

# Simulated Segment Evolution using the TKF91 Model

## APPENDICES

1. Character Assignments
2. Partition Assignments
3. TKF Configuration
4. Concepts Used
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## Appendix 1 - Character Assignments

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Each segment gets a different number

0	e	1	g	2	o:	3	ʒ	4	ə	5	j	6	o	7	i	8	w	9	ɔ
10	dʒ	11	ɪ	12	j	13	k <sup>w</sup>	14	s	15	k	16	i:	17	m	18	n		
19	ẽj	20	ẽj	21	tʃ	22	d	23	a	24	i	25	ɛ	26	ɛ:				
27	tʃ	28	ã	29	ẽ	30	u	31	t	32	ẽ	33	u:	34	œ	35	ũ		
36	õ	37	ɳ	38	ø	39	oj	40	ʃ	41	ø:	42	aj	43	ɐ	44	r		
45	e:	46	ɤ	47	ɑ	48	ɾ	49	ej	50	ẽ	51	θ	52	ĩ	53	g		
54	ɲ	55	l	56	õ	57	ʎ	58	ɣ	59	a:	60	p	61	ã	62	ɐj		
63	h	64	b	65	v	66	z	67	x	68	β	69	ɛa	70	ʝ	71	ð		
72	y	73	ɾ	74	ɔa	75	ɥ	76	c	77	ts	78	ɬ	79	ɛj	80	f		
81	g <sup>w</sup>	82	ẽɥ																

## Appendix 2 - Partition Assignments

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David's basic rules

### 1 Nasal Vowel

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ã ẽ ĕ œ ù õ ė ĭ ã

### 2 Vowel

---

e o: ə o ĭ ɔ ɪ i: ĕ ĵ a ĭ ε ε: u u: ø oʝ ø: aʝ ɐ e: ɑ ej a: ɐj ɘa y ɔa ɛj  
ẽ ʉ

### 3 Consonant Group 1

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w j m n r l

### 4 Consonants

---

g ʒ j dʒ k<sup>w</sup> s k tʃ d ʈ t ɳ ʃ ʁ ɾ θ g ɲ ʎ ɣ p h b v z x β ʝ ð ʀ ɥ c  
ts ɭ f g<sup>w</sup>

## Appendix 3 - TKF Configuration

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```
{
  "Tree": "(Latin,(Romanian,(((Walloon,French),(((Portuguese,PortugueseBrazil),Spanish),Catalan)),
(Friulian,Italian)))));",
  "NumberOfStates": 83,
  "Taxa": ["Latin", "French", "Spanish", "Italian", "PortugueseBrazil", "Portuguese", "Catalan",
"Walloon", "Friulian", "Romanian"],
  "Partition": [1,3,1,3,1,3,1,1,2,1,3,1,2,3,3,3,1,2,2,1,1,3,3,1,1,1,1,3,0,0,1,3,0,1,0,0,0,3,1,1,
3,1,1,1,2,1,3,1,3,1,0,3,0,3,3,2,0,3,3,1,3,0,1,3,3,3,3,3,1,3,3,1,3,1,3,3,3,1,3,3,1],
  "PartitionSets": [[28,29,32,34,35,36,50,52,56,61],[0,2,4,6,7,9,11,16,19,20,23,24,25,26,30,33,
38,39,41,42,43,45,47,49,59,62,69,72,74,79,82],[8,12,17,18,44,55],[1,3,5,10,13,14,15,21,22,27,31
,37,40,46,48,51,53,54,57,58,60,63,64,65,66,67,68,70,71,73,75,76,77,78,80,81]],
  "Words": [
    {"Name": "I", "Data": [
      {"Taxon": "Latin", "Segments": [-1, 0, 1, 2]},
      {"Taxon": "French", "Segments": [-1, 3, -1, 4]},
      {"Taxon": "Spanish", "Segments": [-1, 5, -1, 6]},
      {"Taxon": "Italian", "Segments": [-1, 7, -1, 6]},
      {"Taxon": "PortugueseBrazil", "Segments": [-1, 0, -1, 8]},
      {"Taxon": "Portuguese", "Segments": [-1, 0, -1, 8]},
      {"Taxon": "Catalan", "Segments": [-1, 3, -1, 9]},
      {"Taxon": "Walloon", "Segments": [-1, 10, -1, 11]},
      {"Taxon": "Friulian", "Segments": [-1, 12, -1, 6]},
      {"Taxon": "Romanian", "Segments": [12, 0, -1, 8]}
    ]},
    {"Name": "Who", "Data": [
      {"Taxon": "Latin", "Segments": [13, -1, 7, 14]},
      {"Taxon": "French", "Segments": [15, -1, 7, -1]},
      {"Taxon": "Italian", "Segments": [15, -1, 7, -1]},
      {"Taxon": "Catalan", "Segments": [15, -1, 7, -1]},
      {"Taxon": "Walloon", "Segments": [15, -1, 16, -1]},
      {"Taxon": "Friulian", "Segments": [15, 8, 7, -1]}
    ]},
    {"Name": "Who", "Data": [
      {"Taxon": "Latin", "Segments": [13, -1, 0, 17, -1]},
      {"Taxon": "Spanish", "Segments": [15, 12, 0, 18, -1]},
      {"Taxon": "PortugueseBrazil", "Segments": [15, -1, 19, -1, -1]},
      {"Taxon": "Portuguese", "Segments": [15, -1, 20, -1, -1]},
      {"Taxon": "Romanian", "Segments": [21, -1, 7, 18, 0]}
    ]},
    {"Name": "What", "Data": [
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      {"Taxon": "French", "Segments": [15, 8, 23, -1]},
      {"Taxon": "Spanish", "Segments": [15, -1, 0, -1]},
      {"Taxon": "Italian", "Segments": [15, -1, 0, -1]},
      {"Taxon": "PortugueseBrazil", "Segments": [15, -1, 7, -1]},
      {"Taxon": "Portuguese", "Segments": [15, -1, 24, -1]},
      {"Taxon": "Catalan", "Segments": [15, -1, 25, -1]},
      {"Taxon": "Walloon", "Segments": [15, 8, 26, -1]},
      {"Taxon": "Friulian", "Segments": [27, -1, 0, -1]},
      {"Taxon": "Romanian", "Segments": [27, -1, 0, -1]}
    ]}
  ],
}
```

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```
{
  "Name": "When", "Data": [
    {"Taxon": "Latin", "Segments": [13, -1, 23, 18, 22, 2]},
    {"Taxon": "French", "Segments": [15, -1, 28, -1, -1, -1]},
    {"Taxon": "Spanish", "Segments": [15, 8, 23, 18, 22, 6]},
    {"Taxon": "Italian", "Segments": [15, 8, 23, 18, 22, 6]},
    {"Taxon": "PortugueseBrazil", "Segments": [15, 8, 29, -1, 22, 30]},
    {"Taxon": "Portuguese", "Segments": [15, 8, 29, -1, 22, 30]},
    {"Taxon": "Catalan", "Segments": [15, 8, 23, 18, -1, -1]},
    {"Taxon": "Walloon", "Segments": [15, 8, 23, 18, 22, -1]},
    {"Taxon": "Friulian", "Segments": [15, 8, 23, 18, 31, -1]},
    {"Taxon": "Romanian", "Segments": [15, -1, 24, 18, 22, -1]}
  ],
  "Name": "How", "Data": [
    {"Taxon": "Latin", "Segments": [13, 2, 17, 6, 22, 6]},
    {"Taxon": "French", "Segments": [15, 9, 17, -1, -1, -1]},
    {"Taxon": "Spanish", "Segments": [15, 6, 17, 6, -1, -1]},
    {"Taxon": "Italian", "Segments": [15, 6, 17, 0, -1, -1]},
    {"Taxon": "PortugueseBrazil", "Segments": [15, 6, 17, 30, -1, -1]},
    {"Taxon": "Portuguese", "Segments": [15, 6, 17, 30, -1, -1]},
    {"Taxon": "Catalan", "Segments": [15, 9, 17, -1, -1, -1]},
    {"Taxon": "Walloon", "Segments": [15, 9, 17, 32, -1, -1]},
    {"Taxon": "Friulian", "Segments": [21, 0, 17, 33, 31, -1]},
    {"Taxon": "Romanian", "Segments": [15, 30, 17, -1, -1, -1]}
  ],
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    {"Taxon": "Latin", "Segments": [33, 18, 30, 17]},
    {"Taxon": "French", "Segments": [34, -1, -1, -1]},
    {"Taxon": "Spanish", "Segments": [30, 18, 6, -1]},
    {"Taxon": "Italian", "Segments": [30, 18, 6, -1]},
    {"Taxon": "PortugueseBrazil", "Segments": [35, -1, -1, -1]},
    {"Taxon": "Portuguese", "Segments": [35, -1, -1, -1]},
    {"Taxon": "Catalan", "Segments": [30, 18, -1, -1]},
    {"Taxon": "Walloon", "Segments": [36, -1, -1, -1]},
    {"Taxon": "Friulian", "Segments": [30, 37, -1, -1]},
    {"Taxon": "Romanian", "Segments": [30, 18, 30, -1]}
  ],
  "Name": "Two", "Data": [
    {"Taxon": "Latin", "Segments": [22, 30, 2, 14]},
    {"Taxon": "French", "Segments": [22, -1, 38, -1]},
    {"Taxon": "Spanish", "Segments": [22, -1, 6, 14]},
    {"Taxon": "PortugueseBrazil", "Segments": [22, -1, 39, 14]},
    {"Taxon": "Portuguese", "Segments": [22, -1, 39, 40]},
    {"Taxon": "Catalan", "Segments": [22, -1, 6, 14]},
    {"Taxon": "Walloon", "Segments": [22, -1, 41, -1]},
    {"Taxon": "Friulian", "Segments": [22, -1, 39, -1]},
    {"Taxon": "Romanian", "Segments": [22, -1, 39, -1]}
  ],
  "Name": "Two", "Data": [
    {"Taxon": "Latin", "Segments": [22, 30, -1, 42]},
    {"Taxon": "Italian", "Segments": [22, 30, -1, 0]},
    {"Taxon": "Romanian", "Segments": [22, 6, 8, 4]}
  ]
}
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```
  ]},
  {"Name": "Two", "Data": [
    {"Taxon": "Latin", "Segments": [22, 30, 23, 14]},
    {"Taxon": "PortugueseBrazil", "Segments": [22, 30, 43, 14]},
    {"Taxon": "Portuguese", "Segments": [22, 30, 43, 40]}
  ]},
  {"Name": "Three", "Data": [
    {"Taxon": "Latin", "Segments": [31, 44, -1, 45, 14]},
    {"Taxon": "French", "Segments": [31, 46, 8, 47, -1]},
    {"Taxon": "Spanish", "Segments": [31, 48, -1, 0, 14]},
    {"Taxon": "Italian", "Segments": [31, 44, -1, 0, -1]},
    {"Taxon": "PortugueseBrazil", "Segments": [31, 48, -1, 0, 14]},
    {"Taxon": "Portuguese", "Segments": [31, 48, -1, 0, 40]},
    {"Taxon": "Catalan", "Segments": [31, 44, -1, 25, 14]},
    {"Taxon": "Walloon", "Segments": [31, 44, -1, 41, -1]},
    {"Taxon": "Friulian", "Segments": [31, 44, -1, 45, -1]},
    {"Taxon": "Romanian", "Segments": [31, 44, -1, 49, -1]}
  ]},
  {"Name": "Five", "Data": [
    {"Taxon": "Latin", "Segments": [13, 16, 18, 13, -1, 0]},
    {"Taxon": "French", "Segments": [14, 50, -1, 15, -1, -1]},
    {"Taxon": "Spanish", "Segments": [51, 7, 18, 15, -1, 6]},
    {"Taxon": "Italian", "Segments": [27, 7, 37, 15, 8, 0]},
    {"Taxon": "PortugueseBrazil", "Segments": [14, 52, -1, 15, -1, 30]},
    {"Taxon": "Portuguese", "Segments": [14, 52, -1, 15, -1, 30]},
    {"Taxon": "Catalan", "Segments": [14, 7, 37, 15, -1, -1]},
    {"Taxon": "Walloon", "Segments": [14, 50, -1, 15, -1, -1]},
    {"Taxon": "Friulian", "Segments": [27, 7, 37, 15, -1, -1]},
    {"Taxon": "Romanian", "Segments": [27, 7, 18, 27, -1, -1]}
  ]},
  {"Name": "Big", "Data": [
    {"Taxon": "Latin", "Segments": [17, 23, 53, 18, 30, 17]},
    {"Taxon": "Spanish", "Segments": [17, 23, -1, 54, 6, -1]},
    {"Taxon": "Italian", "Segments": [17, 23, 54, 54, 6, -1]}
  ]},
  {"Name": "Big", "Data": [
    {"Taxon": "Latin", "Segments": [53, 44, 23, 18, 22, 0, 17]},
    {"Taxon": "French", "Segments": [1, 46, 28, -1, -1, -1, -1]},
    {"Taxon": "Spanish", "Segments": [1, 48, 23, 18, 22, 0, -1]},
    {"Taxon": "Italian", "Segments": [1, 44, 23, 18, 22, 0, -1]},
    {"Taxon": "PortugueseBrazil", "Segments": [1, 48, 29, -1, 10, 7, -1]},
    {"Taxon": "Portuguese", "Segments": [1, 48, 29, -1, 22, 24, -1]},
    {"Taxon": "Catalan", "Segments": [53, 44, 23, 18, -1, -1, -1]},
    {"Taxon": "Walloon", "Segments": [53, 46, 28, -1, -1, -1, -1]},
    {"Taxon": "Friulian", "Segments": [53, 44, 23, 18, 31, -1, -1]}
  ]},
  {"Name": "Big", "Data": [
    {"Taxon": "Latin", "Segments": [17, 42, 12, 6, 44, 0, 17, -1]},
    {"Taxon": "Romanian", "Segments": [17, 23, -1, -1, -1, 48, 0, -1]}
  ]},
  {"Name": "Long", "Data": [
```

