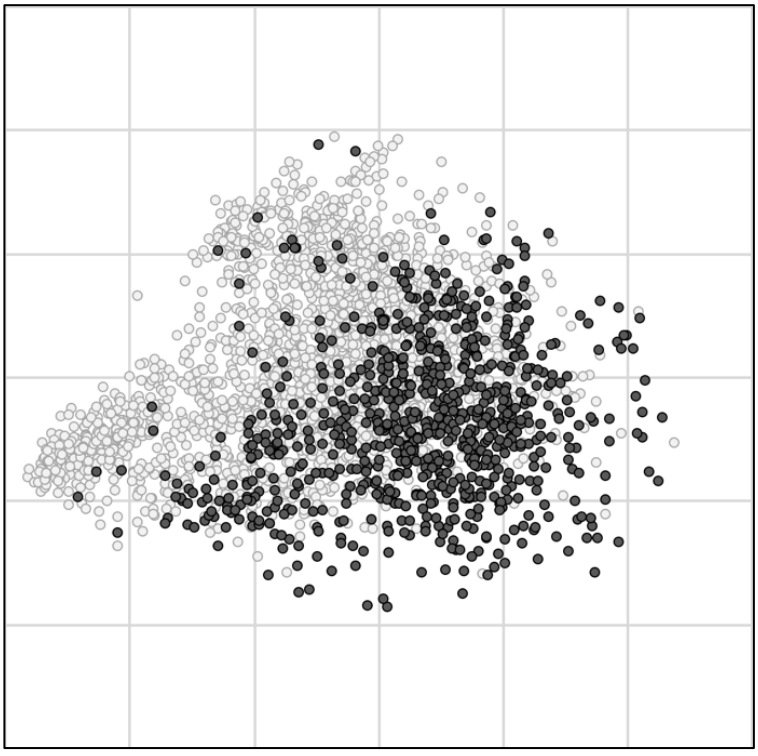


Figure A9.2.7: Possessive prefixes on nouns in Dimensions 2 and 4 ($r^2 = 0.15$).

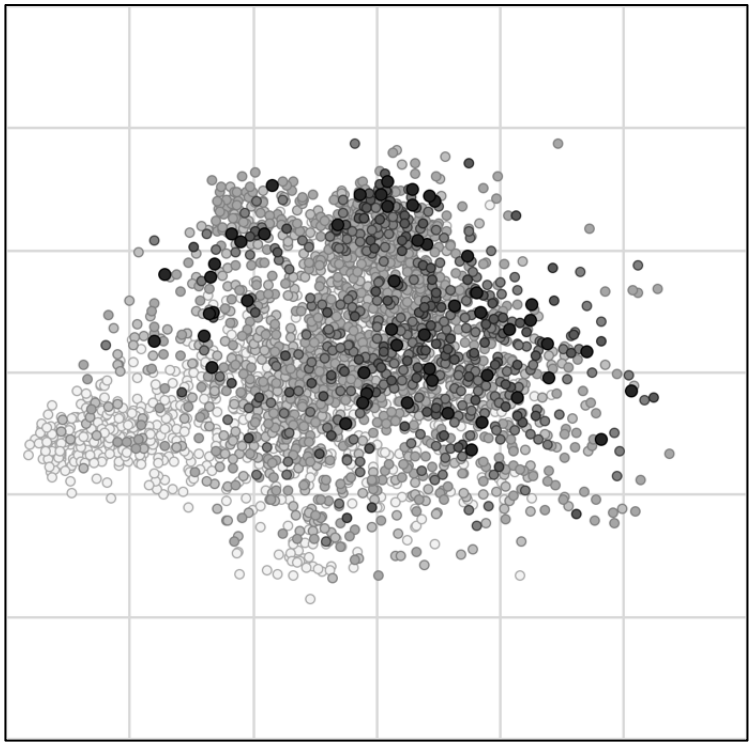


Figure A9.2.8: Total tense distinctions in Dimensions 2 and 3 ($r^2 = 0.11$).

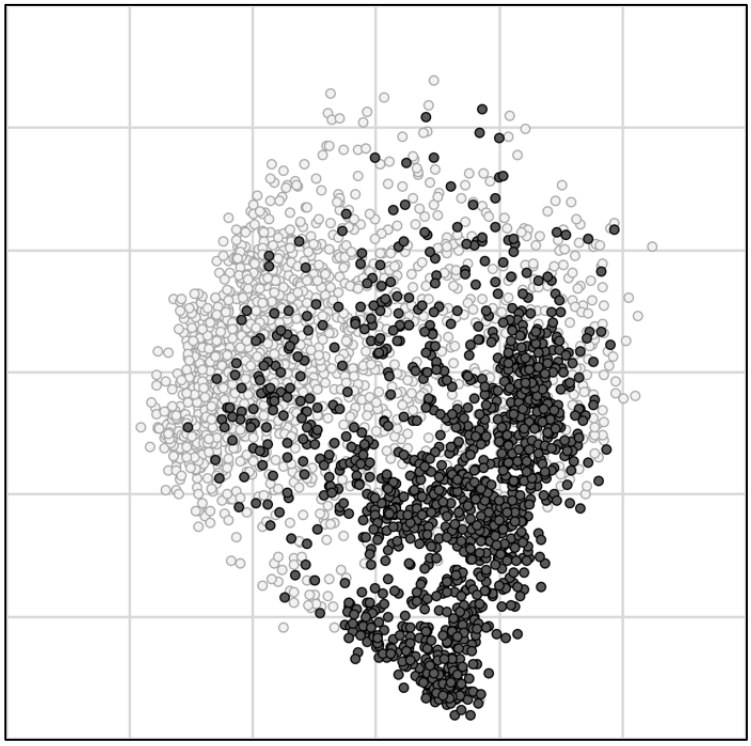


Figure A9.2.9: SVO order in Dimensions 1 and 2 ($r^2 = 0.14$).

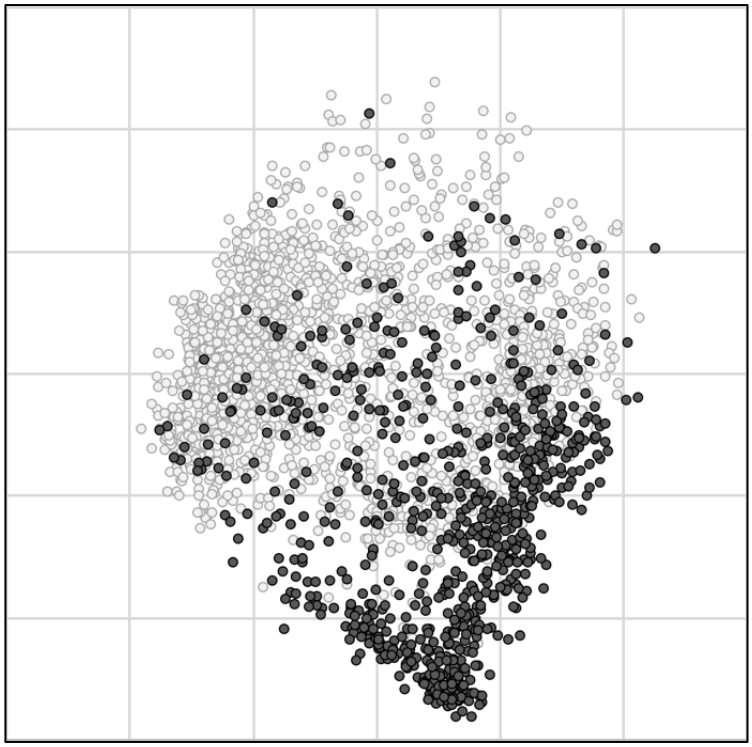


Figure A9.2.10: Symmetrical clauses: purpose in Dimensions 1 and 2 ($r^2 = 0.17$).

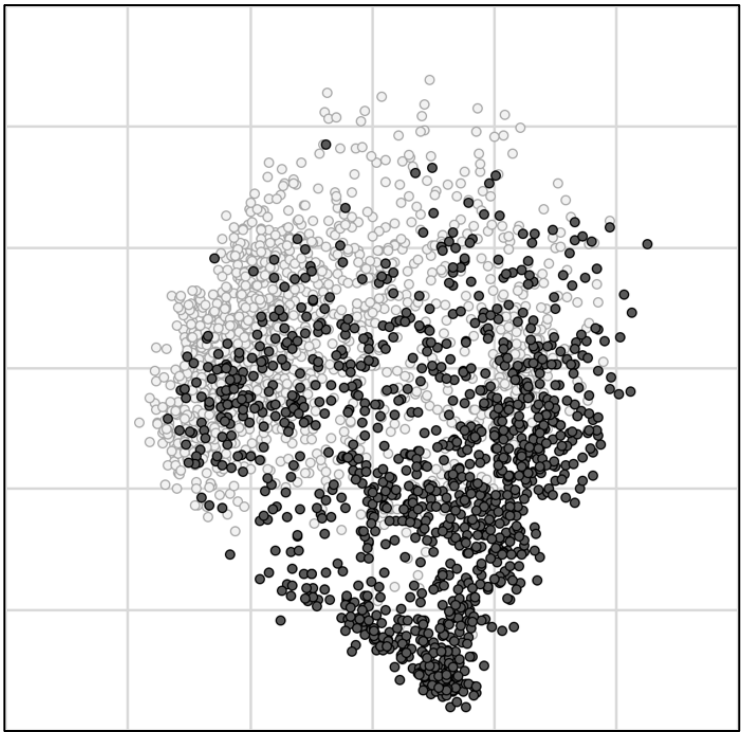


Figure A9.2.11: Symmetrical clauses: temporal in Dimensions 1 and 2 ($r^2 = 0.18$).

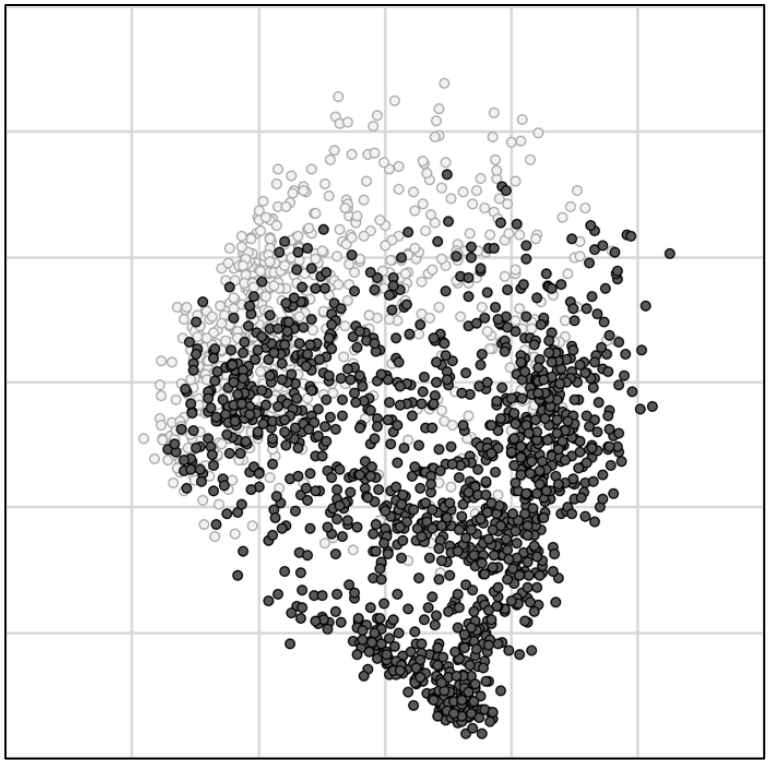
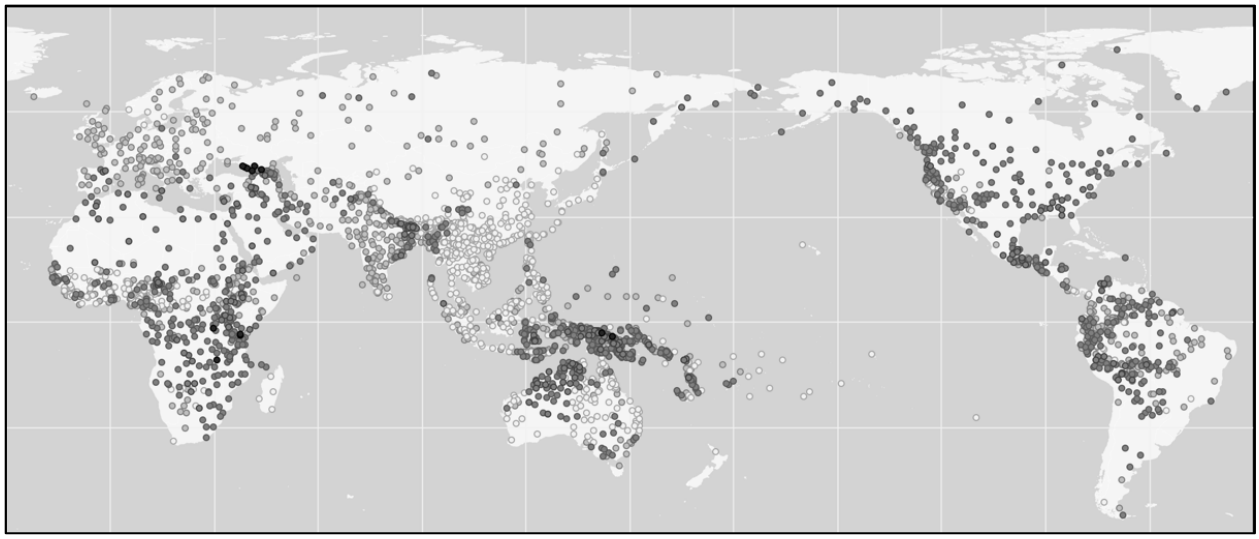
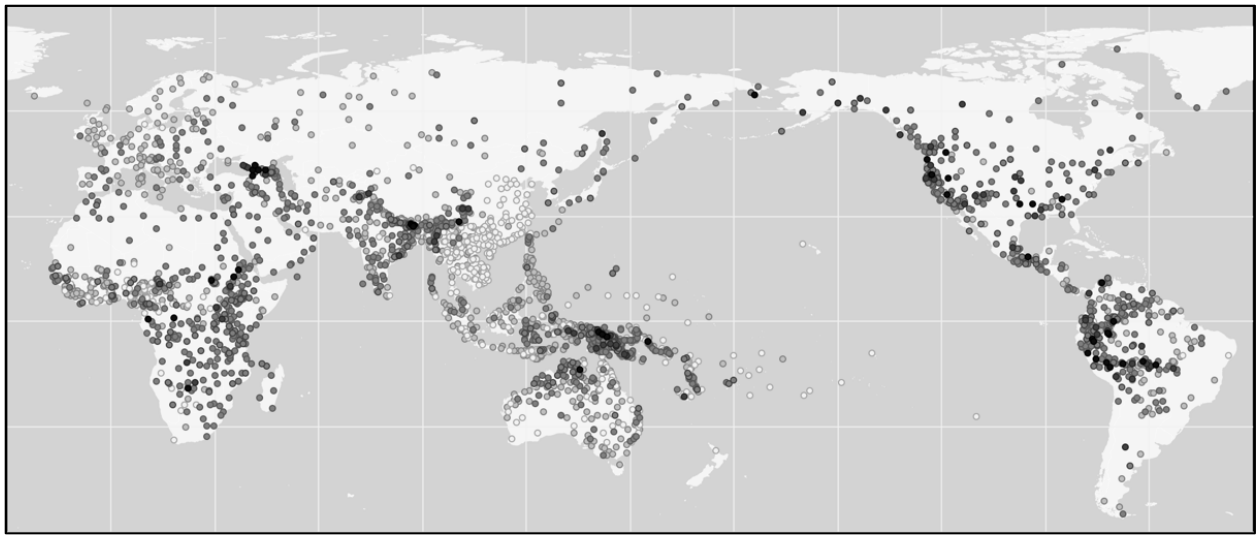


Figure A9.2.12: Symmetrical clauses: reason in Dimensions 1 and 2 ($r^2 = 0.21$).

