Modelling Chinese dialect evolution

Johann-Mattis List, Shijulal Nelson-Sathi, Dagan Tal

Modelling Chinese Dialect Evolution

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Structure of the Talk

1. Languages
   - Languages
   - Diasystems
   - Change
2. Modelling Language History
   - Trees
   - Waves
   - Networks
3. Modelling Chinese Dialect History
   - Data
   - Analysis
   - Results


语言
язык
Languages
language
språk

Languages and Dialects

Norwegian, Danish, and Swedish are different languages.

Beijing-Chinese, Shanghai-Chinese, and Hakka-Chinese are dialects of the same Chinese language.

Languages and Dialects

Beijing Chinese	1	iou^{21}	i^{55}	xuei^{35}		pei^{21}fəŋ^{55}		kən^{55}		tʰai^{51}iaŋ^{11}		t͡ʂəŋ^{55}	tsai^{53}	naə̯^{51}		t͡ʂəŋ^{55}luən^{51}
Hakka Chinese	1	iu^{33}	it^{55}	pai^{33}a^{11}		pet^{33}fuŋ^{33}		tʰuŋ^{11}		ɲit^{11}tʰeu^{11}		hɔk^{33}		e^{53}		au^{55}
Shanghai Chinese	1	ɦi^{22}		tʰɑ̃^{55}	tsɿ^{21}	poʔ^{3}foŋ^{44}		taʔ^{5}		tʰa^{33}ɦiã^{44}		tsəŋ^{33}	hɔ^{44}			ləʔ^{1}lə^{23}tsa^{53}
Beijing Chinese	2	ʂei^{35}			də^{55}			pən^{35}	liŋ^{21}	ta^{51}						
Hakka Chinese	2	man^{33}	ɲin^{11}			kʷɔ^{55}		vɔi^{53}								
Shanghai Chinese	2	sa^{33}	ɲiŋ^{55}		ɦəʔ^{21}			pəŋ^{33}	zɿ^{44}	du^{13}						
Norwegian	1	nuːɾɑʊinˑn̩		ɔ	suːlɳ̩									kɾɑŋlət		ɔm
Swedish	1	nuːɖanvɪndən		ɔ	suːlən			tʏ̯ɪstadə		ən gɔŋ						ɔm
Danish	1	noɑ̯ʌnvenˀn̩		ʌ	soːl̩ˀn	kʰʌm				eŋg̊ɑŋ		i sɖʁiðˀ				ʌmˀ
Norwegian	2	ʊem	ɑ		dem		sm̩	ʊɑː		ɖn̩		stæɾ̯kəstə				
Swedish	2	vɛm	ɑv		dɔm		sɔm	vɑ				staɹkast				
Danish	2	vɛmˀ	a		b̥m̩		ɖ̥	vɑ		ɖn̩		sɖæɑ̯g̊əsɖə				

Languages and Dialects

From the perspective of the lexicon and the sound system, the Chinese **dialects** are at least equally if not more different than the Scandinavian **languages**.

Language as a Diasystem

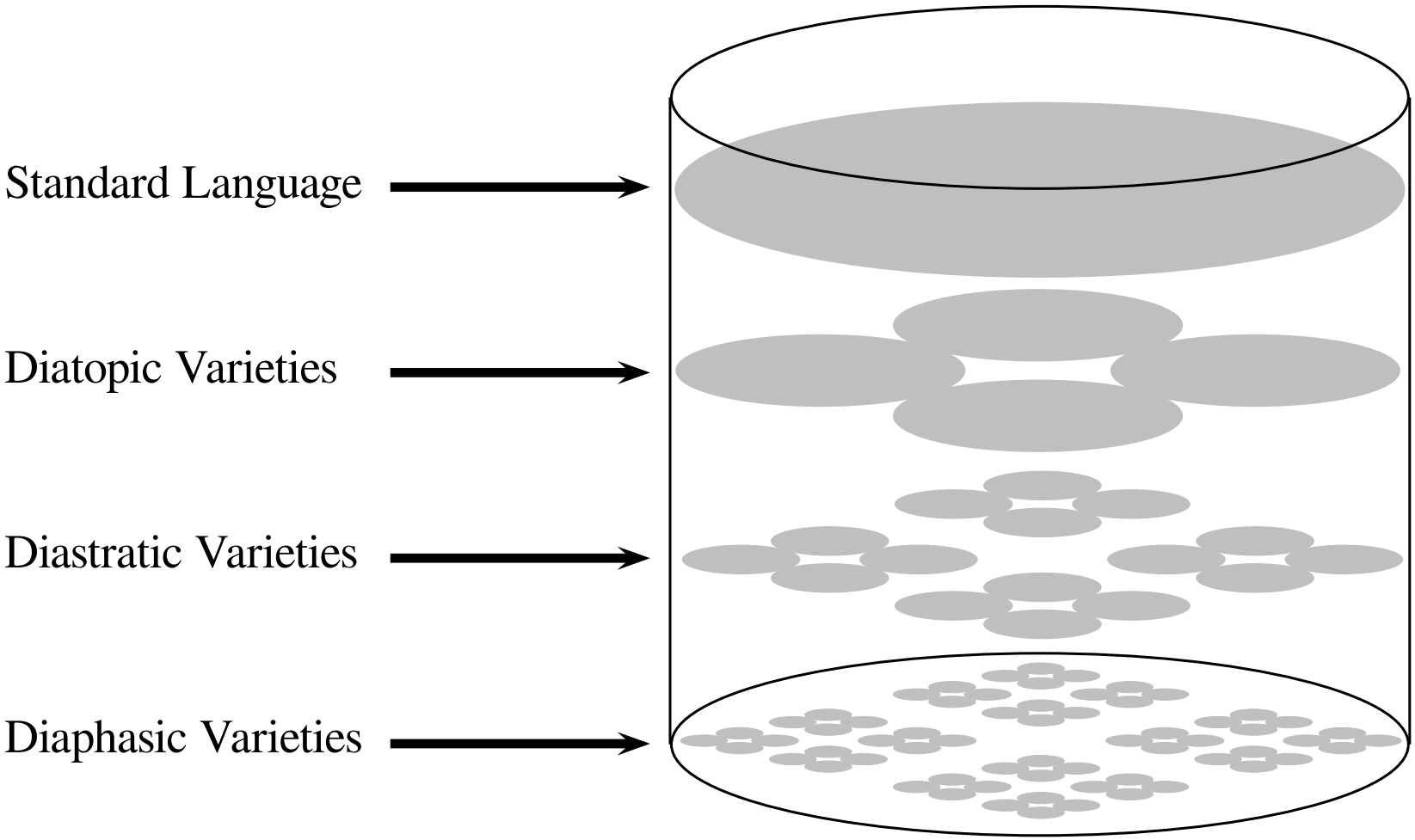
Languages are complex aggregates of different linguistic systems that ‘coexist and influence each other’ (Coseriu 1973: 40, my translation).