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```
{
  "Taxon": "Latin", "Segments": [55, 6, -1, 18, 1, 30, 17]},
  {"Taxon": "French", "Segments": [55, 56, -1, -1, -1, -1, -1]},
  {"Taxon": "Spanish", "Segments": [55, 6, -1, 18, 53, 6, -1]},
  {"Taxon": "Italian", "Segments": [55, 30, -1, 18, 1, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [55, 36, -1, 1, 30, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [55, 36, -1, 1, 30, -1, -1]},
  {"Taxon": "Catalan", "Segments": [57, 6, -1, 37, -1, -1, -1]},
  {"Taxon": "Walloon", "Segments": [55, 36, -1, -1, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [55, 30, 18, 15, -1, -1, -1]},
  {"Taxon": "Romanian", "Segments": [55, 30, 18, 53, -1, -1, -1]}
}],
{"Name": "Long", "Data": [
  {"Taxon": "Latin", "Segments": [55, 23, 44, 53, 30, 17]},
  {"Taxon": "French", "Segments": [55, 23, 46, 3, -1, -1]},
  {"Taxon": "Spanish", "Segments": [55, 23, 48, 58, 6, -1]},
  {"Taxon": "Italian", "Segments": [55, 23, 44, 1, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [55, 23, 46, 1, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [55, 23, 48, 1, 30, -1]},
  {"Taxon": "Catalan", "Segments": [57, 23, 48, 15, -1, -1]},
  {"Taxon": "Friulian", "Segments": [55, 23, 44, 15, -1, -1]},
  {"Taxon": "Romanian", "Segments": [55, 23, 44, 53, -1, -1]}
]},
{"Name": "Wide", "Data": [
  {"Taxon": "Latin", "Segments": [55, 59, 31, 30, 17]},
  {"Taxon": "French", "Segments": [55, 0, -1, -1, -1]},
  {"Taxon": "Spanish", "Segments": [55, 23, 31, 6, -1]},
  {"Taxon": "Italian", "Segments": [55, 23, 31, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [55, 23, 31, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [55, 23, 31, 30, -1]},
  {"Taxon": "Romanian", "Segments": [55, 23, 31, -1, -1]}
]},
{"Name": "Wide", "Data": [
  {"Taxon": "Latin", "Segments": [23, 17, 60, 55, 30, 17]},
  {"Taxon": "French", "Segments": [61, -1, 60, 55, -1, -1]},
  {"Taxon": "Spanish", "Segments": [23, 18, 27, -1, 6, -1]},
  {"Taxon": "Italian", "Segments": [23, 17, 60, 12, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [29, -1, 40, -1, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [29, -1, 40, -1, 30, -1]},
  {"Taxon": "Catalan", "Segments": [23, 17, 60, 55, 4, -1]}
]},
{"Name": "Fish", "Data": [
  {"Taxon": "Latin", "Segments": [60, 7, 14, 15, 0, 17]},
  {"Taxon": "Spanish", "Segments": [60, 0, 51, -1, -1, -1]},
  {"Taxon": "Italian", "Segments": [60, 0, 40, 40, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [60, 49, 40, -1, 7, -1]},
  {"Taxon": "Portuguese", "Segments": [60, 62, 40, -1, 24, -1]},
  {"Taxon": "Catalan", "Segments": [60, 0, 40, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [60, 25, 14, -1, -1, -1]},
  {"Taxon": "Romanian", "Segments": [60, 0, 40, 31, 0, -1]}
]},
{"Name": "Fish", "Data": [
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```
{
  "Taxon": "French", "Segments": [60, 8, 23, 14, 36]},
  "Taxon": "Walloon", "Segments": [60, -1, 25, 63, 36]}
}],
{"Name": "Bird", "Data": [
  {"Taxon": "Latin", "Segments": [23, 8, 0, 17]},
  {"Taxon": "Spanish", "Segments": [23, 64, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [23, 65, 7, -1]},
  {"Taxon": "Portuguese", "Segments": [23, 65, 24, -1]},
  {"Taxon": "Catalan", "Segments": [23, 8, -1, -1]}
]},
{"Name": "Bird", "Data": [
  {"Taxon": "Latin", "Segments": [-1, 23, 8, 7, -1, 15, -1, 0, 55, 55, 30, 17]},
  {"Taxon": "French", "Segments": [8, 23, -1, -1, -1, 66, -1, 6, -1, -1, -1, -1]},
  {"Taxon": "Italian", "Segments": [-1, -1, 30, -1, 31, 27, -1, 25, 55, 55, 6, -1]},
  {"Taxon": "Catalan", "Segments": [-1, -1, 30, -1, -1, 14, -1, 0, -1, 57, -1, -1]},
  {"Taxon": "Walloon", "Segments": [-1, -1, 33, -1, -1, 63, -1, 26, -1, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [-1, -1, 30, -1, -1, 27, 12, 25, -1, 55, -1, -1]}
]},
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  {"Taxon": "Spanish", "Segments": [60, 23, -1, 67, 23, 48, 6, -1]},
  {"Taxon": "Italian", "Segments": [60, 23, 14, 14, 0, 44, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [60, 23, -1, 14, 43, 48, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [60, 23, -1, 14, 43, 48, 30, -1]},
  {"Taxon": "Romanian", "Segments": [60, 23, -1, 14, 4, 48, 0, -1]}
]},
{"Name": "ToDrink", "Data": [
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  {"Taxon": "French", "Segments": [64, -1, -1, 8, 47, 46, -1]},
  {"Taxon": "Spanish", "Segments": [64, 0, 64, -1, 0, 48, -1]},
  {"Taxon": "Italian", "Segments": [64, 0, -1, -1, -1, 48, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [64, 0, 64, -1, 0, 46, -1]},
  {"Taxon": "Portuguese", "Segments": [64, 24, 68, -1, 0, 48, -1]},
  {"Taxon": "Catalan", "Segments": [64, 25, 8, -1, -1, 48, 4]},
  {"Taxon": "Walloon", "Segments": [64, -1, -1, -1, 41, 46, -1]},
  {"Taxon": "Friulian", "Segments": [64, 0, 65, 7, -1, -1, -1]},
  {"Taxon": "Romanian", "Segments": [64, -1, -1, -1, 69, -1, -1]}
]},
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  {"Taxon": "Latin", "Segments": [15, 6, 17, 0, 22, 0, 44, 0]},
  {"Taxon": "Spanish", "Segments": [15, 6, 17, 0, -1, -1, 48, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [15, 6, 17, 0, -1, -1, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [15, 30, 17, -1, -1, 0, 48, -1]}
]},
{"Name": "ToEat", "Data": [
  {"Taxon": "Latin", "Segments": [17, 23, 18, 22, 30, 15, 59, 44, 0]},
  {"Taxon": "French", "Segments": [17, 61, -1, 3, -1, -1, 0, -1, -1]},
  {"Taxon": "Spanish", "Segments": [17, 23, 18, 22, 30, 15, 23, 48, -1]},
  {"Taxon": "Italian", "Segments": [17, 23, 18, 10, -1, -1, 59, 48, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [17, 29, -1, 3, -1, -1, 23, 46, -1]},
  {"Taxon": "Portuguese", "Segments": [17, 29, -1, 3, -1, -1, 23, 48, -1]},
```



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```
{
  "Taxon": "Catalan", "Segments": [17, 4, 54, 3, -1, -1, 23, -1, -1]},
  {"Taxon": "Walloon", "Segments": [17, 23, 54, -1, -1, -1, 16, -1, -1]},
  {"Taxon": "Friulian", "Segments": [17, 23, 37, 70, -1, -1, 23, -1, -1]},
  {"Taxon": "Romanian", "Segments": [17, 24, 18, -1, -1, 15, 23, -1, -1]}
]},
{"Name": "ToBite", "Data": [
  {"Taxon": "Latin", "Segments": [17, 6, 44, 22, 45, 44, 0]},
  {"Taxon": "French", "Segments": [17, 6, 46, 22, -1, 46, -1]},
  {"Taxon": "Spanish", "Segments": [17, 6, 48, 71, 0, 48, -1]},
  {"Taxon": "Italian", "Segments": [17, 9, 44, 22, 0, 44, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [17, 6, 46, 22, 0, 46, -1]},
  {"Taxon": "Portuguese", "Segments": [17, 30, 48, 71, 0, 48, -1]}
]},
{"Name": "ToBite", "Data": [
  {"Taxon": "Latin", "Segments": [17, 6, 44, 14, 7, 15, 59, 44, 0]},
  {"Taxon": "Spanish", "Segments": [17, 6, -1, 14, -1, 15, 23, 48, -1]},
  {"Taxon": "Italian", "Segments": [17, 6, 44, 14, 7, 15, 23, 48, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [17, 30, -1, 14, 4, 1, 23, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [17, 30, -1, 14, 4, 1, 23, 44, -1]},
  {"Taxon": "Catalan", "Segments": [17, 30, -1, 14, 4, 58, 23, -1, -1]},
  {"Taxon": "Romanian", "Segments": [17, 30, 44, 14, 0, 15, 23, -1, -1]}
]},
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]},
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  {"Taxon": "PortugueseBrazil", "Segments": [15, 30, -1, 14, 60, 7, 46, -1, -1]},
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]},
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}],
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  {"Taxon": "Walloon", "Segments": [15, 7, -1, 18, 9, 63, -1, -1, -1, -1]},
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  {"Taxon": "Italian", "Segments": [15, -1, 6, 10, 7, 31, 59, 44, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [15, -1, 30, 3, 7, 31, 23, 46, -1]},
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  {"Taxon": "Portuguese", "Segments": [60, 50, -1, 14, 23, 48, -1]},
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  {"Taxon": "Walloon", "Segments": [60, 32, -1, 14, 0, -1, -1]},
  {"Taxon": "Friulian", "Segments": [60, 0, 37, 14, 59, -1, -1]},
  {"Taxon": "Romanian", "Segments": [60, 4, -1, 14, 23, -1, -1]}
}],
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  {"Taxon": "Italian", "Segments": [31, 0, 17, 45, 44, 0]},
```