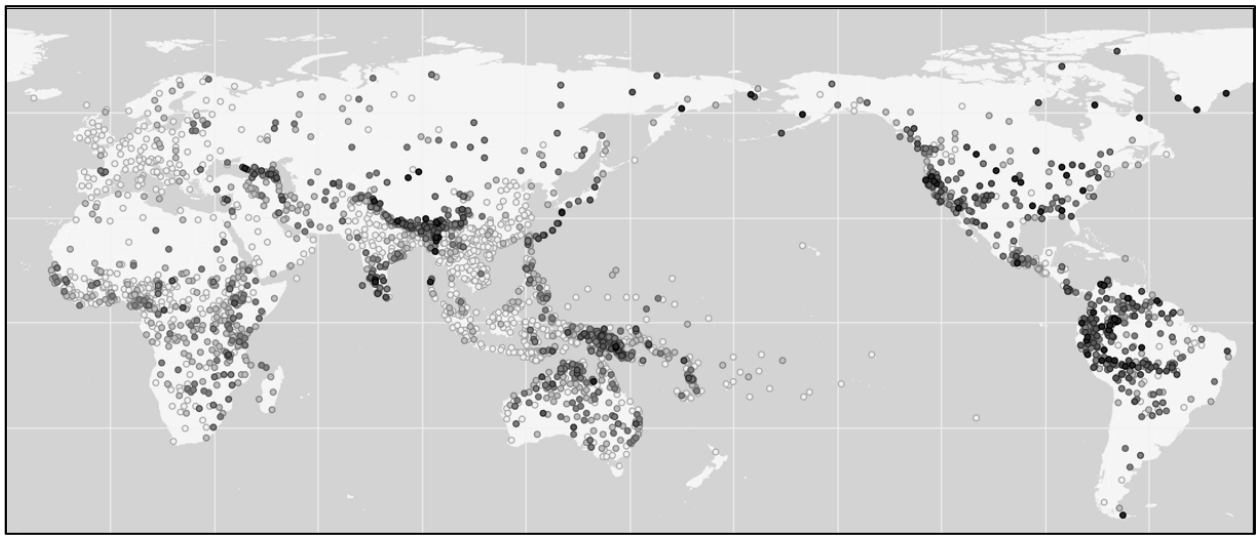
Maps of features with strong associations with Dimension 2:



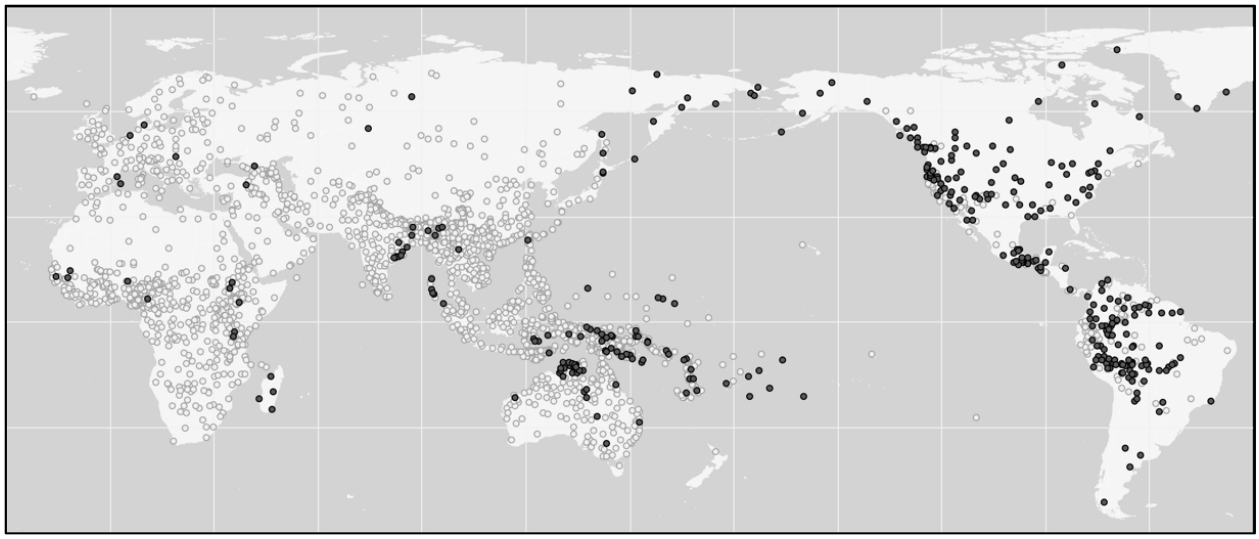
Map A9.2.1: Total verbal agreement positions.



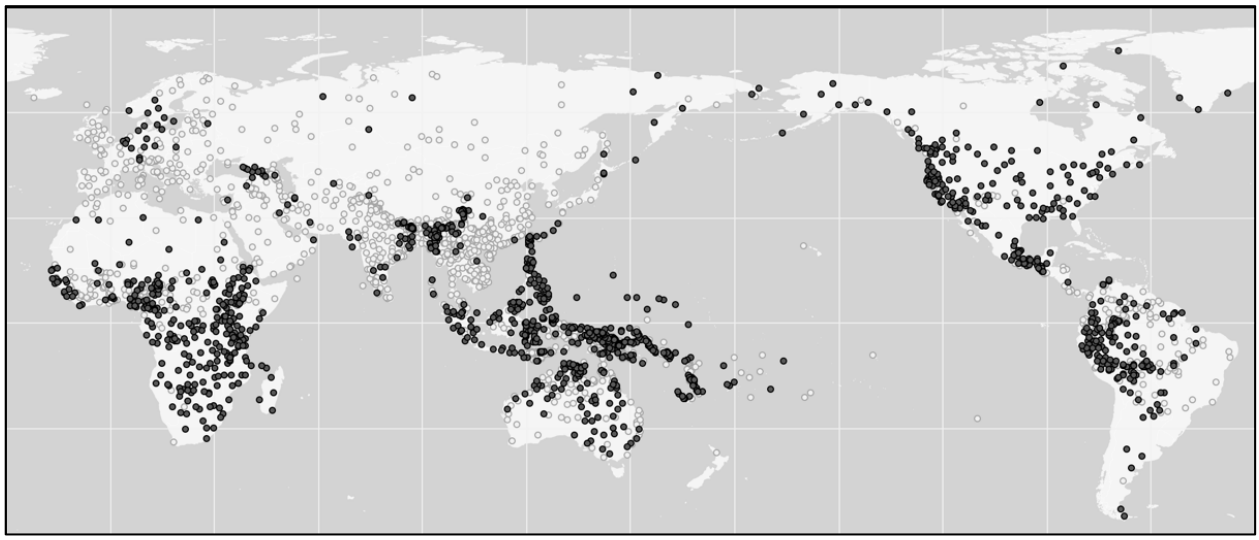
Map A9.2.2: Total verbal inflectional synthesis.



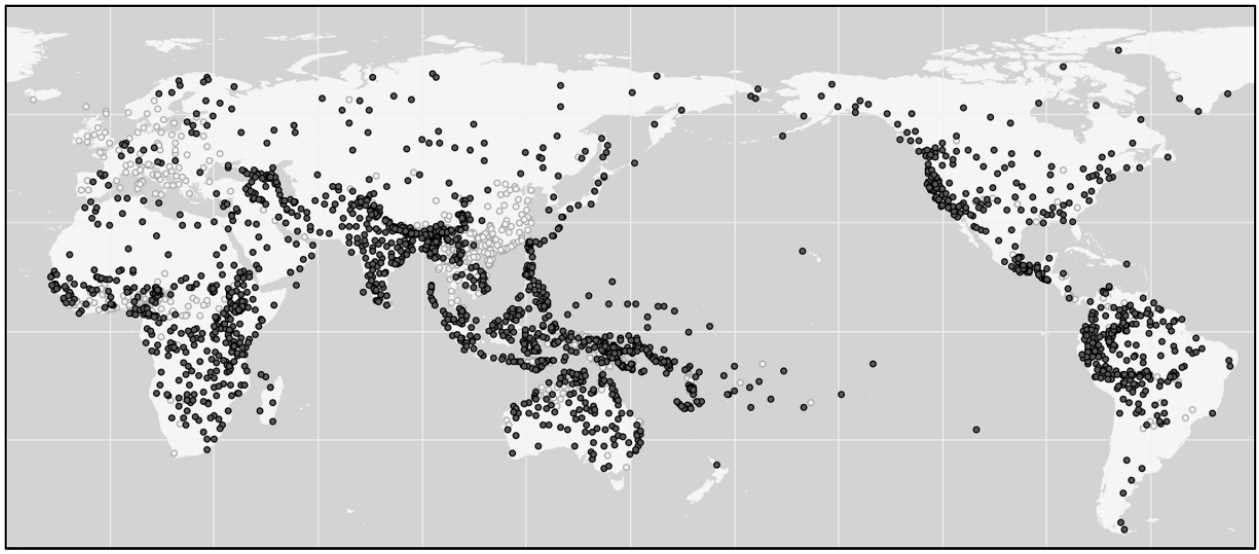
Map A9.2.3: Total Modality affixes.



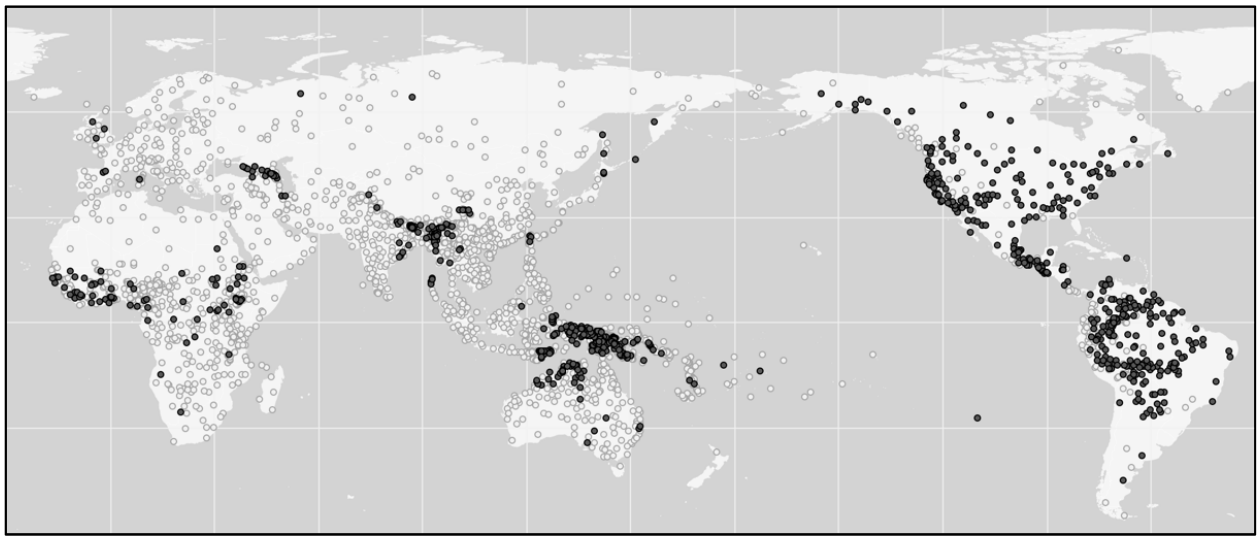
Map A9.2.4: Incorporation.



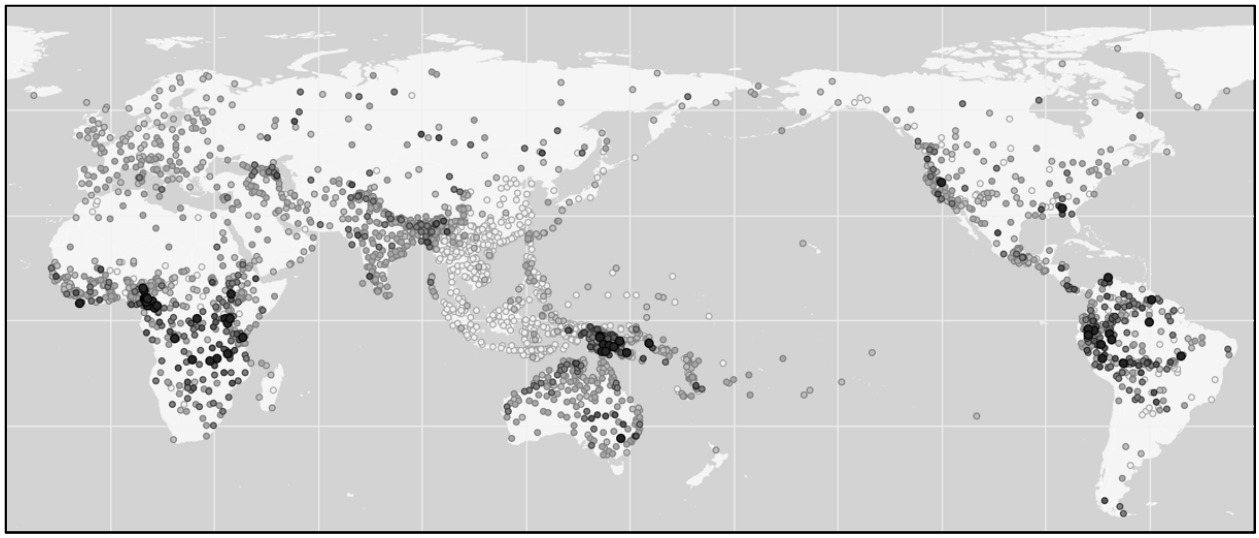
Map A9.2.5: Applicatives.



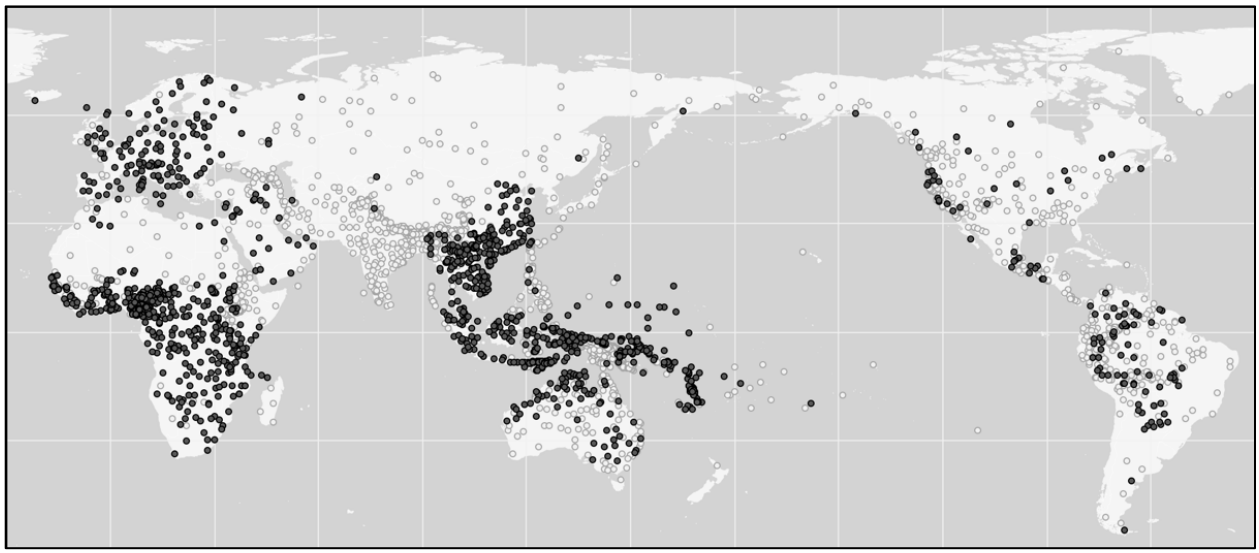
Map A9.2.6: Morphological causatives.



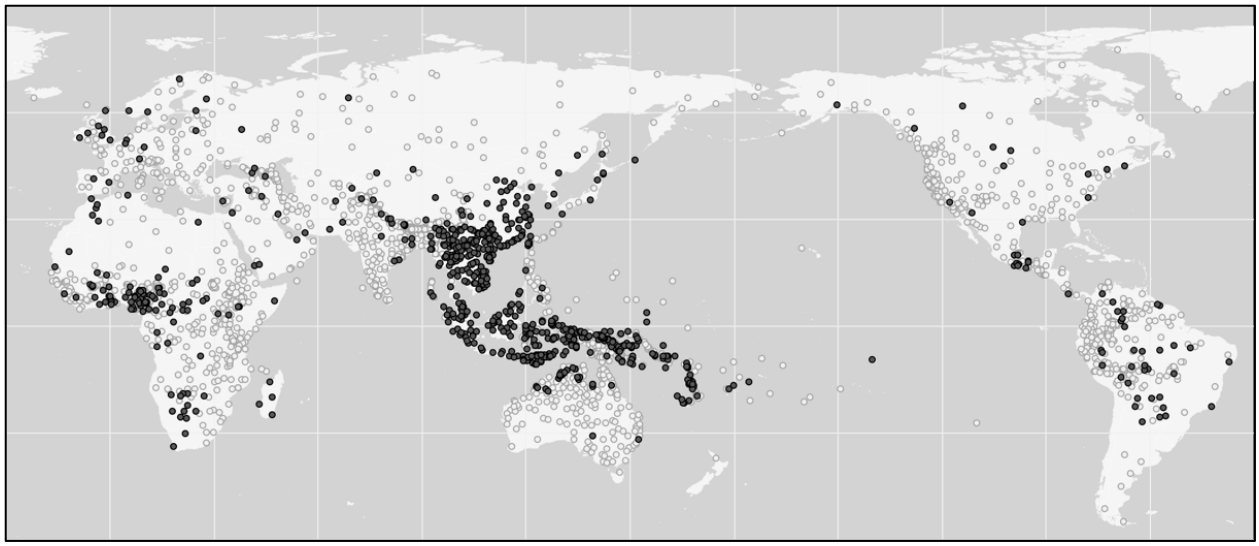
Map A9.2.7: Possessive prefixes on nouns.



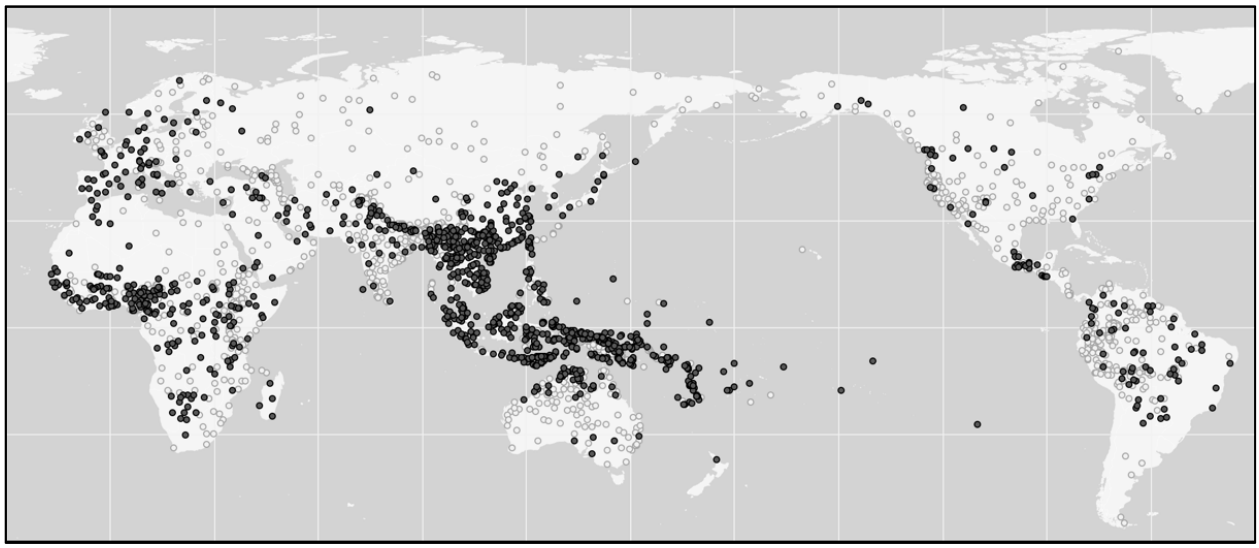
Map A9.2.8: Total tense distinctions.



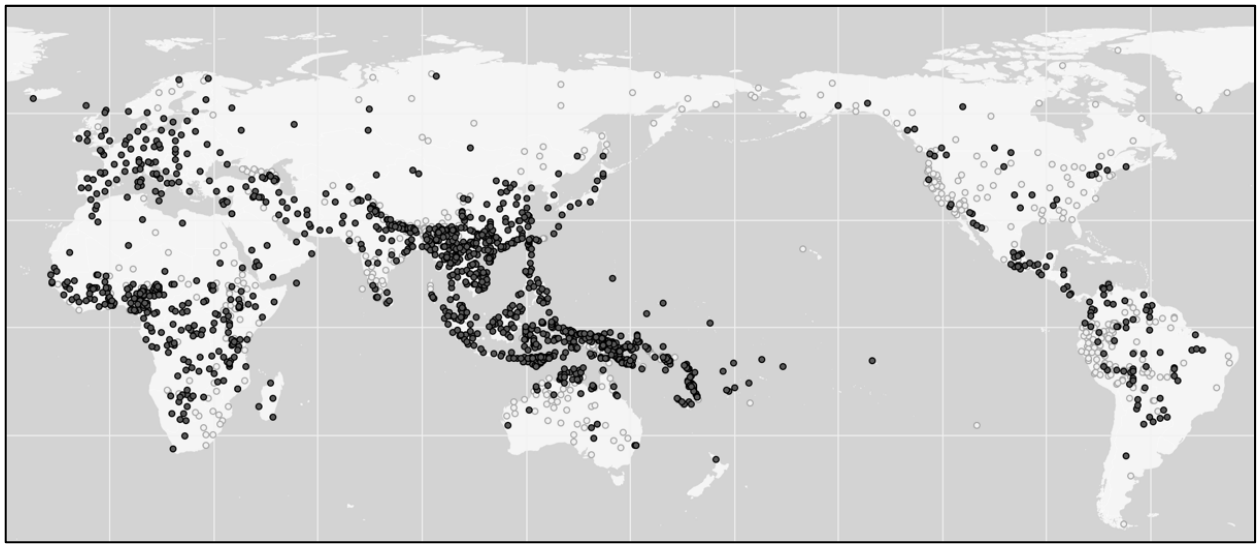
Map A9.2.9: SVO order.



Map A9.2.10: Symmetrical clauses: Purpose.



Map A9.2.11: Symmetrical clauses: Temporal.



Map A9.2.12: Symmetrical clauses: Reason.

A9.3 Features associated with Dimension 3

Dimension plots of features with strong associations with Dimension 3. Pairs of dimensions listed for each chart.

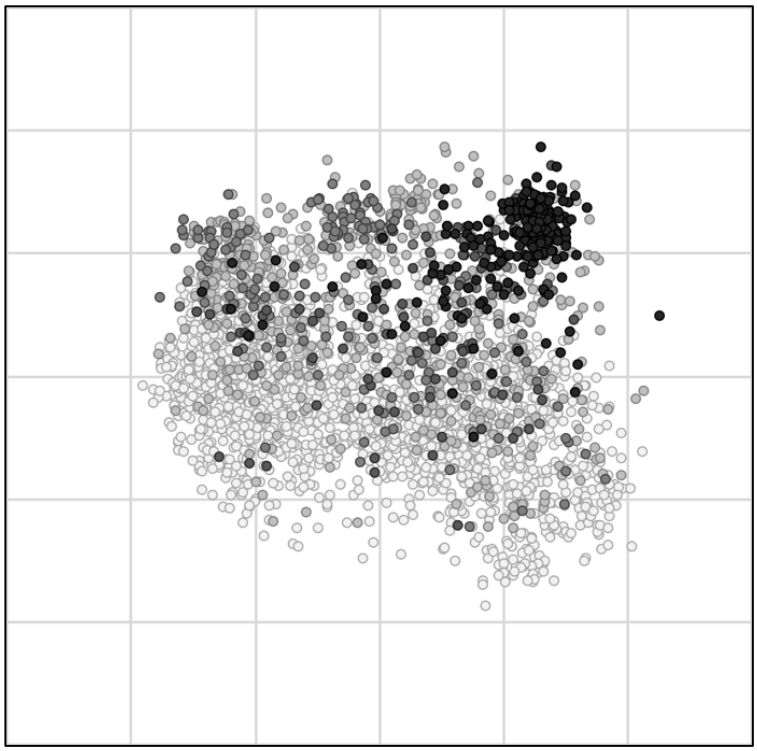


Figure A9.3.1: Genders in Dimensions 1 and 3 ($r^2 = 0.28$).

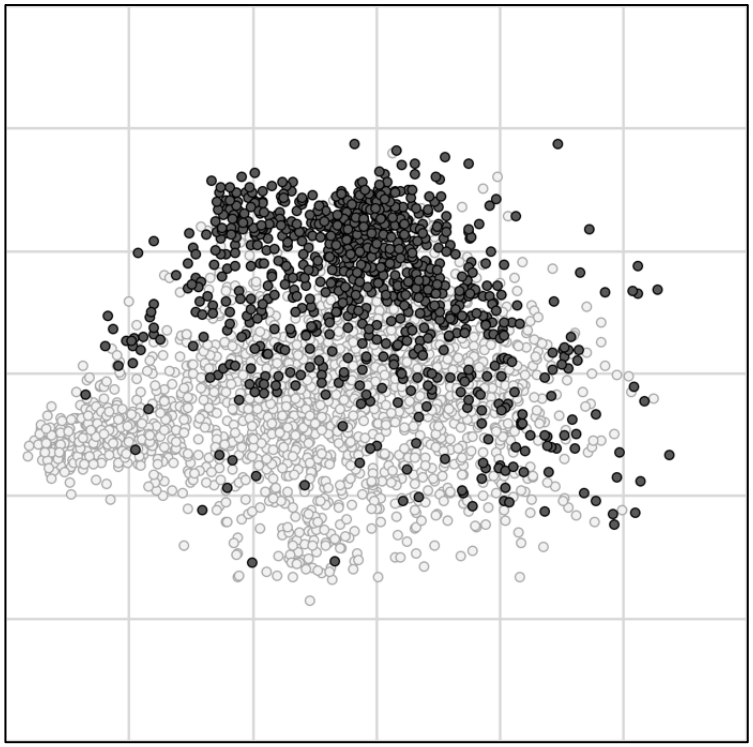


Figure A9.3.2: Obligatory plural marking on nouns in Dimensions 2 and 3 ($r^2 = 0.27$).

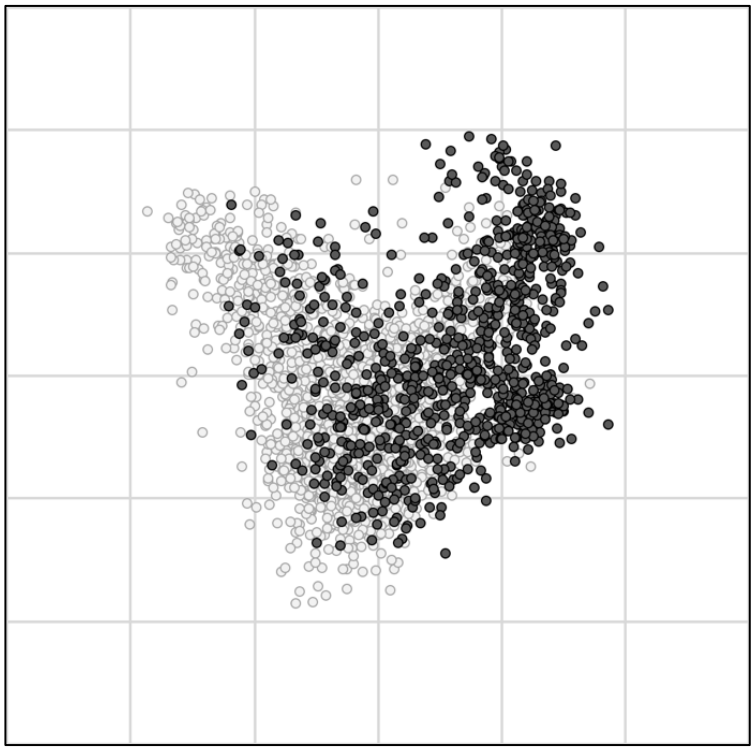


Figure A9.3.3: 3SG pronominal gender in Dimensions 3 and 4 ($r^2 = 0.25$).

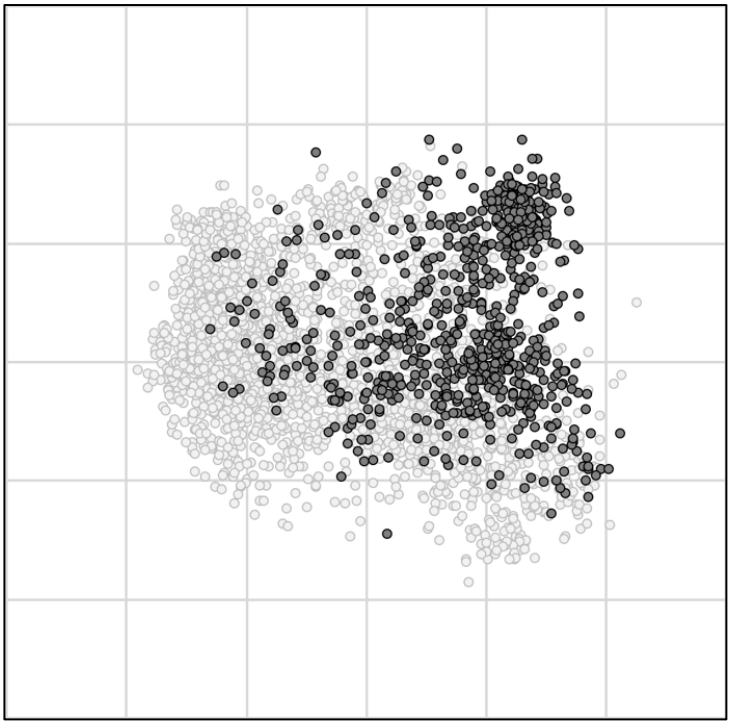


Figure A9.3.4: Accusative verb alignment in Dimensions 1 and 3 ($r^2 = 0.22$).

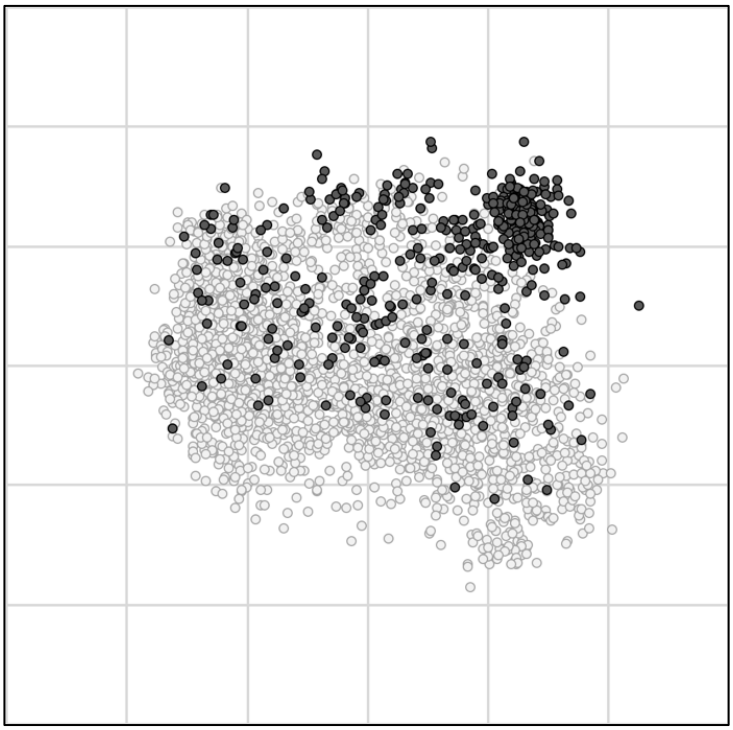


Figure A9.3.5: 3PL pronominal gender in Dimensions 1 and 3 ($r^2 = 0.17$).