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```
{
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  "Taxon": "Portuguese", "Segments": [31, 24, 17, 0, 48, -1]},
  "Taxon": "Catalan", "Segments": [31, 0, 17, 4, -1, -1]},
  "Taxon": "Friulian", "Segments": [31, 0, 17, 7, -1, -1]},
  "Taxon": "Romanian", "Segments": [31, 0, 17, 0, -1, -1]}
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  {"Taxon": "Italian", "Segments": [31, 44, 0, 17, -1, 59, 44, 0]},
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  {"Taxon": "Portuguese", "Segments": [31, 48, 24, 17, -1, 0, 48, -1]},
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  {"Taxon": "Spanish", "Segments": [22, -1, 6, 48, 17, 7, 48, -1]},
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  {"Taxon": "Portuguese", "Segments": [22, -1, 30, 48, 17, 7, 48, -1]},
  {"Taxon": "Catalan", "Segments": [22, -1, 30, 44, 17, 7, -1, -1]},
  {"Taxon": "Walloon", "Segments": [22, 8, 23, 46, 17, 7, -1, -1]},
  {"Taxon": "Friulian", "Segments": [22, -1, 30, 44, 17, 16, -1, -1]},
  {"Taxon": "Romanian", "Segments": [22, -1, 6, 44, 17, 7, -1, -1]}
]},
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  {"Taxon": "Portuguese", "Segments": [65, 7, 65, 0, 48, -1]},
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  {"Taxon": "Friulian", "Segments": [65, 7, 65, 7, -1, -1]},
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  {"Taxon": "Spanish", "Segments": [17, 6, 48, 7, 48, -1]},
  {"Taxon": "Italian", "Segments": [17, 6, 44, 16, 44, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [17, 6, 46, 0, 46, -1]},
  {"Taxon": "Portuguese", "Segments": [17, 30, 46, 0, 48, -1]},
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  {"Taxon": "Walloon", "Segments": [17, 9, 73, 7, -1, -1]},
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  {"Taxon": "Romanian", "Segments": [17, 30, 44, 7, -1, -1]}
]},
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```

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  {"Taxon": "Italian", "Segments": [18, 8, 6, 31, 59, 48, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [18, -1, 23, 22, 23, 46, -1]},
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  {"Taxon": "Friulian", "Segments": [18, -1, 23, 22, 23, -1, -1]}
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  {"Taxon": "Spanish", "Segments": [18, 23, 64, 0, 1, 23, 48, -1]},
  {"Taxon": "Italian", "Segments": [18, 23, 65, 7, 1, 23, 44, 0]},
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  {"Taxon": "Portuguese", "Segments": [18, 43, 65, 24, 58, 23, 48, -1]},
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  {"Taxon": "Walloon", "Segments": [18, 25, -1, -1, 10, 16, -1, -1]},
  {"Taxon": "Friulian", "Segments": [18, 23, 65, 7, 53, 23, -1, -1]},
  {"Taxon": "Romanian", "Segments": [18, 23, 65, 7, 1, 23, -1, -1]}
]},
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  {"Taxon": "Italian", "Segments": [65, 6, 55, 59, 48, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [65, 6, -1, 23, 46, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [65, 8, -1, 23, 48, -1, -1]},
  {"Taxon": "Catalan", "Segments": [64, 30, 55, 23, -1, -1, -1]},
  {"Taxon": "Walloon", "Segments": [65, 9, 55, 0, -1, -1, -1]},
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  {"Taxon": "Italian", "Segments": [65, 0, 18, 16, 48, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [65, -1, -1, 7, 46, -1]},
  {"Taxon": "Portuguese", "Segments": [65, -1, -1, 7, 48, -1]},
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  {"Taxon": "Walloon", "Segments": [65, 7, 18, 7, -1, -1]},
  {"Taxon": "Friulian", "Segments": [65, 7, 54, 16, -1, -1]},
  {"Taxon": "Romanian", "Segments": [65, 0, 18, 7, -1, -1]}
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```

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  {"Taxon": "Catalan", "Segments": [15, -1, 23, 8, -1, 44, 4]},
  {"Taxon": "Walloon", "Segments": [27, -1, 26, -1, -1, 73, -1]},
  {"Taxon": "Friulian", "Segments": [27, 12, 23, 22, 0, -1, -1]},
  {"Taxon": "Romanian", "Segments": [15, 4, 22, 69, -1, -1, -1]}
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  {"Taxon": "Portuguese", "Segments": [31, 36, -1, 64, 23, 48]},
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  {"Taxon": "Walloon", "Segments": [31, 30, 17, -1, 0, -1]},
  {"Taxon": "Romanian", "Segments": [31, 30, 17, 64, 23, -1]}
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  {"Taxon": "Spanish", "Segments": [15, 23, 18, 31, 23, 48, -1]},
  {"Taxon": "Italian", "Segments": [15, 23, 18, 31, 59, 44, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [15, 29, -1, 31, 23, 48, -1]},
  {"Taxon": "Portuguese", "Segments": [15, 29, -1, 31, 23, 48, -1]},
  {"Taxon": "Catalan", "Segments": [15, 4, 18, 31, 23, -1, -1]},
  {"Taxon": "Walloon", "Segments": [27, 28, -1, 31, 0, -1, -1]},
  {"Taxon": "Friulian", "Segments": [76, 23, 18, 31, 59, -1, -1]},
  {"Taxon": "Romanian", "Segments": [15, 24, 18, 31, 23, -1, -1]}
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  {"Taxon": "Spanish", "Segments": [55, 30, 22, 7, 48, -1]}
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  {"Taxon": "Portuguese", "Segments": [3, 30, -1, 58, 23, 48, -1]},
  {"Taxon": "Catalan", "Segments": [3, 30, -1, 1, 23, -1, -1]},
  {"Taxon": "Walloon", "Segments": [10, 30, 8, -1, 0, -1, -1]},
  {"Taxon": "Friulian", "Segments": [10, 30, 12, -1, 23, -1, -1]},
  {"Taxon": "Romanian", "Segments": [3, 30, -1, 15, 23, -1, -1]}
]},
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  {"Taxon": "Spanish", "Segments": [-1, 0, 55, 23, 48, -1, -1]},
```

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```
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  {"Taxon": "Portuguese", "Segments": [3, 24, 55, 23, 48, -1, -1]},
  {"Taxon": "Catalan", "Segments": [3, 4, 55, 23, -1, -1, -1]},
  {"Taxon": "Walloon", "Segments": [10, 23, 55, 0, -1, -1, -1]}
]},
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  {"Taxon": "Italian", "Segments": [1, 12, 23, 31, 27, 12, 23, 44, 0]},
  {"Taxon": "Catalan", "Segments": [1, 55, 4, -1, 14, -1, 23, -1, -1]},
  {"Taxon": "Friulian", "Segments": [53, 55, 23, -1, 27, -1, 23, -1, -1]}
]},
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  {"Taxon": "Romanian", "Segments": [24, 18, 53, -1, 0, 77, -1, 23, -1, -1]}
]},
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  {"Taxon": "Spanish", "Segments": [14, 6, 55, -1, -1]},
  {"Taxon": "Italian", "Segments": [14, 6, 55, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [14, 9, 8, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [14, 9, 78, -1, -1]},
  {"Taxon": "Catalan", "Segments": [14, 9, 55, -1, -1]},
  {"Taxon": "Walloon", "Segments": [14, 9, 55, 9, -1]},
  {"Taxon": "Romanian", "Segments": [14, 74, 48, 0, -1]}
]},
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  {"Taxon": "French", "Segments": [14, 9, 55, 79, -1, -1, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [14, 6, 44, 0, -1, -1, 55, 7, -1]}
]},
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  {"Taxon": "French", "Segments": [55, 72, 18, -1]},
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  {"Taxon": "Italian", "Segments": [55, 30, 18, 23]},
  {"Taxon": "PortugueseBrazil", "Segments": [55, 30, -1, 43]},
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  {"Taxon": "Catalan", "Segments": [57, 30, 18, 4]},
  {"Taxon": "Walloon", "Segments": [55, 38, 18, -1]},
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  {"Taxon": "Romanian", "Segments": [55, 30, 18, 4]}
]},
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  {"Taxon": "Spanish", "Segments": [0, 14, 31, 48, 0, -1, 5, 23]},
  {"Taxon": "Italian", "Segments": [-1, 14, 31, -1, 0, 55, 55, 23]},
  {"Taxon": "PortugueseBrazil", "Segments": [7, 14, 31, 48, 0, -1, 55, 43]},
  {"Taxon": "Portuguese", "Segments": [24, 40, 31, 48, 0, -1, 55, 43]},
```