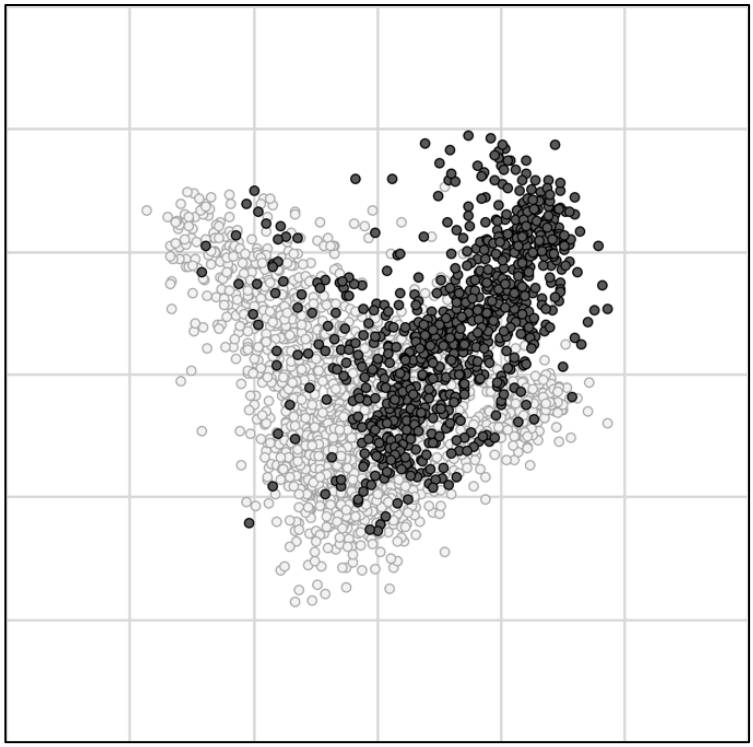


Figure A9.3.6: Suffixal subject agreement on verbs in Dimensions 3 and 4 ($r^2 = 0.13$).

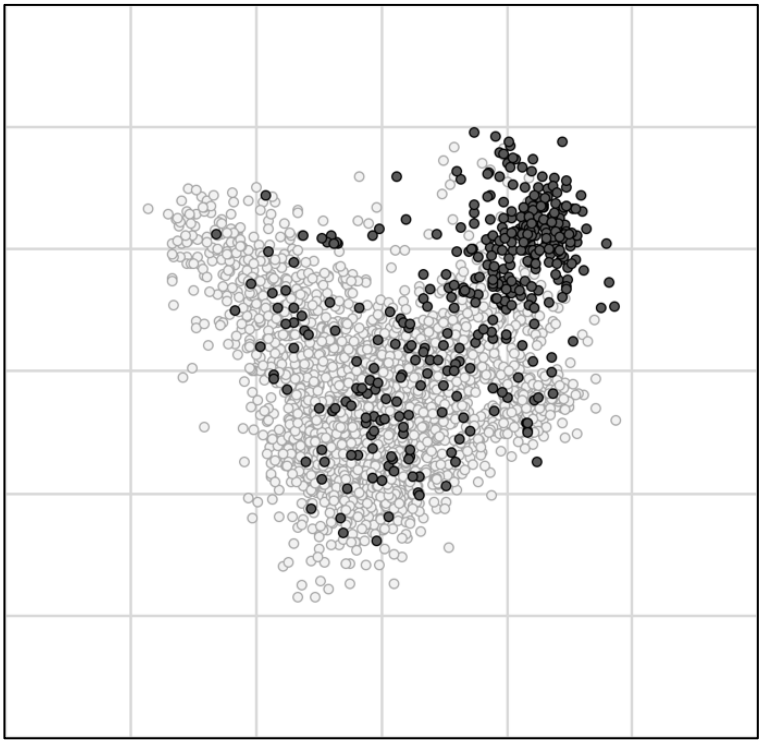


Figure A9.3.7: Relative pronouns in Dimensions 3 and 4 ($r^2 = 0.13$).

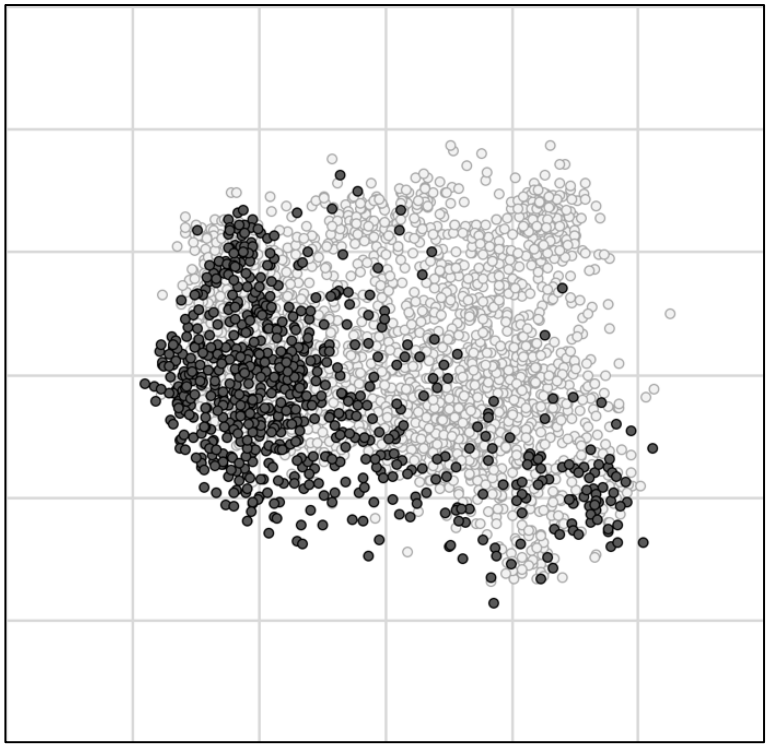


Figure A9.3.8: Ergativity in Dimensions 1 and 3 ($r^2 = 0.13$).

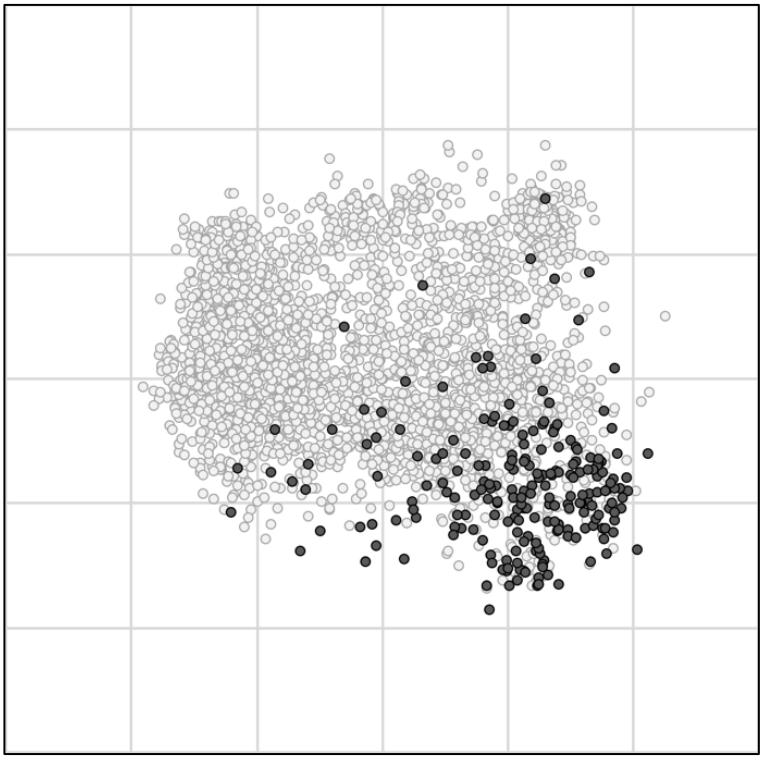


Figure A9.3.9: VOS order in Dimensions 1 and 3 ($r^2 = 0.15$).

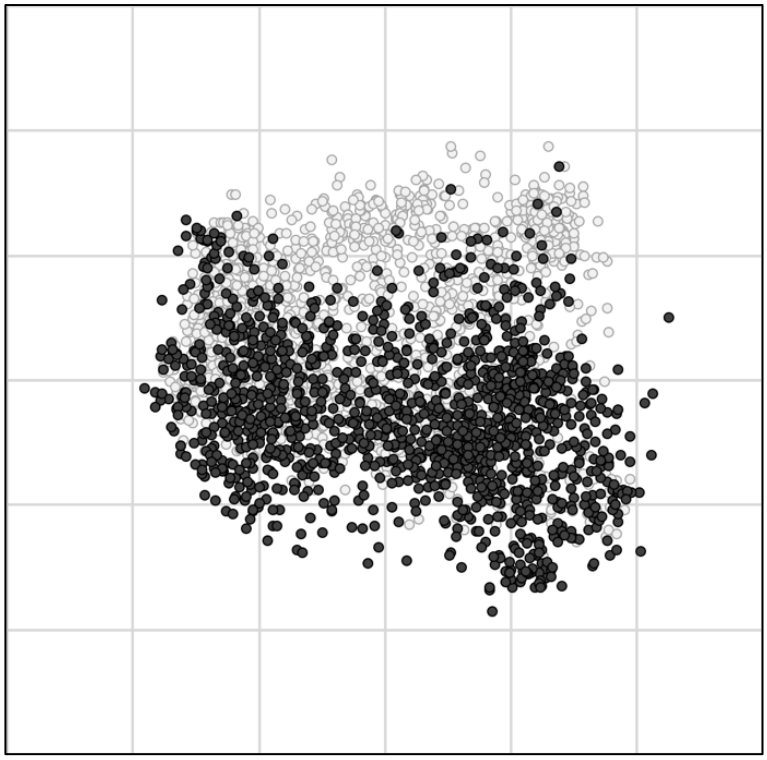


Figure A9.3.10: Inclusive/Exclusive contrasts in Dimensions 1 and 3 ($r^2 = 0.18$).

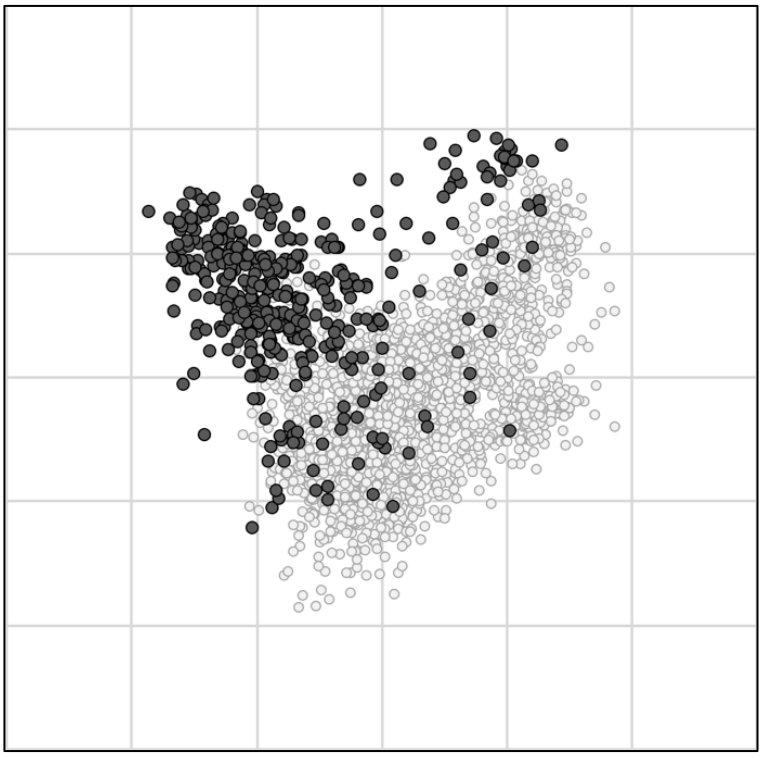
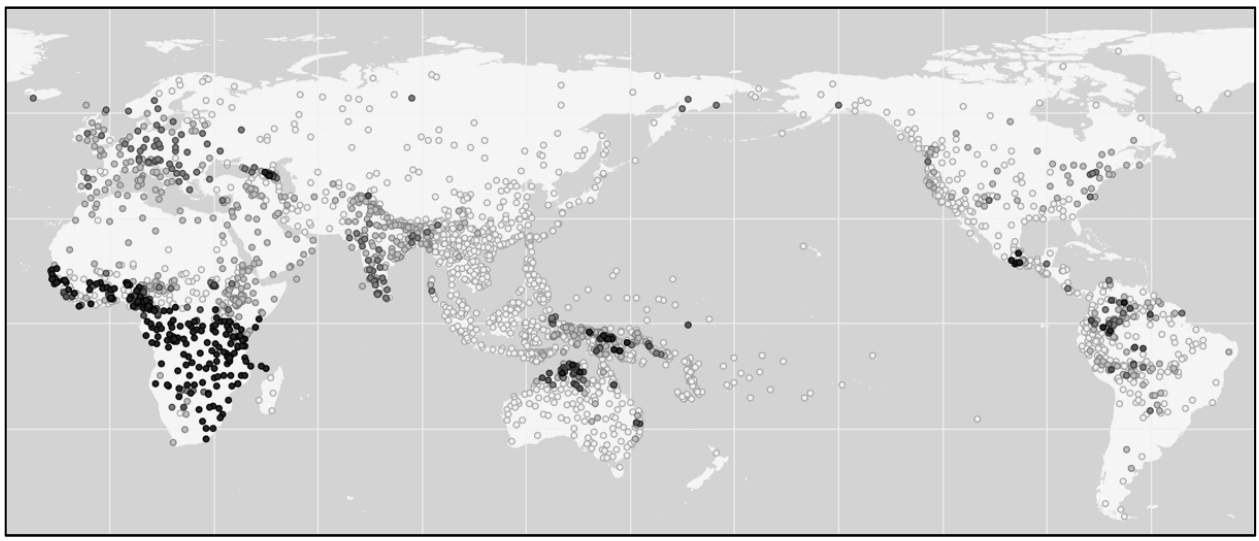
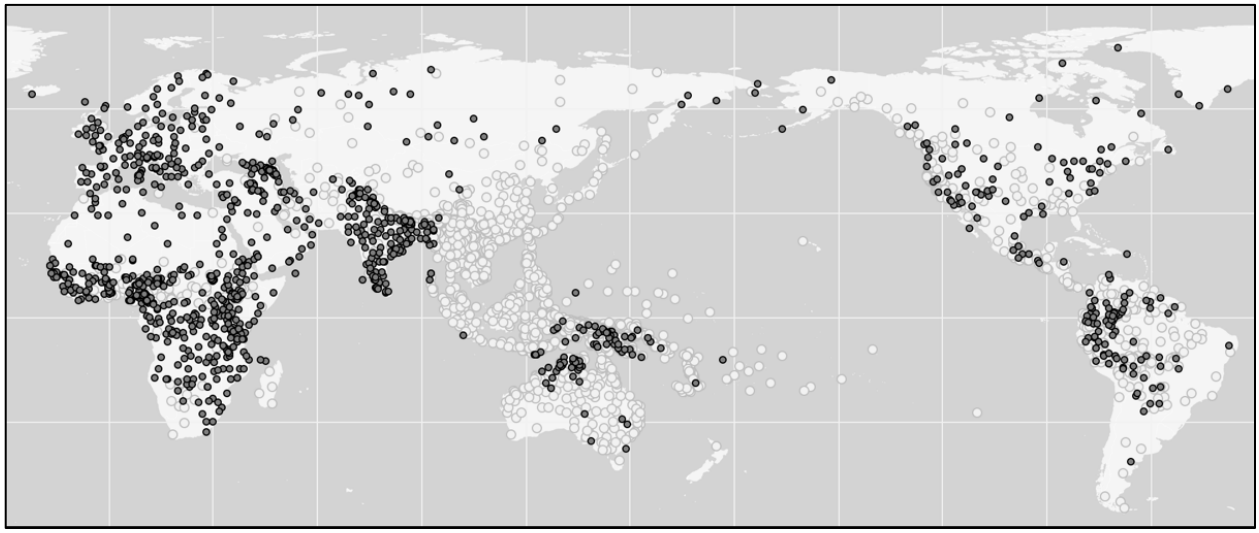


Figure A9.3.11: Clause-initial negation in Dimensions 3 and 4 ($r^2 = 0.18$).

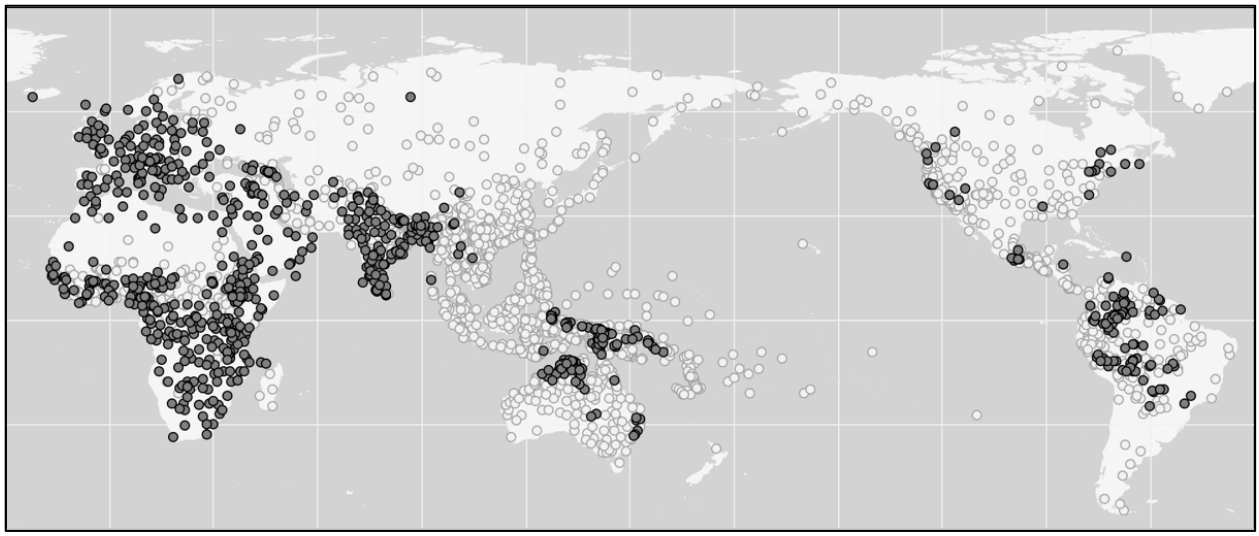
Maps of features with strong associations with Dimension 3:



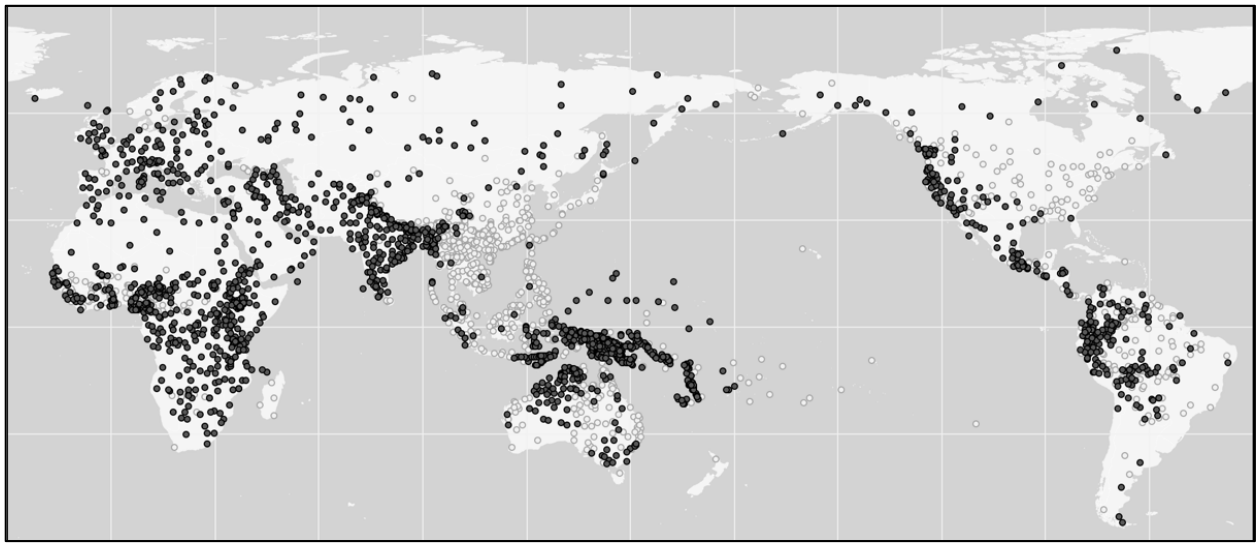
Map A9.3.1: Genders.



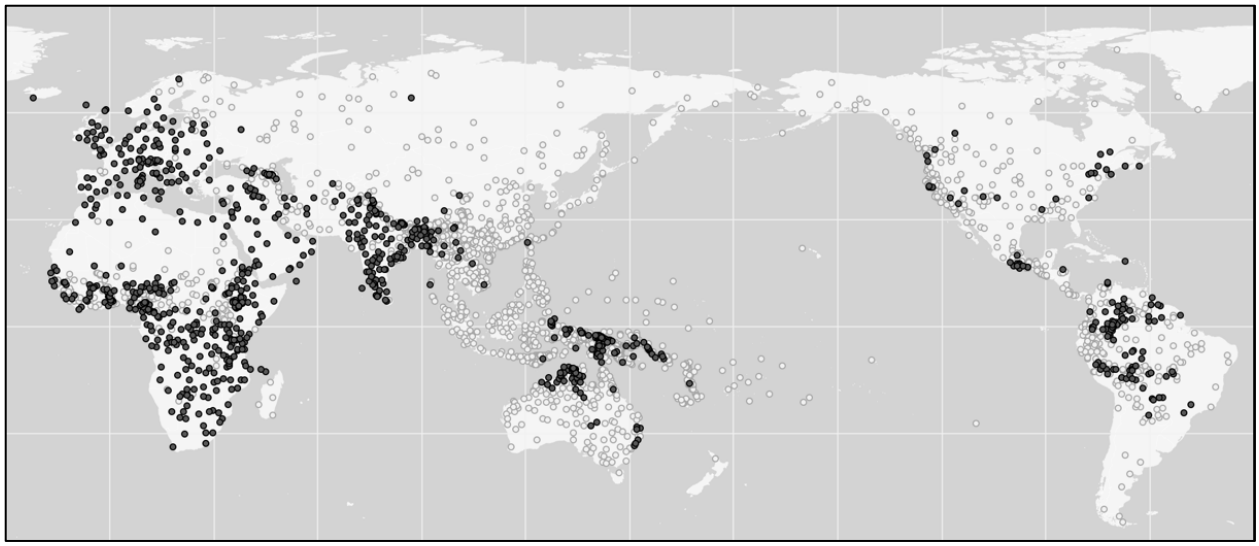
Map A9.3.2: Obligatory plural marking on nouns.



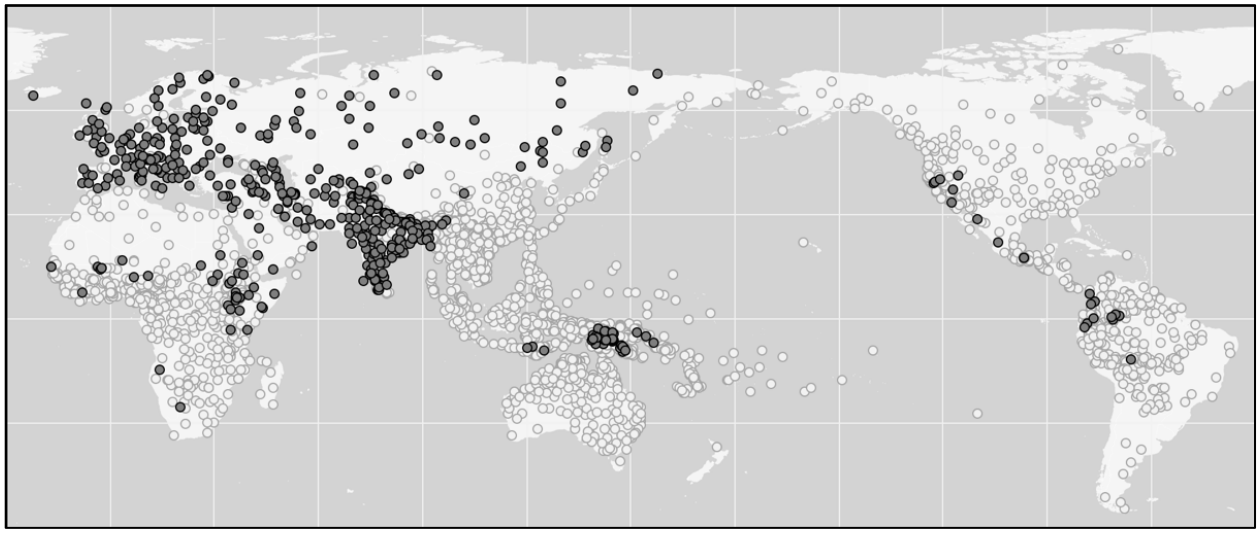
Map A9.3.3: 3SG pronominal gender.



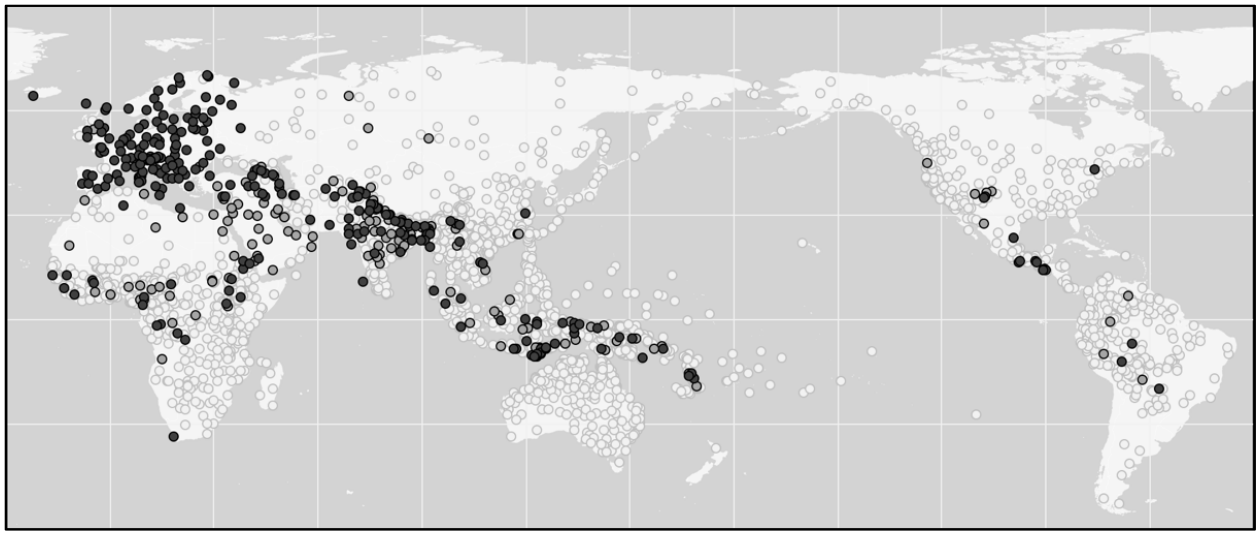
Map A9.3.4: Verb alignment: accusative.



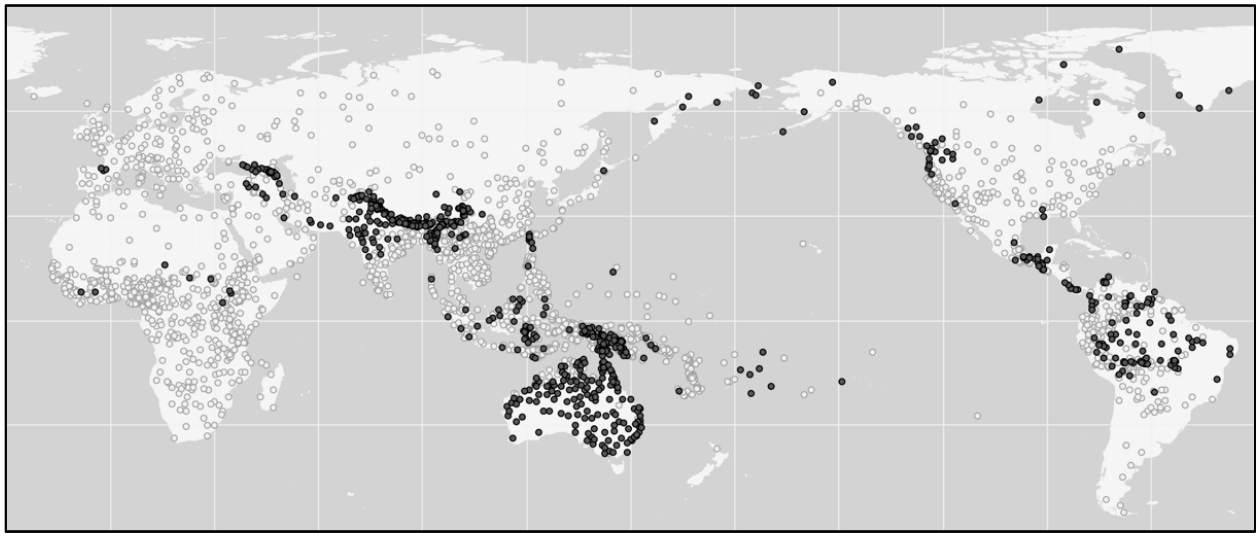
Map A9.3.5: 3PL pronominal gender.