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```
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  {"Taxon": "Walloon", "Segments": [-1, 14, 31, -1, 41, -1, 55, -1]},
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  {"Taxon": "Romanian", "Segments": [-1, 14, 31, -1, 69, -1, -1, -1]}
]},
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  {"Taxon": "Portuguese", "Segments": [23, -1, 1, 8, 43]},
  {"Taxon": "Catalan", "Segments": [42, -1, 58, 8, 4]},
  {"Taxon": "Walloon", "Segments": [26, -1, -1, 8, -1]},
  {"Taxon": "Friulian", "Segments": [23, -1, 53, -1, 0]},
  {"Taxon": "Romanian", "Segments": [23, -1, 60, -1, 4]}
]},
{"Name": "Rain", "Data": [
  {"Taxon": "Latin", "Segments": [60, 55, 30, -1, 8, 7, 23]},
  {"Taxon": "French", "Segments": [60, 55, 75, -1, -1, 7, -1]},
  {"Taxon": "Spanish", "Segments": [5, -1, 30, -1, 64, 12, 23]},
  {"Taxon": "Italian", "Segments": [60, 12, 6, 22, 10, -1, 23]},
  {"Taxon": "PortugueseBrazil", "Segments": [40, -1, 30, -1, 65, -1, 43]},
  {"Taxon": "Portuguese", "Segments": [40, -1, 30, -1, 65, -1, 43]},
  {"Taxon": "Catalan", "Segments": [60, 55, 30, -1, 3, -1, 4]},
  {"Taxon": "Walloon", "Segments": [60, 55, 33, -1, 46, -1, -1]},
  {"Taxon": "Friulian", "Segments": [60, 55, 6, -1, -1, 12, 0]},
  {"Taxon": "Romanian", "Segments": [60, 55, 74, -1, -1, 12, 0]}
]},
{"Name": "Lake", "Data": [
  {"Taxon": "Latin", "Segments": [55, 23, 15, 30, 17]},
  {"Taxon": "French", "Segments": [55, 23, 15, -1, -1]},
  {"Taxon": "Spanish", "Segments": [55, 23, 53, 6, -1]},
  {"Taxon": "Italian", "Segments": [55, 23, 1, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [55, 23, 1, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [55, 23, 58, 30, -1]},
  {"Taxon": "Catalan", "Segments": [57, 23, 15, -1, -1]},
  {"Taxon": "Walloon", "Segments": [55, 23, 15, -1, -1]},
  {"Taxon": "Friulian", "Segments": [55, 59, 31, -1, -1]},
  {"Taxon": "Romanian", "Segments": [55, 23, 15, -1, -1]}
]},
{"Name": "Sea", "Data": [
  {"Taxon": "Latin", "Segments": [17, 23, 44, 0]},
  {"Taxon": "French", "Segments": [17, 25, 46, -1]},
  {"Taxon": "Spanish", "Segments": [17, 23, 48, -1]},
  {"Taxon": "Italian", "Segments": [17, 23, 44, 0]},
  {"Taxon": "PortugueseBrazil", "Segments": [17, 23, 46, -1]},
  {"Taxon": "Portuguese", "Segments": [17, 23, 48, -1]},
  {"Taxon": "Catalan", "Segments": [17, 23, 44, -1]},
  {"Taxon": "Walloon", "Segments": [17, 0, 46, -1]},
  {"Taxon": "Friulian", "Segments": [17, 59, 44, -1]},
```



## Appendix 3 - TKF Configuration

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```
{
  "Taxon": "Romanian", "Segments": [17, 23, 44, 0]}
}},
{"Name": "Salt", "Data": [
  {"Taxon": "Latin", "Segments": [14, 59, 55, 0, 17]},
  {"Taxon": "French", "Segments": [14, 25, 55, -1, -1]},
  {"Taxon": "Spanish", "Segments": [14, 23, 55, -1, -1]},
  {"Taxon": "Italian", "Segments": [14, 23, 55, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [14, 23, 8, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [14, 23, 55, -1, -1]},
  {"Taxon": "Catalan", "Segments": [14, 23, 55, -1, -1]},
  {"Taxon": "Walloon", "Segments": [14, 0, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [14, 59, 55, -1, -1]},
  {"Taxon": "Romanian", "Segments": [14, 23, 44, 0, -1]}
]},
{"Name": "Earth", "Data": [
  {"Taxon": "Latin", "Segments": [31, -1, 0, 44, 44, 23]},
  {"Taxon": "French", "Segments": [31, -1, 0, -1, 46, -1]},
  {"Taxon": "Spanish", "Segments": [31, 12, 0, -1, 44, 23]},
  {"Taxon": "Italian", "Segments": [31, -1, 25, 44, 44, 23]},
  {"Taxon": "PortugueseBrazil", "Segments": [31, -1, 0, -1, 46, 43]},
  {"Taxon": "Portuguese", "Segments": [31, -1, 25, -1, 46, 43]},
  {"Taxon": "Catalan", "Segments": [31, -1, 25, -1, 44, 4]},
  {"Taxon": "Walloon", "Segments": [31, -1, 26, -1, 46, -1]},
  {"Taxon": "Friulian", "Segments": [31, 12, 25, -1, 44, 0]},
  {"Taxon": "Romanian", "Segments": [77, -1, 23, -1, 44, 4]}
]},
{"Name": "Sky", "Data": [
  {"Taxon": "Latin", "Segments": [15, -1, 42, 55, 30, 17]},
  {"Taxon": "French", "Segments": [14, 12, 25, 55, -1, -1]},
  {"Taxon": "Spanish", "Segments": [51, 12, 0, 55, 6, -1]},
  {"Taxon": "Italian", "Segments": [27, -1, 25, 55, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [14, -1, 25, 8, -1, -1]},
  {"Taxon": "Portuguese", "Segments": [14, -1, 25, 8, -1, -1]},
  {"Taxon": "Catalan", "Segments": [14, -1, 25, 55, -1, -1]},
  {"Taxon": "Walloon", "Segments": [14, -1, 16, 46, -1, -1]},
  {"Taxon": "Friulian", "Segments": [27, -1, 16, 55, -1, -1]},
  {"Taxon": "Romanian", "Segments": [27, -1, 0, 48, -1, -1]}
]},
{"Name": "Wind", "Data": [
  {"Taxon": "Latin", "Segments": [8, -1, 0, 18, 31, 30, 17]},
  {"Taxon": "French", "Segments": [65, -1, 61, -1, -1, -1, -1]},
  {"Taxon": "Spanish", "Segments": [64, 12, 0, 18, 31, 6, -1]},
  {"Taxon": "Italian", "Segments": [65, -1, 25, 18, 31, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [65, -1, 50, -1, 31, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [65, -1, 50, -1, 31, 30, -1]},
  {"Taxon": "Catalan", "Segments": [64, -1, 0, 18, -1, -1, -1]},
  {"Taxon": "Walloon", "Segments": [65, -1, 50, -1, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [65, -1, 7, 18, 31, -1, -1]},
  {"Taxon": "Romanian", "Segments": [65, -1, 24, 18, 31, -1, -1]}
]},
{"Name": "Fire", "Data": [
```