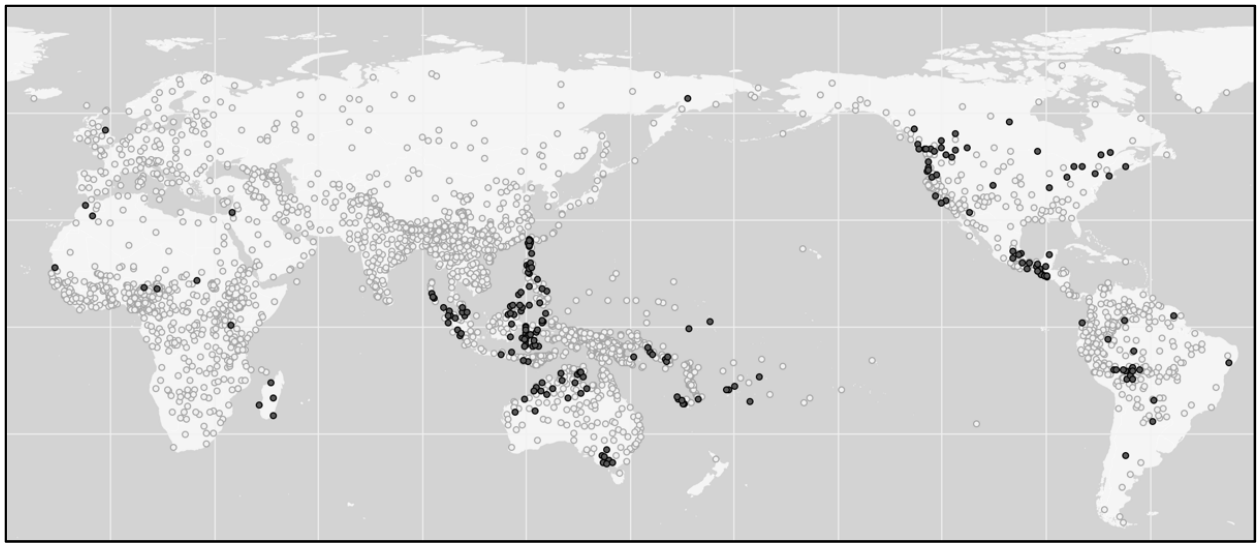
Map A9.3.6: Suffixal subject agreement on verbs.



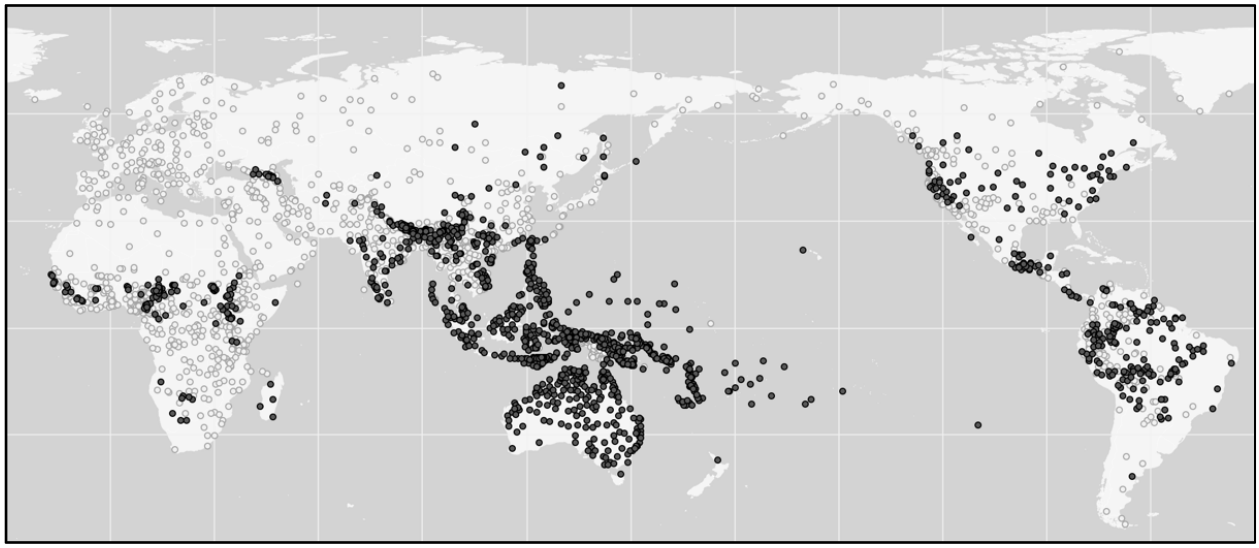
Map A9.3.7: Relative pronouns.



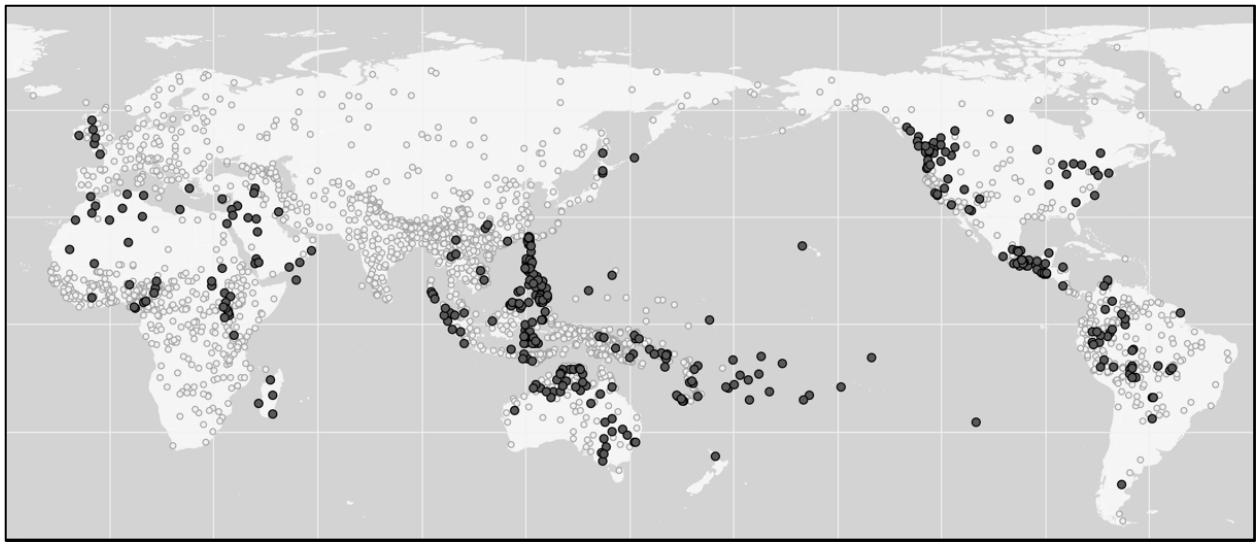
Map A9.3.8: Ergativity.



Map A9.3.9: VOS order.



Map A9.3.10: Inclusive/Exclusive contrasts.



Map A9.3.11: Clause-initial negation.

A9.4 Features associated with Dimension 4

Dimension plots of features with strong associations with Dimension 4.
Pairs of dimensions listed for each chart.

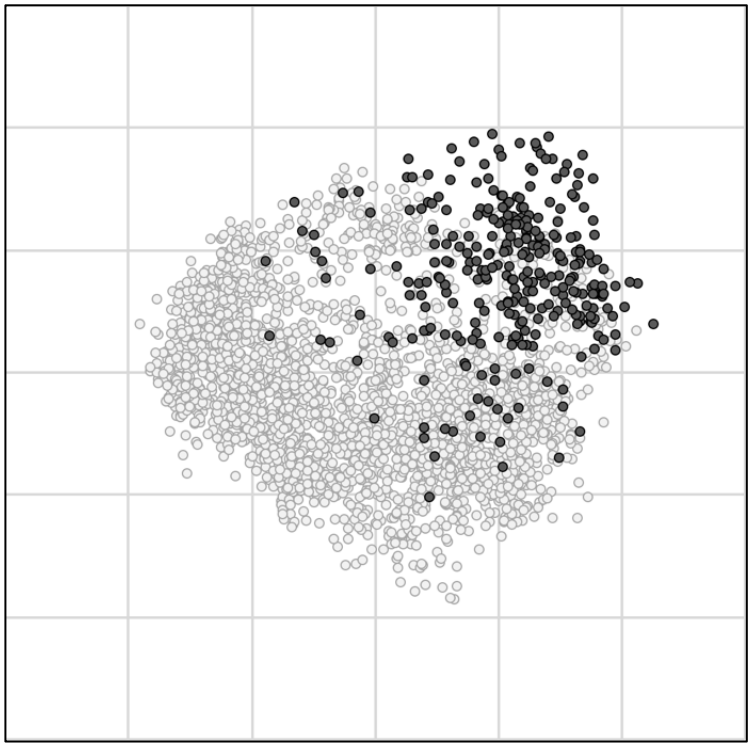


Figure A9.4.1: VSO order in Dimensions 1 and 4 ($r^2 = 0.22$).

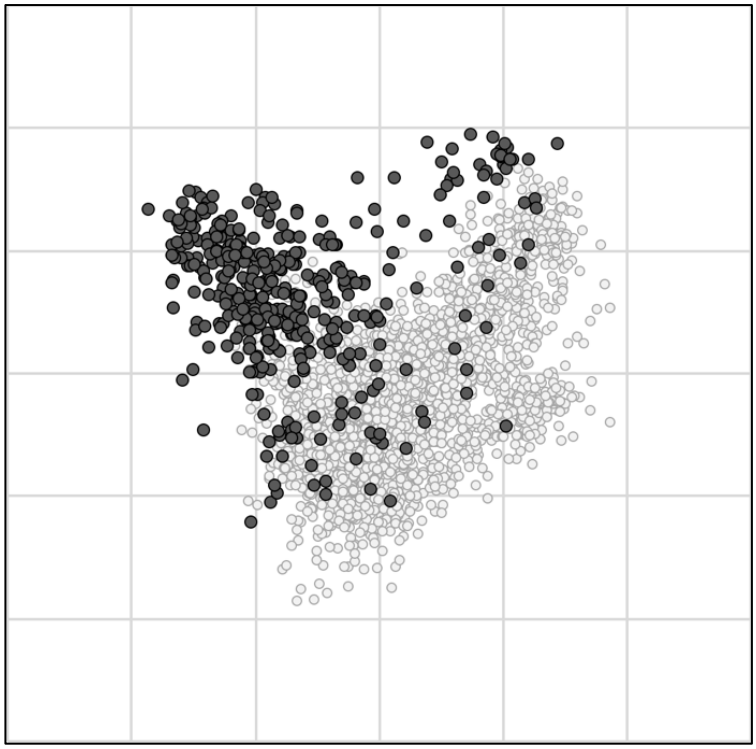


Figure A9.4.2: Clause-initial negation in Dimensions 3 and 4 ($r^2 = 0.20$)

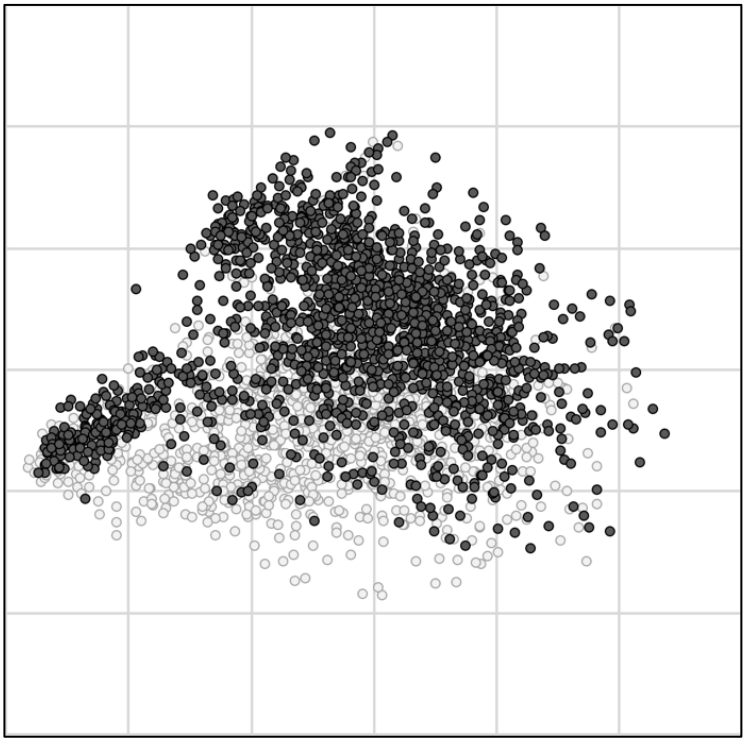


Figure A9.4.3: Numeral N order in Dimensions 2 and 4 ($r^2 = 0.19$).

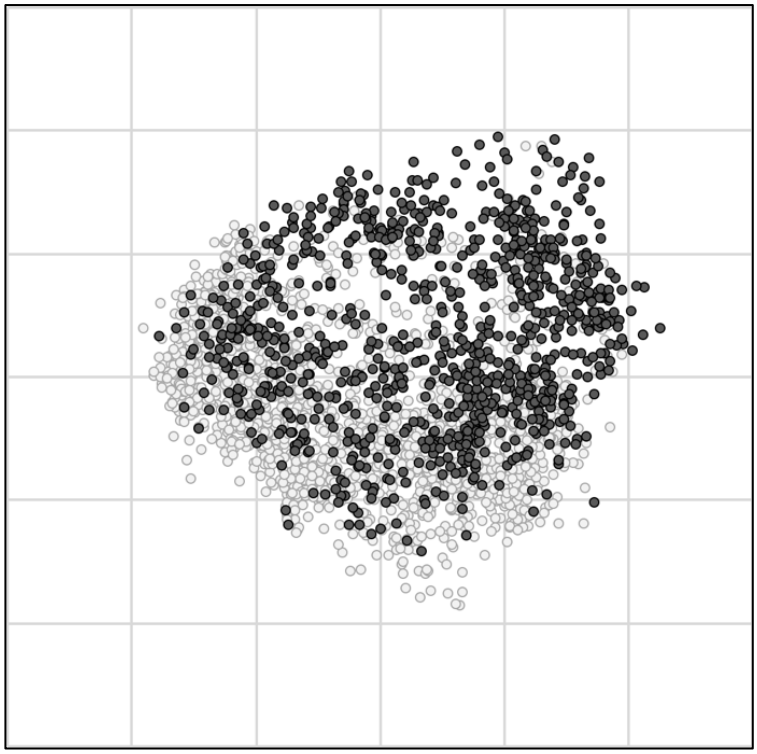


Figure A9.4.4: Clause-initial Wh in Dimensions 1 and 4 ($r^2 = 0.11$).

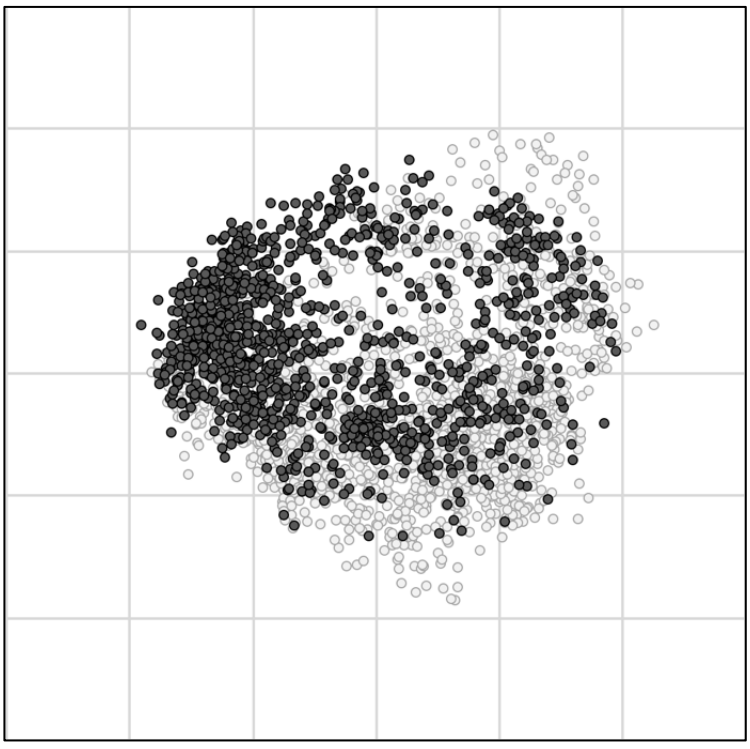


Figure A9.4.5: Adjective N order in Dimensions 1 and 4 ($r^2 = 0.11$).