## Appendix 3 - TKF Configuration

---

```
{
  "Taxon": "Latin", "Segments": [80, -1, 6, 15, 30, 17]},
  {"Taxon": "French", "Segments": [80, -1, 38, -1, -1, -1]},
  {"Taxon": "Spanish", "Segments": [80, 8, 0, 1, 6, -1]},
  {"Taxon": "Italian", "Segments": [80, 8, 9, 15, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [80, -1, 6, 1, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [80, -1, 6, 58, 30, -1]},
  {"Taxon": "Catalan", "Segments": [80, -1, 9, 15, -1, -1]},
  {"Taxon": "Walloon", "Segments": [80, -1, 41, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [80, -1, 33, 15, -1, -1]},
  {"Taxon": "Romanian", "Segments": [80, -1, 6, 15, -1, -1]}
}],
{"Name": "Green", "Data": [
  {"Taxon": "Latin", "Segments": [8, 7, 44, 7, 22, 0, 17]},
  {"Taxon": "French", "Segments": [65, 0, 46, -1, -1, -1, -1]},
  {"Taxon": "Spanish", "Segments": [64, 0, 48, -1, 22, 0, -1]},
  {"Taxon": "Italian", "Segments": [65, 0, 44, -1, 22, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [65, 0, 48, -1, 22, 24, -1]},
  {"Taxon": "Portuguese", "Segments": [65, 0, 48, -1, 22, 24, -1]},
  {"Taxon": "Catalan", "Segments": [65, 25, 48, -1, 31, -1, -1]},
  {"Taxon": "Walloon", "Segments": [65, 25, 46, -1, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [65, 25, 44, -1, 31, -1, -1]},
  {"Taxon": "Romanian", "Segments": [65, 0, 48, -1, 22, 0, -1]}
]},
{"Name": "Year", "Data": [
  {"Taxon": "Latin", "Segments": [23, 18, 18, 30, 17]},
  {"Taxon": "French", "Segments": [61, -1, -1, -1, -1]},
  {"Taxon": "Spanish", "Segments": [23, -1, 54, 6, -1]},
  {"Taxon": "Italian", "Segments": [23, 18, 18, 6, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [43, -1, 18, 30, -1]},
  {"Taxon": "Portuguese", "Segments": [43, -1, 18, 30, -1]},
  {"Taxon": "Catalan", "Segments": [23, -1, 54, -1, -1]},
  {"Taxon": "Walloon", "Segments": [28, -1, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [23, -1, 37, -1, -1]},
  {"Taxon": "Romanian", "Segments": [23, 18, -1, -1, -1]}
]},
{"Name": "Name", "Data": [
  {"Taxon": "Latin", "Segments": [18, 2, 17, 0, 18]},
  {"Taxon": "French", "Segments": [18, 56, -1, -1, -1]},
  {"Taxon": "Italian", "Segments": [18, 2, 17, 0, -1]},
  {"Taxon": "PortugueseBrazil", "Segments": [18, 6, 17, 7, -1]},
  {"Taxon": "Portuguese", "Segments": [18, 6, 17, 24, -1]},
  {"Taxon": "Catalan", "Segments": [18, 9, 17, -1, -1]},
  {"Taxon": "Walloon", "Segments": [18, 36, -1, -1, -1]},
  {"Taxon": "Friulian", "Segments": [18, 9, 37, -1, -1]},
  {"Taxon": "Romanian", "Segments": [18, 30, 17, 0, -1]}
]},
{"Name": "Name", "Data": [
  {"Taxon": "Latin", "Segments": [18, 2, 17, 7, 18, -1, 0, 17]},
  {"Taxon": "Spanish", "Segments": [18, 6, 17, -1, 64, 48, 0, -1]}
]},
{"Name": "Tongue", "Data": [
```

## Appendix 3 - TKF Configuration

---

```
{
  "Taxon": "Latin", "Segments": [55, 7, 18, 81, -1, 23]},
  "Taxon": "French", "Segments": [55, 61, -1, 1, -1, -1]},
  "Taxon": "Spanish", "Segments": [55, 0, 37, 1, 8, 23]},
  "Taxon": "Italian", "Segments": [55, 7, 18, 1, 8, 23]},
  "Taxon": "PortugueseBrazil", "Segments": [55, 52, -1, 1, 8, 43]},
  "Taxon": "Portuguese", "Segments": [55, 52, -1, 1, 8, 43]},
  "Taxon": "Walloon", "Segments": [55, 82, -1, -1, -1, -1]},
  "Taxon": "Friulian", "Segments": [55, 25, 18, 53, -1, 25]},
  "Taxon": "Romanian", "Segments": [55, 7, 17, 64, -1, 4]}
}]
]
```

## Appendix 4 - Concepts Used

	I	Who-Qui	Who-Quem	What
Latin	- e g o:	k <sup>w</sup> - i s	k <sup>w</sup> - e m -	k <sup>w</sup> - i d
French	- ʒ - ə	k - i -		k w a -
Spanish	- j - o		k j e n -	k - e -
Italian	- i - o	k - i -		k - e -
Brazilian	- e - w		k - [ẽ] -	k - i -
Portuguese				
Portuguese	- e - w		k - [ẽj] -	k - i -
Catalan	- ʒ - ɔ	k - i -		k - ε -
Walloon	- dʒ - ɪ	k - i: -		k w ε: -
Friulian	- j - o	k w i -		tʃ - e -
Romanian	j e - w		tʃ - i n e	tʃ - e -
	When-Quando	How-Quomodo	One	Two-Duos
Latin	k <sup>w</sup> - a n d o:	k <sup>w</sup> o: m o d o	u: n u m	d u o: s
French	k - â - -	k ɔ m - -	œ - - -	d - ø -
Spanish	k w a n d o	k o m o - -	u n o -	d - o s
Italian	k w a n d o	k o m e - -	u n o -	
Brazilian	k w ẽ - d u	k o m u - -	ũ - - -	d - o j s
Portuguese				
Portuguese	k w ẽ - d u	k o m u - -	ũ - - -	d - o j ʃ
Catalan	k w a n	k ɔ m - -	u n - -	d - o s
Walloon	k w a n d	k ɔ m ẽ - -	õ - - -	d - ø: -
Friulian	k w a n t	tʃ e m u: t -	u ŋ - -	d - o j -
Romanian	k - i n d	k u m - - -	u n u -	d - o j -
	Two-Duae	Two-Duas	Three	Five
Latin	d u - aj	d u a s	t r - e: s	k <sup>w</sup> i: n k <sup>w</sup> - e
French			t ʁ w a -	s ẽ - k - -
Spanish			t r - e s	θ i n k - o
Italian	d u - e		t r - e -	tʃ i ŋ k w e
Brazilian		d u e s	t r - e s	s ĩ - k - u
Portuguese				
Portuguese		d u e ʃ	t r - e ʃ	s ĩ - k - u
Catalan			t r - ε s	s i ŋ k - -
Walloon			t r - ø: -	s ẽ - k - -
Friulian			t r - e: -	tʃ i ŋ k - -
Romanian	d o w ə		t r - ej -	tʃ i n tʃ - -
	Big	Big-Grandem	Big-Majjorem	Long-Longum
Latin	m a g n u m	g r a n d e m	m a j j o r e m	l o - n g u m
French		g ʁ â - - -		l ɔ̃ - - - -
Spanish	m a - ɲ o -	g r a n d e -		l o - n g o -
Italian	m a ɲ ɲ o -	g r a n d e -		l u - n g o -
Brazilian		g r ẽ - dʒ i -		l õ - g u -
Portuguese				
Portuguese		g r ẽ - d i -		l õ - g u -
Catalan		g r a n - - -		Á o - ŋ - - -
Walloon		g ʁ â - - -		l õ - - - -
Friulian		g r a n t - - -		l u n k - - -
Romanian			m a - - - r e -	l u n g - - -

## Appendix 4 - Concepts Used

	Long-Largum	Wide	Wide-Amplum	Fish-Piskem
Latin	l a r g u m	l a : t u m	a m p l u m	p i s k e m
French	l a ʁ ʒ - -	l e - - -	ã - p l - -	
Spanish	l a r ʝ o -	l a t o -	a n ʃ - o -	p e θ - - -
Italian	l a r g o -	l a t o -	a m p j o -	p e ʃ ʃ e -
Brazilian	l a ʁ g u -	l a t u -	ẽ - ʃ - u -	p e j ʃ - i -
Portuguese				
Portuguese	l a r g u -	l a t u -	ẽ - ʃ - u -	p e j ʃ - i -
Catalan	ʎ a r k - -		a m p l ə -	p e ʃ - - -
Walloon				
Friulian	l a r k - -			p ε s - - -
Romanian	l a r g - -	l a t - -		p e ʃ t e -
	Fish-Pescion	Bird-Avem	Bird-Avicellum	Bird-Passerem
Latin		a w e m	- a w i - k - e l l u m	p a s s e r e m
French	p w a s õ		w a - - - z - o - - -	
Spanish		a b e -		p a - x a r o -
Italian			- - u - t ʃ - ε l l o	p a s s e r o -
Brazilian		a v i -		p a - s v e r u -
Portuguese				
Portuguese		a v i -		p a - s v e r u -
Catalan		a w - -	- - u - - s - e - ʎ - -	
Walloon	p - ε h õ		- - u: - - h - ε: - - -	
Friulian			- - u - - ʃ j ε - l - -	
Romanian				p a - s ə r e -
	ToDrink	ToEat	ToEat-Manducare	ToBite
Latin	b i b - e r e	k o m e d e r e	m a n d u k a: r e	m o r d e: r e
French	b - - w a ʁ -		m ã - ʒ - - e - -	m o ʁ d - ʁ -
Spanish	b e b - e r -	k o m e - - r -	m a n d u k a r -	m o r ð e r -
Italian	b e - - - r e		m a n d ʒ - - a: r e	m ɔ r d e r e
Brazilian	b e b - e ʁ -	k o m e - - -	m ẽ - ʒ - - a ʁ -	m o ʁ d e ʁ -
Portuguese				
Portuguese	b i β - e r -	k u m - - e r -	m ẽ - ʒ - - a r -	m u r ð e r -
Catalan	b ε w - - r ə		m ə ɲ ʒ - - a - -	
Walloon	b - - - ø: ʁ -		m a ɲ - - - i: - -	
Friulian	b e v i - -		m a ɲ j - - a - -	
Romanian	b - - - ɛa - -		m i n - - k a - -	
	ToBite-Morsicare	ToSuck	ToSpit	ToSpit-Exconspuere
Latin	m o r s i k a: r e	s u: g e r e	k o n s p u e r e	
French		s y s e - -	k õ - s p y e - -	
Spanish	m o - s - k a r -			e s k u - p i r
Italian	m o r s i k a r e			
Brazilian	m u - s ə g a - -	s u g a ʁ -	k u - s p i ʁ -	
Portuguese				
Portuguese	m u - s ə g a r -	s u g a r -	k u - ʃ p i r -	
Catalan	m u - s ə ɣ a - -			ə s k u - p i - -
Walloon		s y s i: - -		
Friulian				
Romanian	m u r s e k a - -	s u ɟ e - -		- s k u j p a

## Appendix 4 - Concepts Used

	ToSpit-Sputare	ToSpit-Cracher	ToKnow	ToKnow-Sapere
Latin	- s p u t e r e		s k i: r e	s a p - e r e
French		k ʁ a ʃ e		s a v w a ʁ -
Spanish	e s p u t a r -			s a b - e r -
Italian	- s p u t a: r e			s a p - e: r e
Brazilian				s a b - e ʁ -
Portuguese				
Portuguese				s ɐ b - e r -
Catalan				s ə β - ε - -
Walloon				s a v - ø: ʀ -
Friulian				s a v - e: - -
Romanian			ʃ t i - -	
	ToKnow-Cognoscere	ToThink	ToThink-Pensare	ToFear
Latin	k o g n o: s k e r e	k - o: g i t a: r e	p e: n s a: r e	t i m e: r e
French	k ɔ - n ε - t ʁ -	k ʏ - - i d e - -	p ã - s e - -	
Spanish	k o - n o θ e r -	k w - - i d a r -	p e n s a r -	t e m e r -
Italian	k o - n o ʃ ʃ e r e	k - o ɕ i t a: r e	p e n s a: r e	t e m e: r e
Brazilian	k o - ɲ e s - e ʁ -	k - u ʒ i t a ʁ -	p ê - s a ʁ -	t e m e ʁ -
Portuguese				
Portuguese	k u - ɲ i s - e r -	k - u ʒ i t a r -	p ê - s a r -	t i m e r -
Catalan	k u - n ε ʃ - ə - -	k - u - j d a - -	p ə n s a - -	t e m ə - -
Walloon	k i - n ɔ h - - -		p ê - s e - -	
Friulian	k o - ɲ o s - i - -		p e ɲ s a: - -	t e m i - -
Romanian	k u - n ɣ a ʃ t e - -	k - u ɕ e t a - -	p ə - s a - -	t e m e - -
	ToFear-Tremere	ToSleep	ToLive	ToDie
Latin	t r e m - e r e	d - o r m i: r e	w i: w e r e	m o r i: - -
French	k ʁ ê - d - ʁ -	d - ɔ ʁ m i ʁ -	v i v - ʁ -	m u ʁ i ʁ -
Spanish	t r e m - e r -	d - o r m i r -	b i b i r -	m o r i r -
Italian	t r e m - a: r e	d - o r m i: r e	v i: v e r e	m o r i: r e
Brazilian	t r e m - e ʁ -	d - o ʁ m i ʁ -	v i v e ʁ -	m o ʁ e ʁ -
Portuguese				
Portuguese	t r i m - e r -	d - u r m i r -	v i v e r -	m u ʁ e r -
Catalan		d - u r m i - -	b i w - r ə	m u r i - -
Walloon		d w a ʁ m i - -		m ɔ ʀ i - -
Friulian	t r i m - a: - -	d - u r m i: - -	v i v i - -	m u r i: - -
Romanian		d - o r m i - -	v i - a - -	m u r i - -
	ToSwim	ToSwim-Navigare	ToFly	ToFly-Exvolare
Latin	n - a t a: r e	n a v i g a: r e	w o l a: r e	
French		n a - - ʒ e - -	v o l e - -	
Spanish	n - a d a r -	n a b e g a r -	b o l a r -	
Italian	n w o t a: r e	n a v i g a r e	v o l a: r e	z v o l a: r e
Brazilian	n - a d a ʁ -	n a v i ɣ a ʁ -	v o - a ʁ -	
Portuguese				
Portuguese	n - ɐ ð a r -	n ɐ v i ɣ a r -	v w - a r -	
Catalan	n - ə d a - -	n ə b ə ɣ a - -	b u l a - -	
Walloon		n ε - - ɕ i: - -	v ɔ l e - -	
Friulian	n - a d a - -	n a v i g a - -	- - - - - -	z v o l a - -
Romanian		n a v i g a - -	- - - - - -	z b u r a - -

## Appendix 4 - Concepts Used

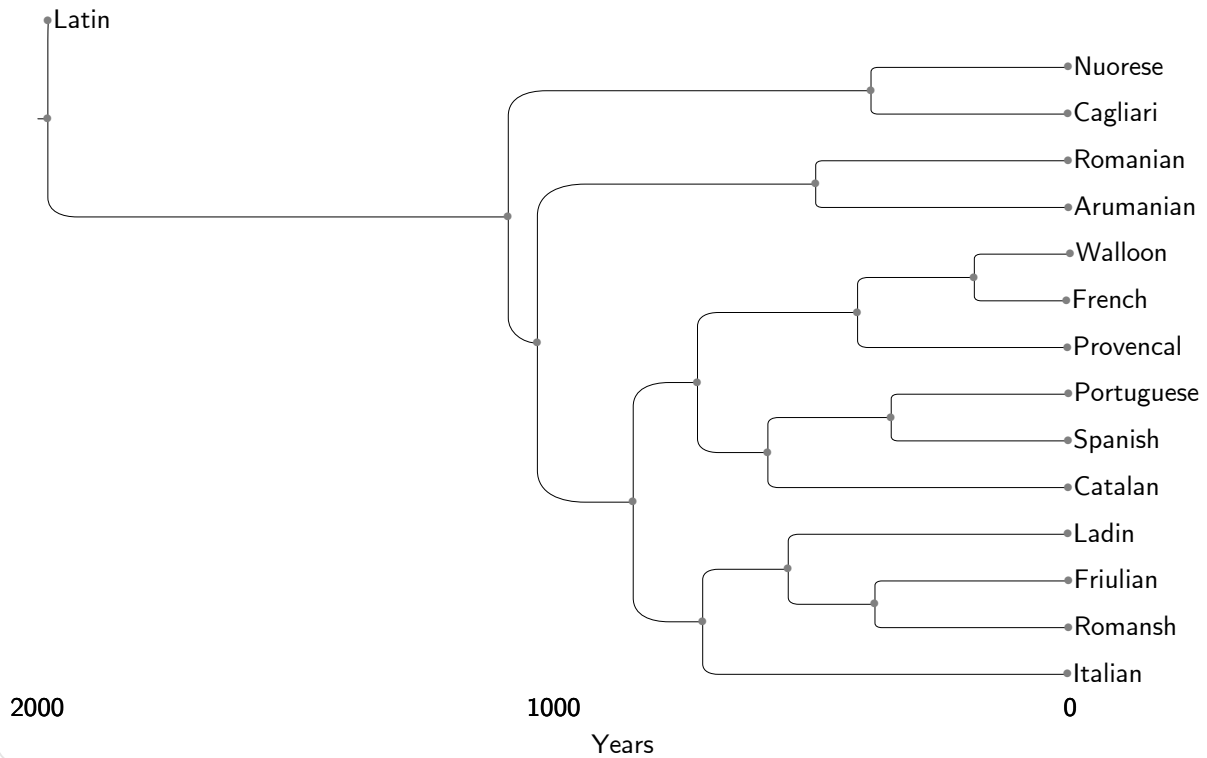
	ToCome	ToFall	ToFall-Tumbare	ToSing-AncestralClass
Latin	w e n i: r e	k - a d e r e		k a n t a: r e
French	v ə n i ʁ -	f w a - - ʁ -	t õ - b e -	f ã - t e - -
Spanish	b e n i r -	k - a - e r -	t u m b a r	k a n t a r -
Italian	v e n i: r e	k - a d e: r e		k a n t a: r e
Brazilian	v - - i ʁ -	k - ɐ - i r -	t õ - b a ʁ	k ẽ - t a r -
Portuguese				
Portuguese	v - - i r -	k - ɐ - i r -	t õ - b a r	k ẽ - t a r -
Catalan	b ə n i - -	k - a w - r ə	t u m b a -	k ə n t a - -
Walloon	v i n i - -	f j - ɛ: - - ʀ -	t u m - e -	f j ã - t e - -
Friulian	v i ɲ i: -	f j j a d e - -		c a n t a: - -
Romanian	v e n i - -	k ə d ɛ a - -	t u m b a -	k i n t a - -
	ToPlay-Ludere	ToPlay-Jiocare	ToFreeze	ToFreeze-Glaciare
Latin	l u: d e r e	j o - k a: r e	g e l a: r e	g l a - k i a: r e
French		ʒ - w - e - -	ʒ ə l e - -	g l a - s - e - -
Spanish	l u d i r -	x u - g a r -	- e l a r - -	
Italian		ʒ o - k a: r e	ʒ e l a r e	g j a t f j a r e
Brazilian		ʒ o - g a ʁ -	ʒ i l a r -	
Portuguese				
Portuguese		ʒ u - ɣ a r -	ʒ i l a r -	
Catalan		ʒ u - g a - -	ʒ ə l a - -	g l ə - s - a - -
Walloon		ʒ u w - e - -	ʒ a l e - -	
Friulian		ʒ u j - a - -		g l a - f j - a - -
Romanian		ʒ u - k a - -		
	ToFreeze-Inglaciare	Sun	Sun-Soliculus	Moon
Latin	i n g l a k i a: r e	s o: l e m	s o l i c u l u s	l u: n a
French			s ɔ l ɛ j - - - -	l y n -
Spanish		s o l - -		l u n a
Italian		s o l e -		l u n a
Brazilian		s ɔ w - -		l u - ɐ
Portuguese				
Portuguese		s ɔ l - -		l u - ɐ
Catalan		s ɔ l - -		ʎ u n ə
Walloon		s ɔ l ɔ -		l ø n -
Friulian			s o r e - - l i -	l u n e
Romanian	i n g - e t s - a - -	s ɔ a r e -		l u n ə
	Star	Water	Rain	Lake
Latin	- s t - e: l l a	a - k <sup>w</sup> - a	p l u - w i a	l a k u m
French	e - t w a - l -	o - - - -	p l ɥ - - i -	l a k - -
Spanish	e s t r e - j a	a - ɣ w a	j - u - b j a	l a g o -
Italian	- s t - e l l a	a k k w a	p j o d ʒ - a	l a g o -
Brazilian	i s t r e - l ɐ	a - g w ɐ	f - u - v - ɐ	l a g u -
Portuguese				
Portuguese	i f t r e - l ɐ	a - g w ɐ	f - u - v - ɐ	l a ɣ u -
Catalan	ə s t - ɛ - l -	aj - ɣ w ə	p l u - ʒ - ə	ʎ a k - -
Walloon	- s t - ø: - l -	ɛ: - - w -	p l u: - ʁ - -	l a k - -
Friulian	- s t - ɛ - l e	a - g - e	p l o - - j e	l a: t - -
Romanian	- s t - ɛ a - - -	a - p - ə	p l ɔ a - - j e	l a k - -