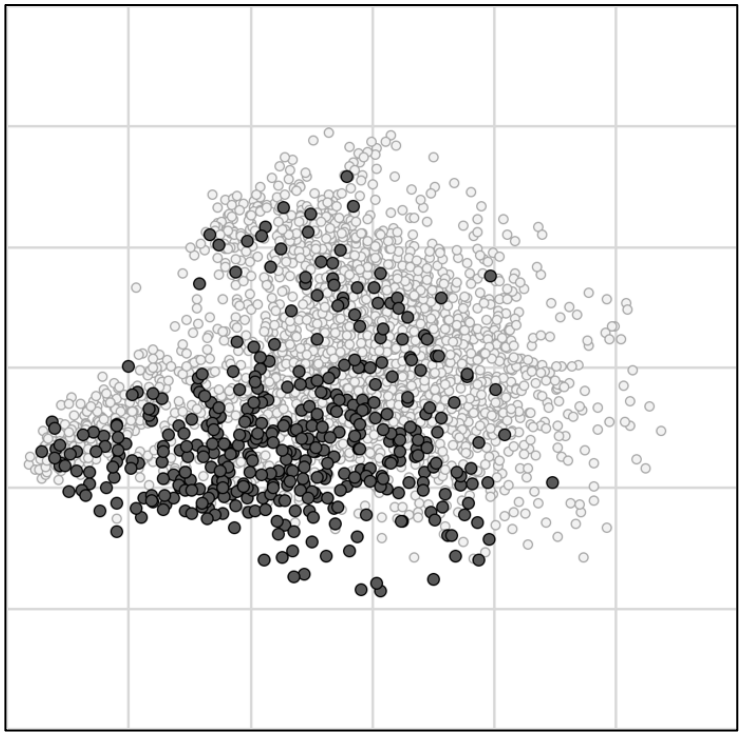


Figure A9.4.6: Clause-final negation in Dimensions 2 and 4 ($r^2 = 0.10$).

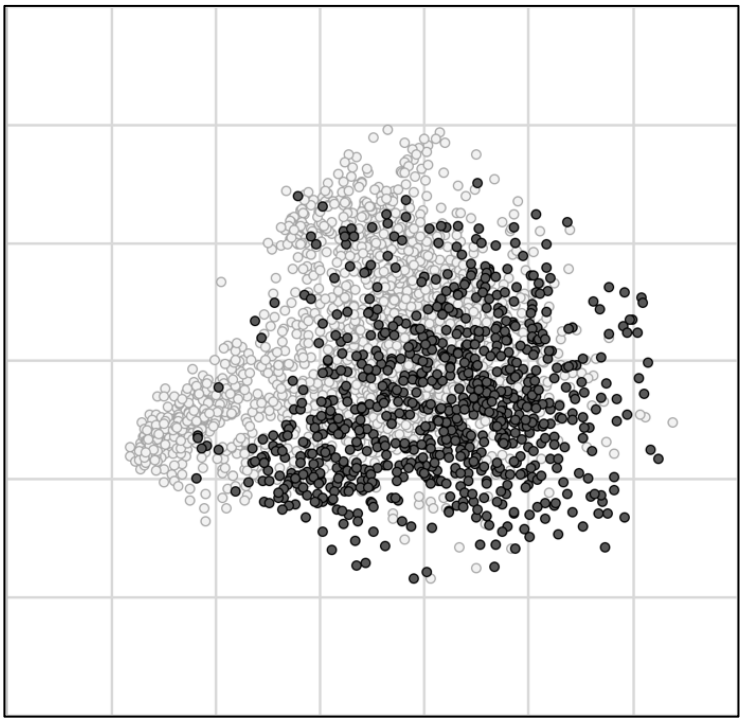


Figure A9.4.7: Inalienable possession in Dimensions 2 and 4 ($r^2 = 0.10$).

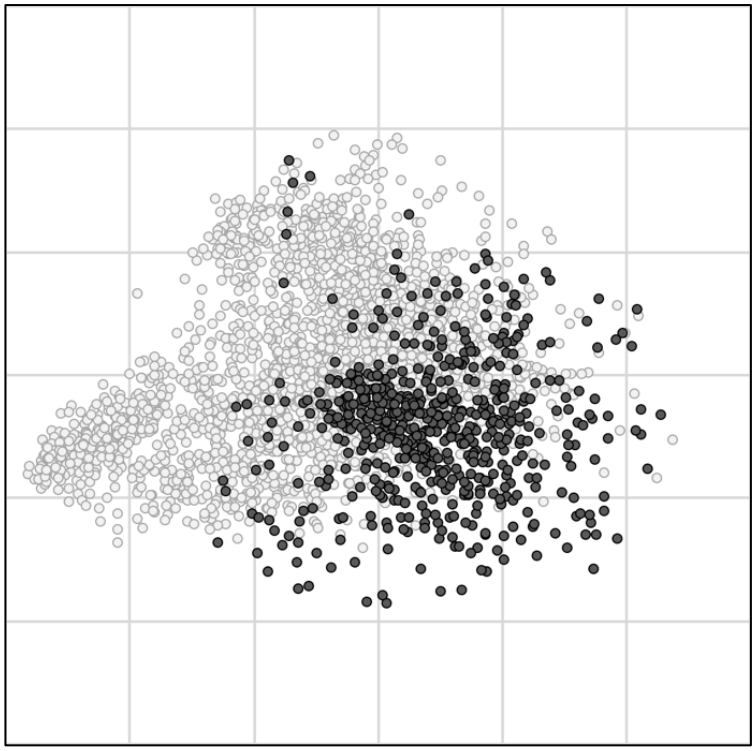


Figure A9.4.8: Object agreement prefixes in Dimensions 2 and 4 ($r^2 = 0.14$).

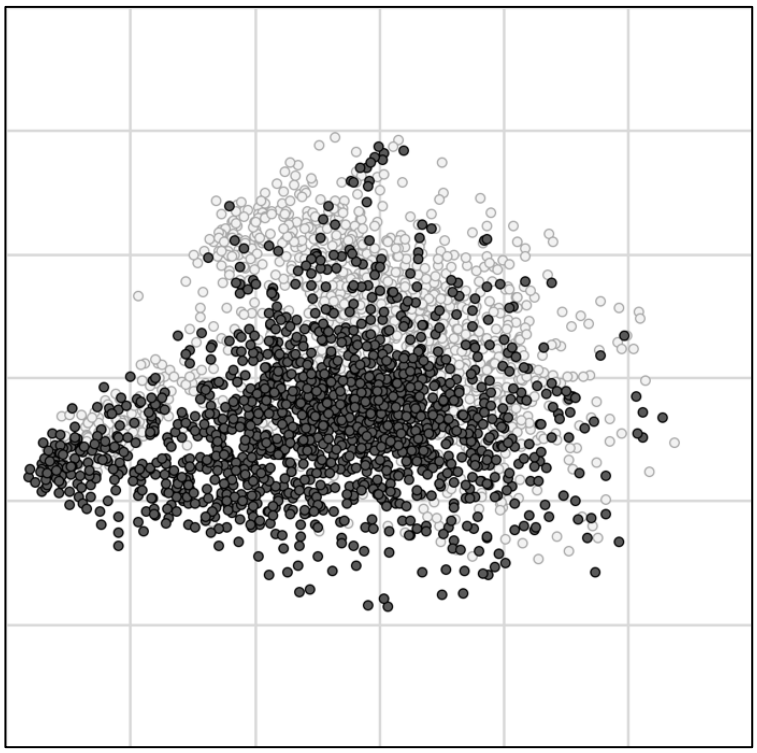


Figure A9.4.9: N Numeral order in Dimensions 2 and 4 ($r^2 = 0.14$).

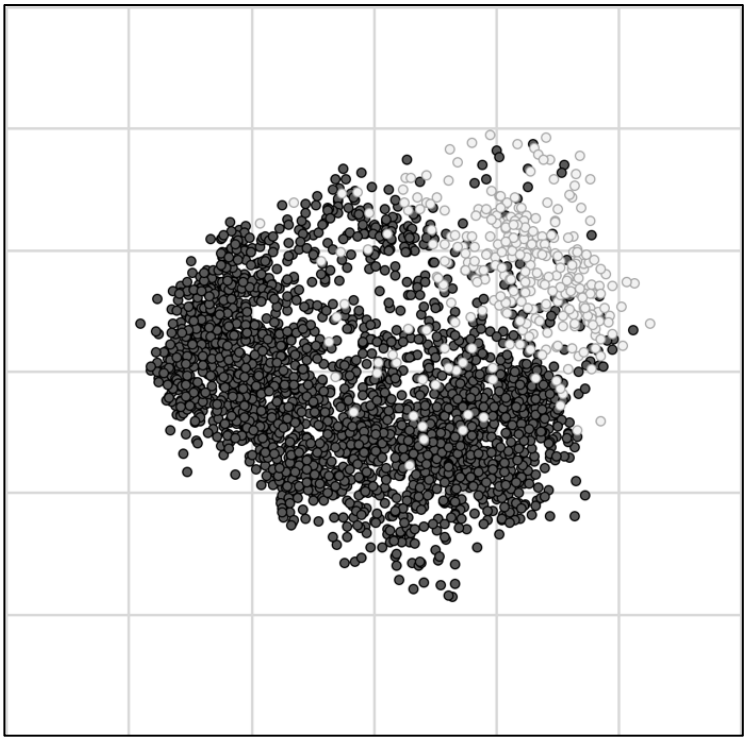
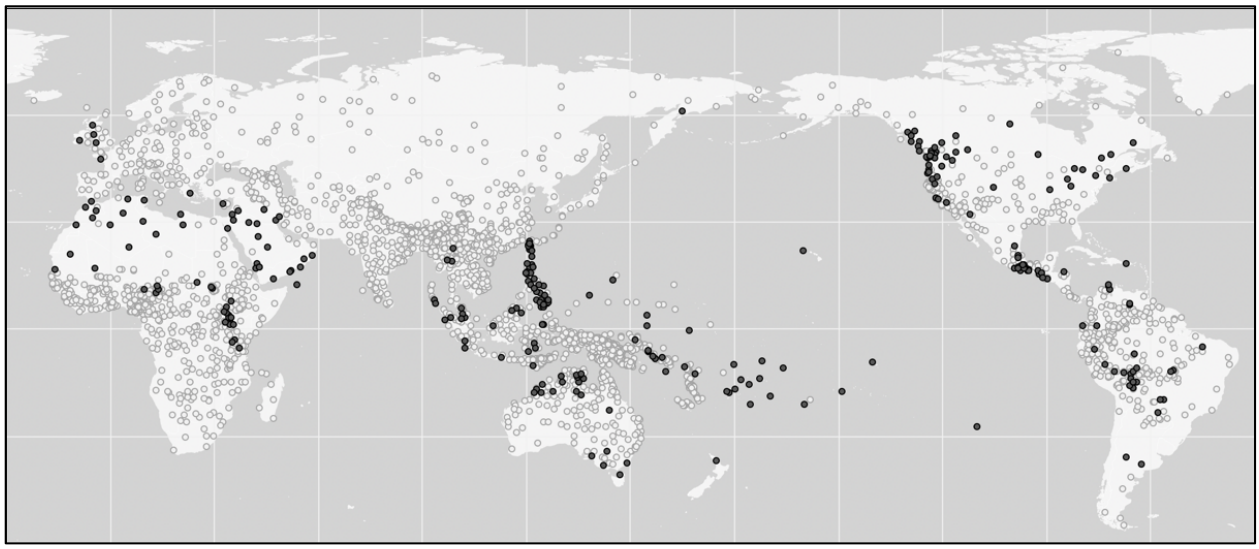
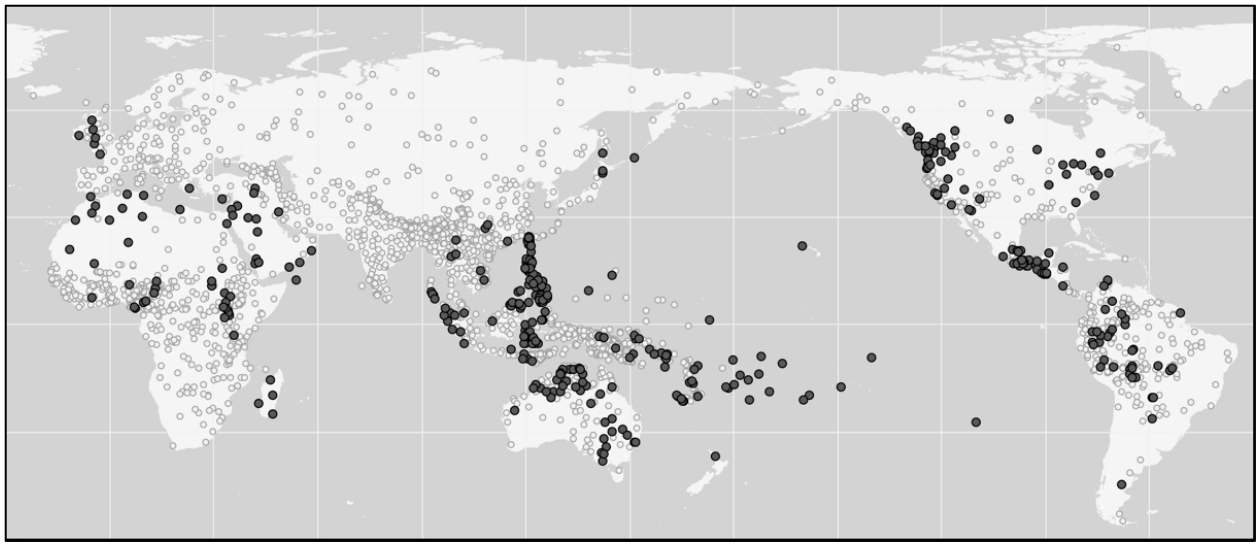


Figure A9.4.10: SV order in Dimensions 1 and 4 ($r^2 = 0.21$).

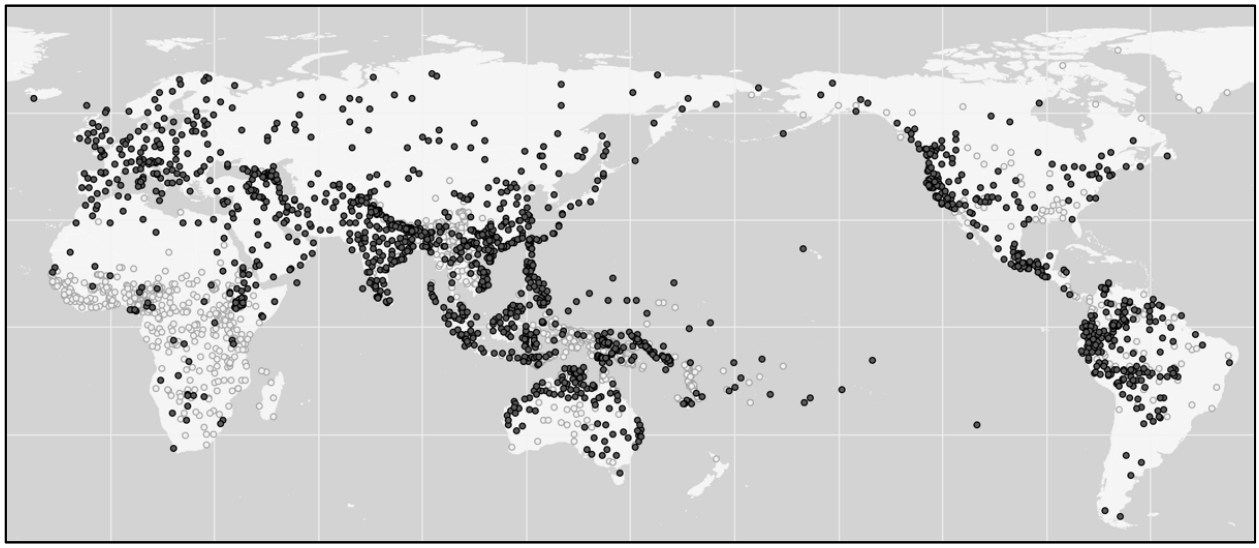
Maps of features with strong associations with Dimension 4.