## Appendix 4 - Concepts Used

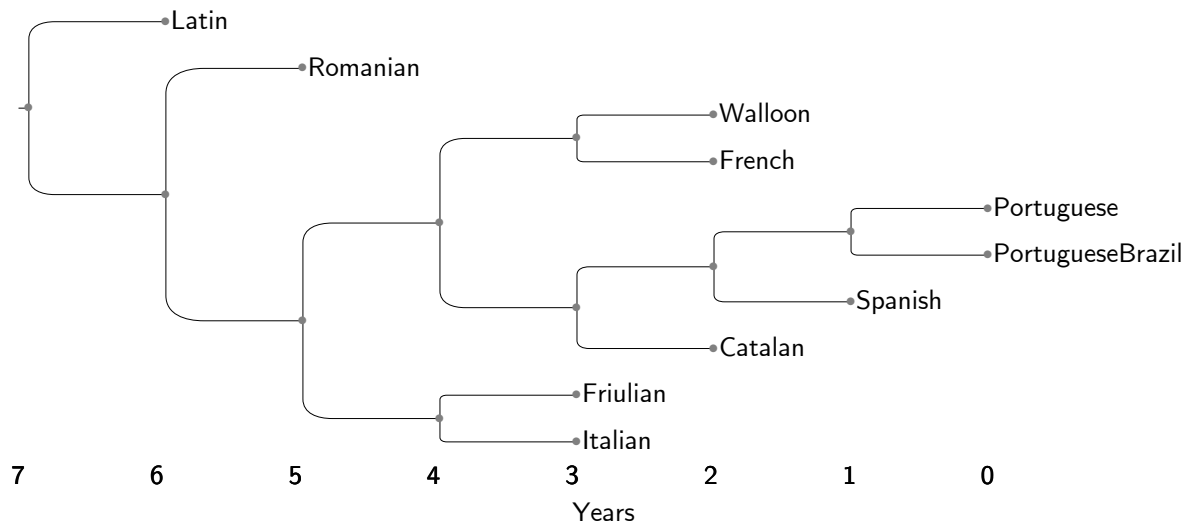
	Sea	Salt	Earth	Sky
Latin	m a r e	s a l e m	t - e r r a	k - a j l u m
French	m ε ʁ -	s ε l - -	t - e - ʁ -	s j ε l - -
Spanish	m a r -	s a l - -	t j e - r a	θ j e l o
Italian	m a r e	s a l e -	t - ε r r a	ʃf - ε l o -
Brazilian	m a ʁ -	s a w - -	t - e - ʁ ɐ	s - ε w - -
Portuguese				
Portuguese	m a r -	s a l - -	t - ε - ʁ ɐ	s - ε w - -
Catalan	m a r -	s a l - -	t - ε - r ə	s - ε l - -
Walloon	m e ʁ -	s e - - -	t - ε: - ʁ -	s - i: ʁ - -
Friulian	m a: r -	s a: l - -	t j ε - r e	ʃf - i: l - -
Romanian	m a r e	s a r e -	ts - a - r ə	ʃf - e r - -
	Wind	Fire-Focus	Green	Year
Latin	w - e n t u m	f - o k u m	w i r i d e m	a n n u m
French	v - ã - - -	f - ø - - -	v e ʁ - - -	ã - - - -
Spanish	b j e n t o -	f w e g o -	b e r - d e -	a - ɲ o -
Italian	v - ε n t o -	f w ɔ k o -	v e r - d e -	a n n o -
Brazilian	v - ã - t u -	f - o g u -	v e r - d i -	e - n u -
Portuguese				
Portuguese	v - ã - t u -	f - o ɣ u -	v e r - d i -	e - n u -
Catalan	b - e n - - -	f - ɔ k - -	v ε r - t - -	a - ɲ - -
Walloon	v - ã - - - -	f - ø: - - -	v ε ʁ - - - -	ã - - - -
Friulian	v - i n t - -	f - u: k - -	v ε r - t - -	a - ɲ - -
Romanian	v - i n t - -	f - o k - -	v e r - d e -	a n - - -
	Name-Nomen	Name-Nominem	Tongue	
Latin	n o: m e n	n o: m i n - e m	l i n g <sup>w</sup> - a	
French	n ɔ̃ - - -		l ã - g - -	
Spanish		n o m - b r e -	l e ɲ g w a	
Italian	n o: m e -		l i n g w a	
Brazilian	n o m i -		l i - g w ɐ	
Portuguese				
Portuguese	n o m i -		l i - g w ɐ	
Catalan	n ɔ m - -			
Walloon	n ɔ̃ - - -		l ɛ̃ ɣ - - -	
Friulian	n ɔ ɲ - -		l ε n g - ε	
Romanian	n u m e -		l i m b - ə	