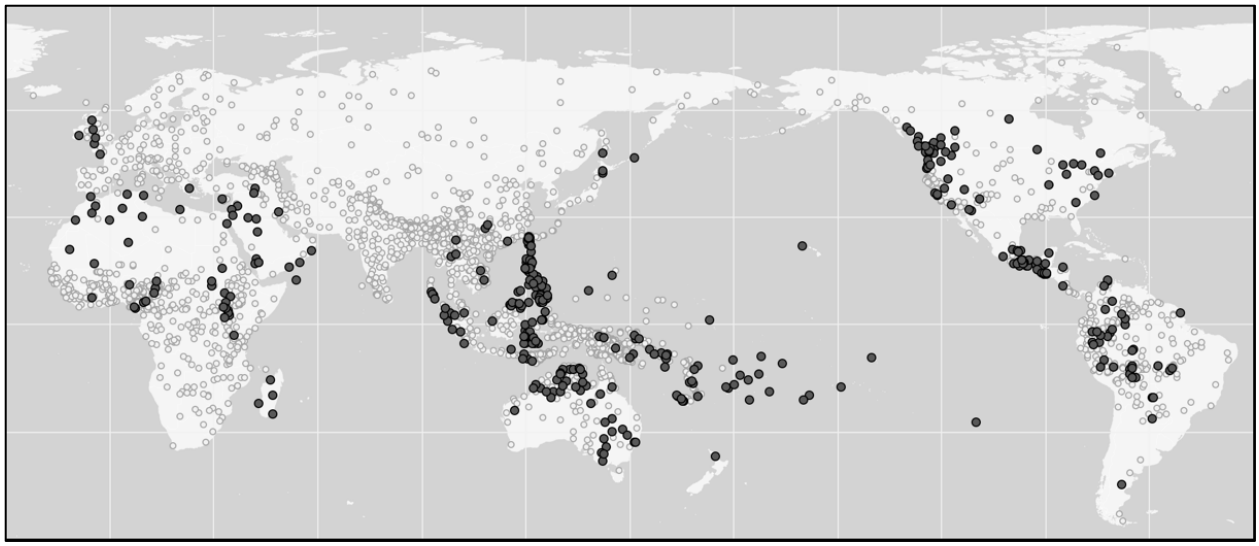
Map A9.4.1: VSO order.



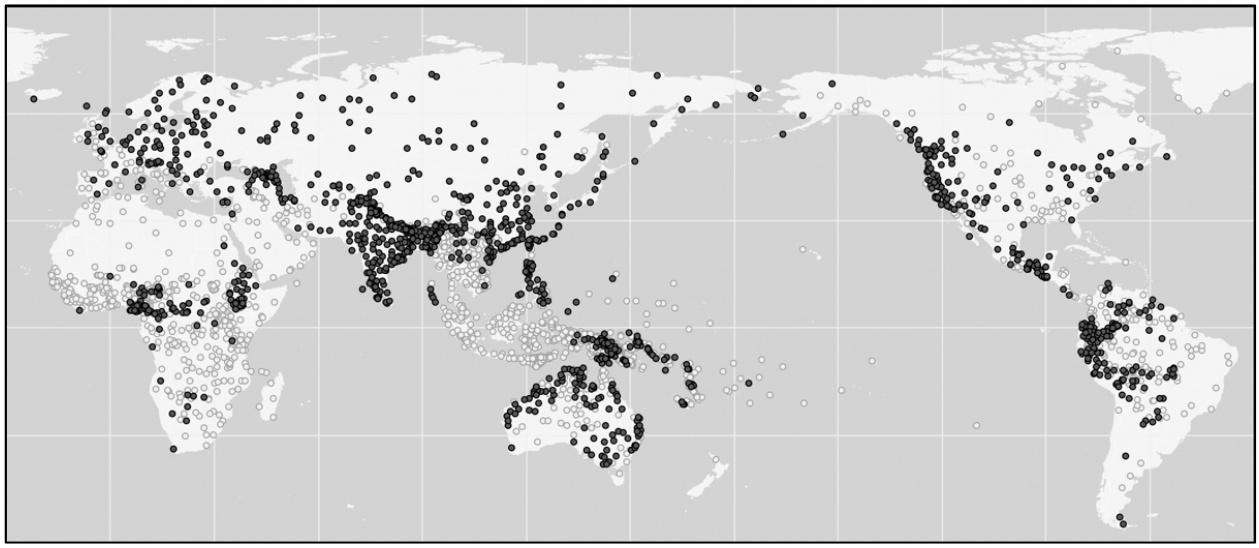
Map A9.4.2: Clause-initial negation.



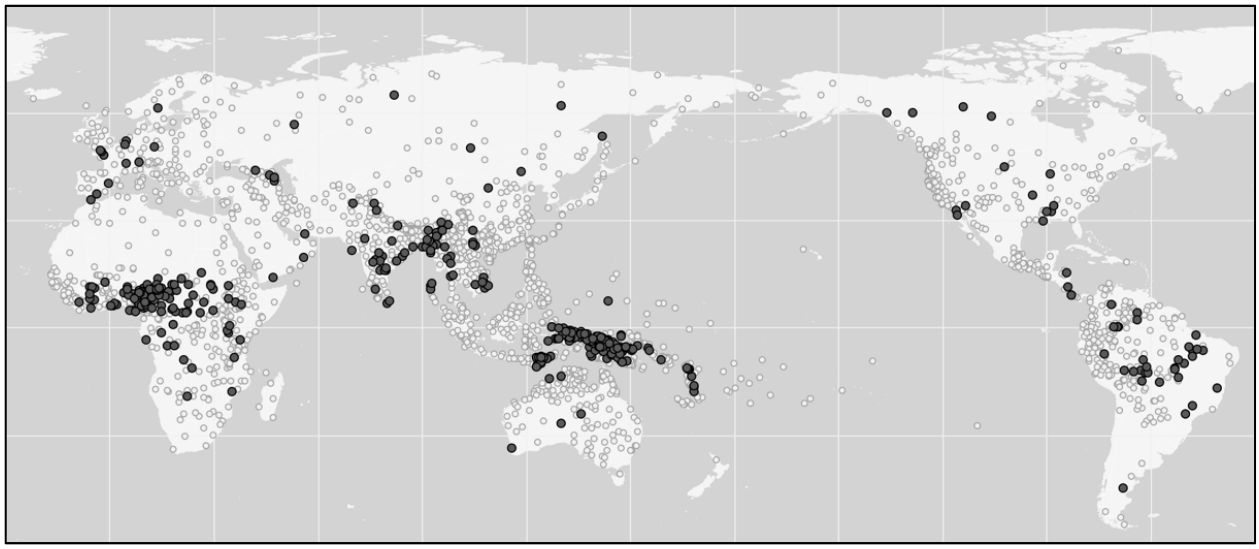
Map A9.4.3: Numeral N order.



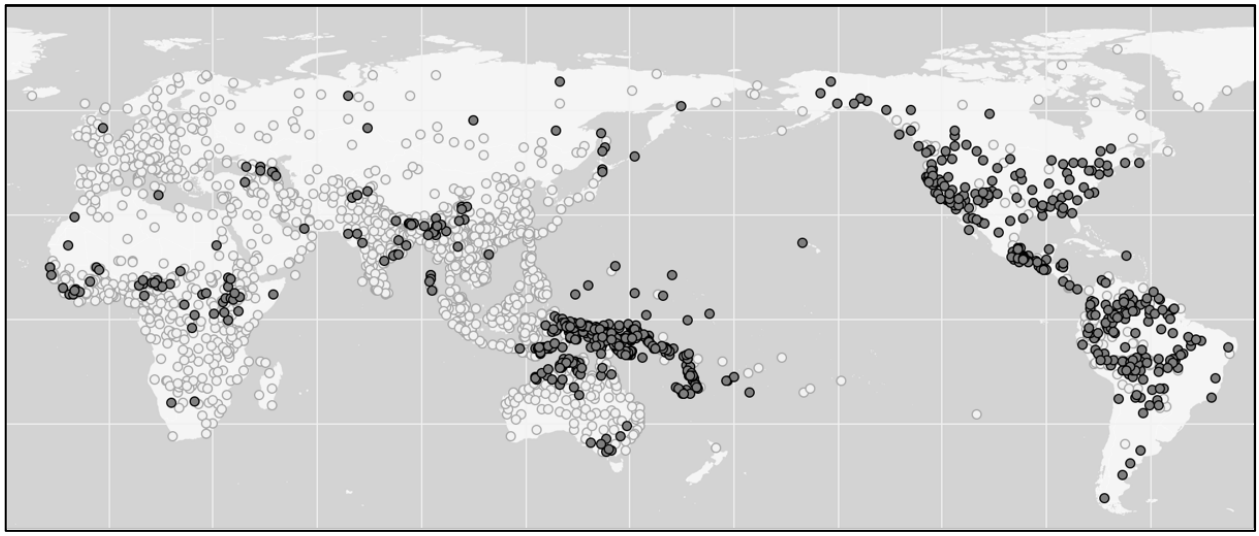
Map A9.4.4: Clause-initial Wh.



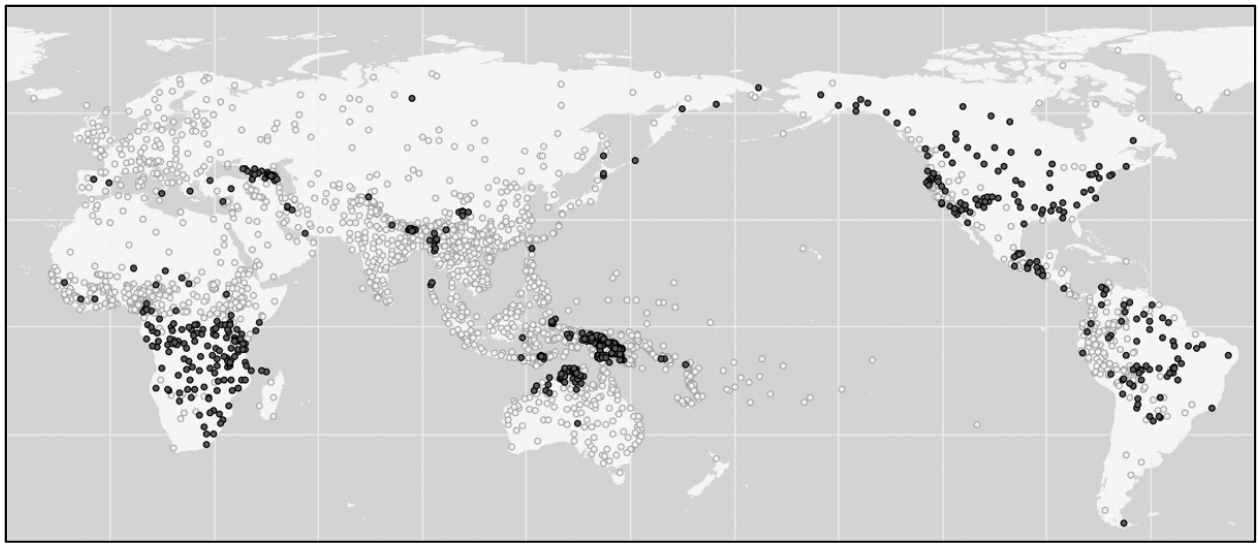
Map A9.4.5: Adjective N order.



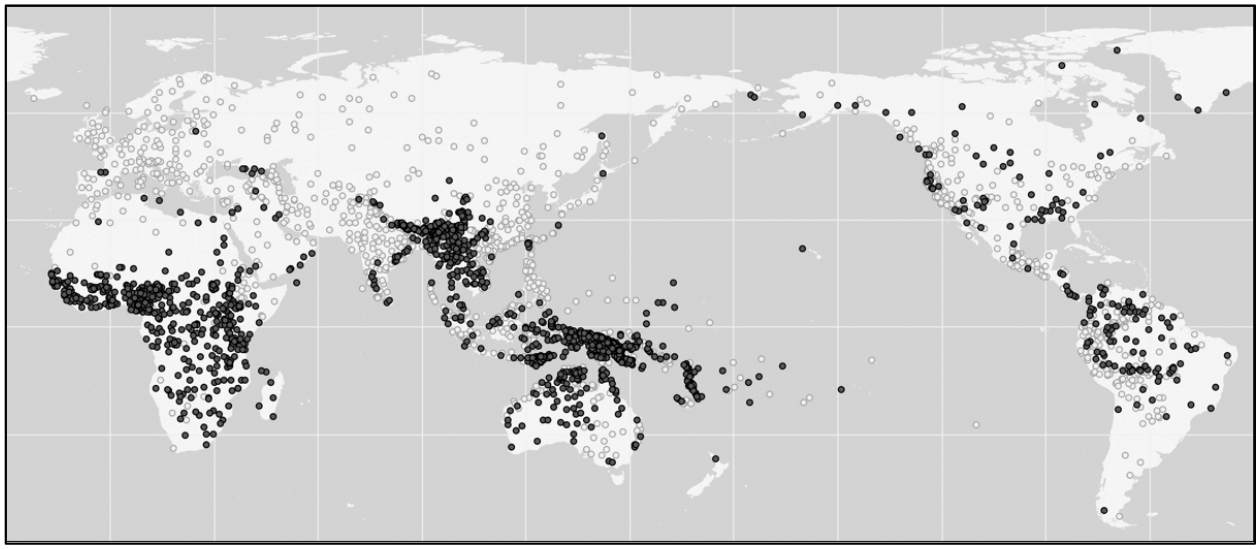
Map A9.4.6: Clause-final negation.



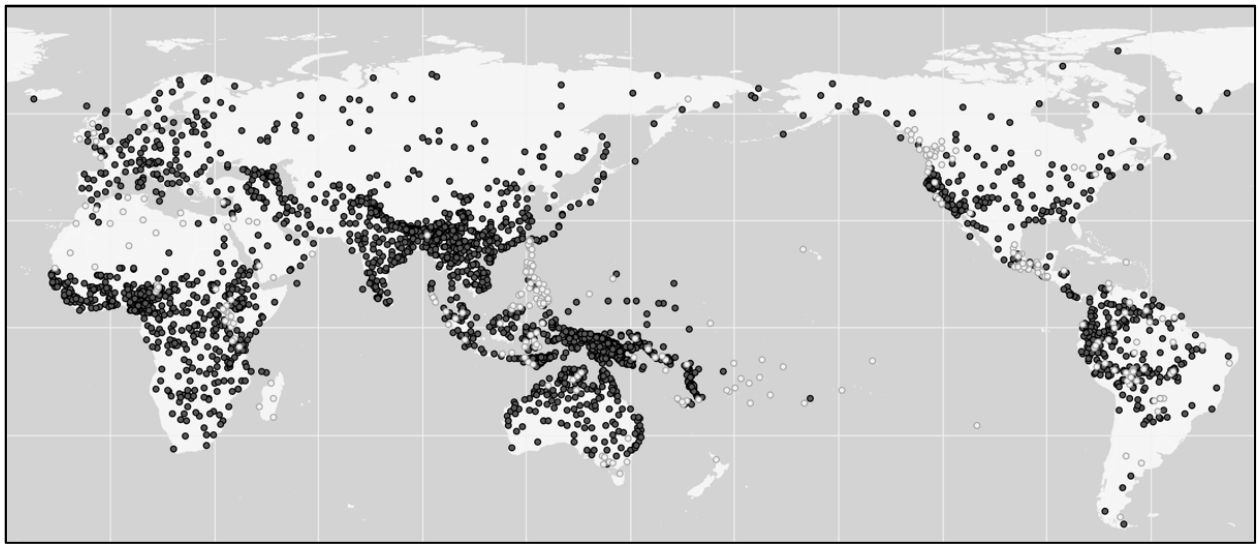
Map A9.4.7: Inalienable possession.



Map A9.4.8: Object agreement prefix.



Map A9.4.9: N Numeral order.



Map A9.4.10: SV order.

Appendix 10. Source code

The source code used can be found at https://osf.io/u9qbe/.