## Appendix 5 - Results

### Commonly Accepted Romance Tree



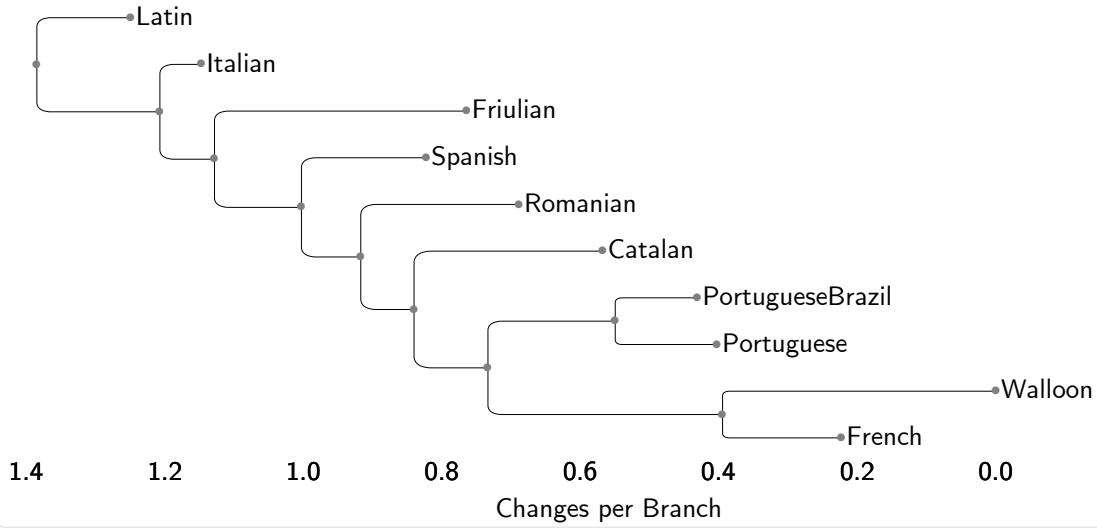
### Priors



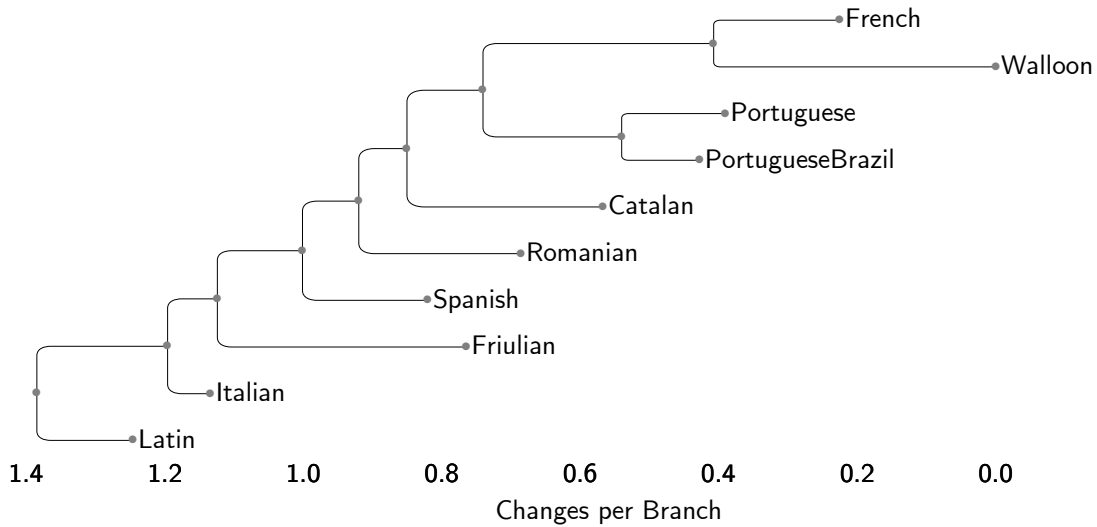


## Appendix 5 - Results

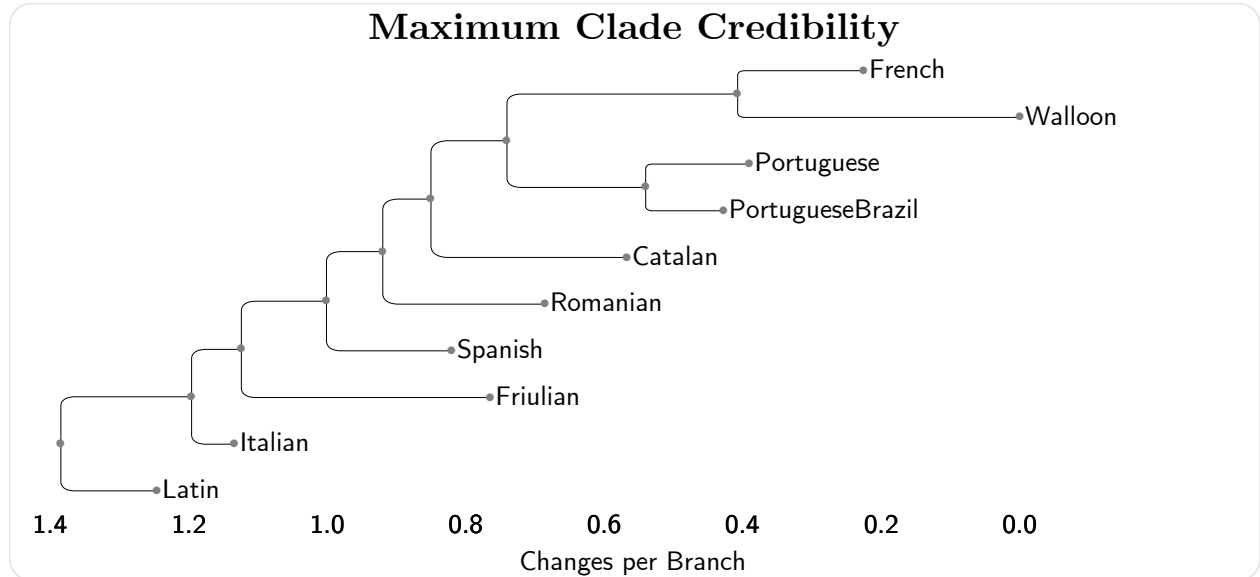
### Consensus



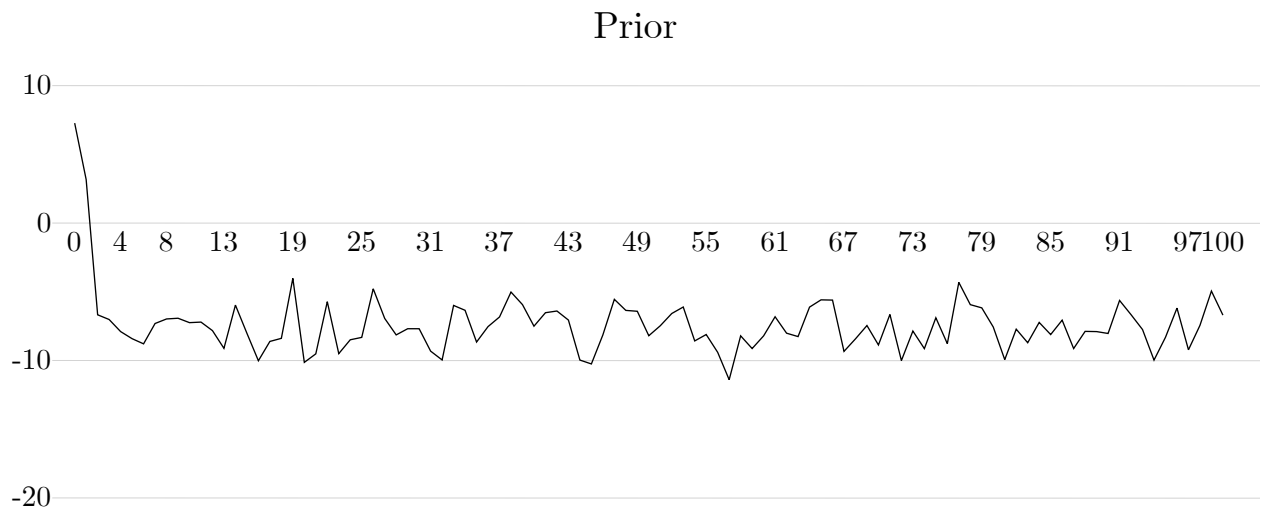
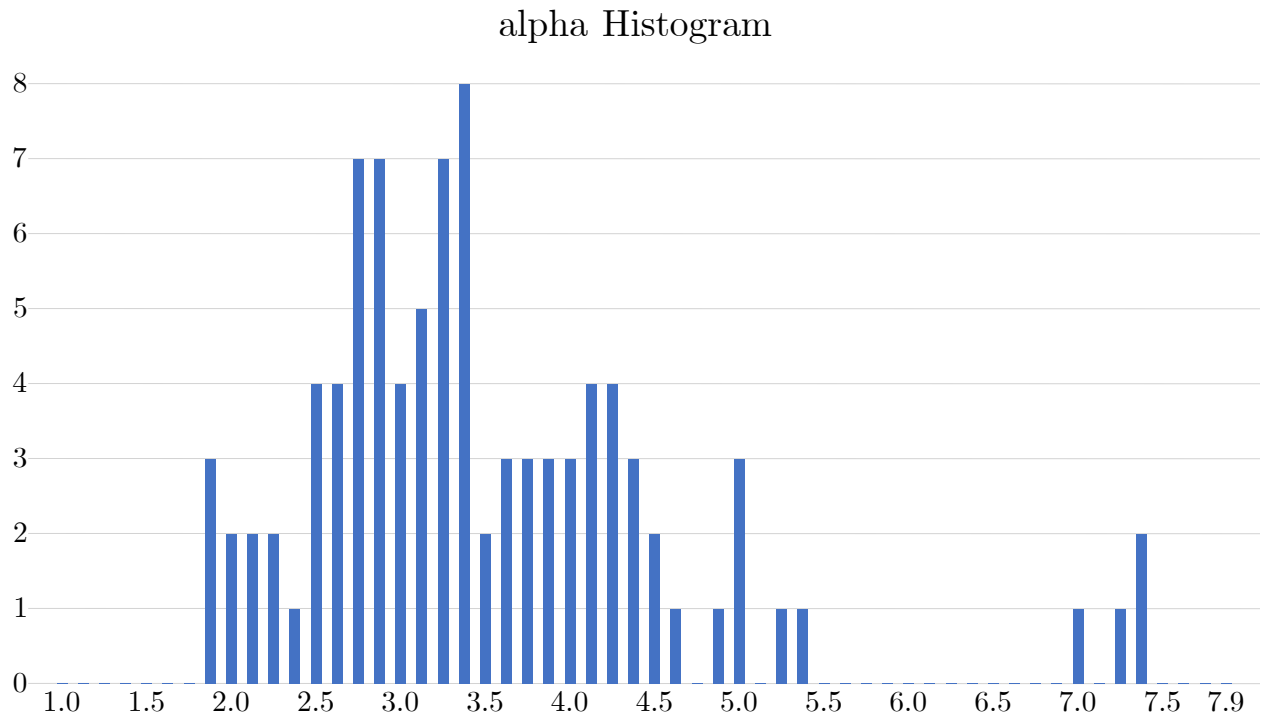
### MAP



## Appendix 5 - Results



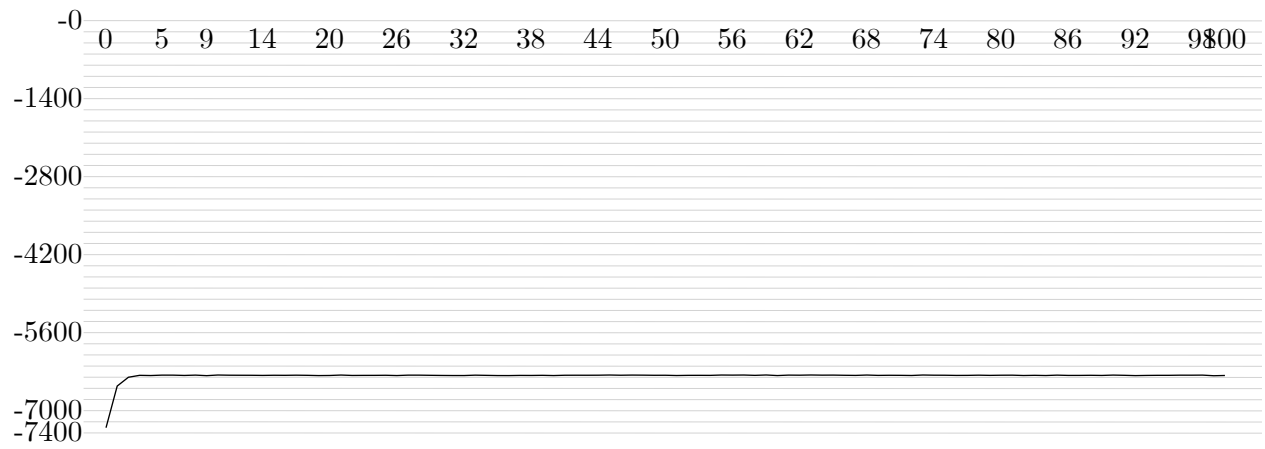
## Appendix 6 - Statistics



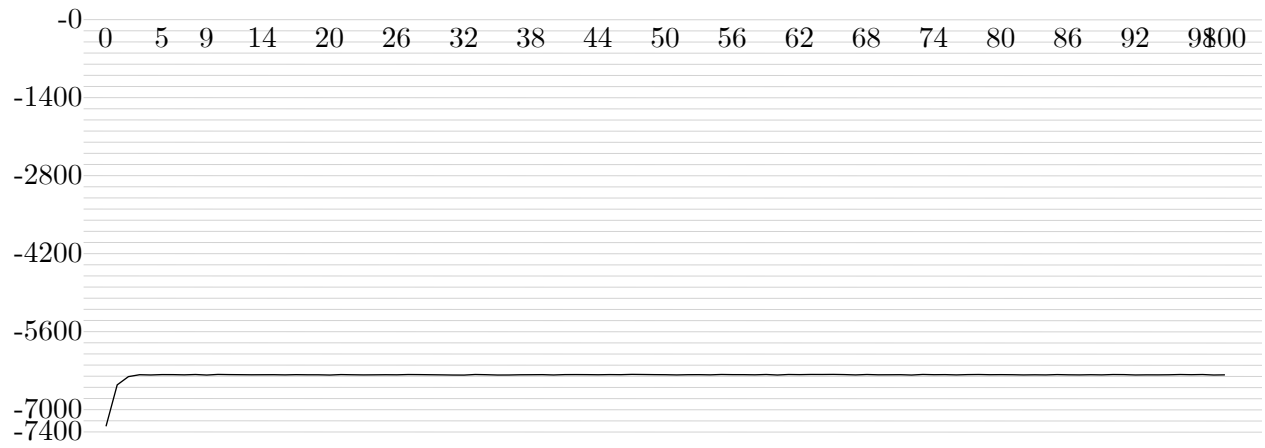
## Appendix 6 - Statistics

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### Likelihood



### Posterior



## Appendix 6 - Statistics