Language as a Diasystem

Languages are complex aggregates of different linguistic systems that ‘coexist and influence each other’ (Coseriu 1973: 40, my translation).

A linguistic diasystem requires a “roof language” (Goossens 1973:11), i.e. a linguistic variety that serves as a standard for interdialectal communication.

Language as a Diasystem



Change

Change

expected Mandarin $[\mathrm{ma}_{55}\mathrm{po}_{21}\mathrm{lou}]$

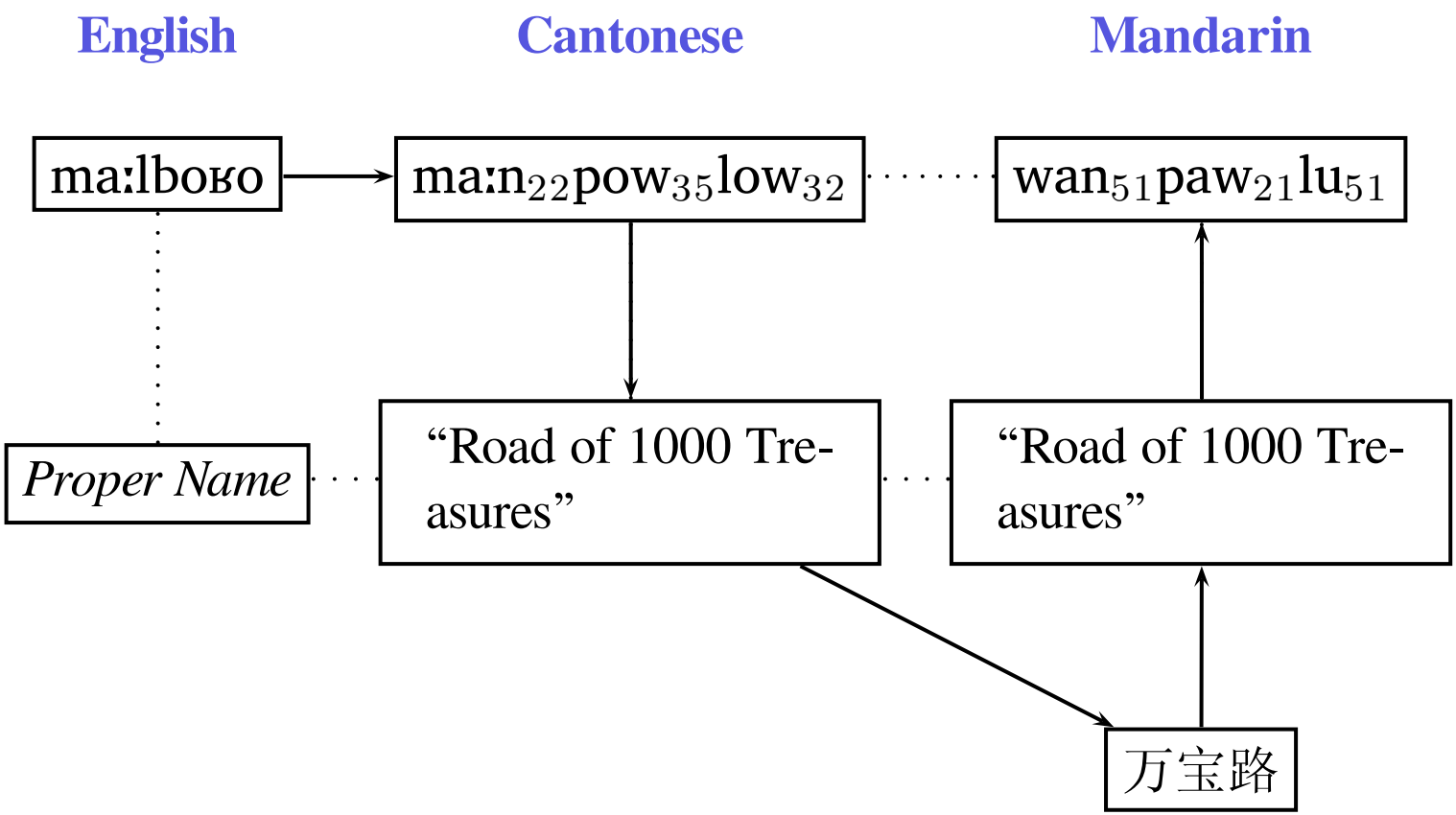
Change

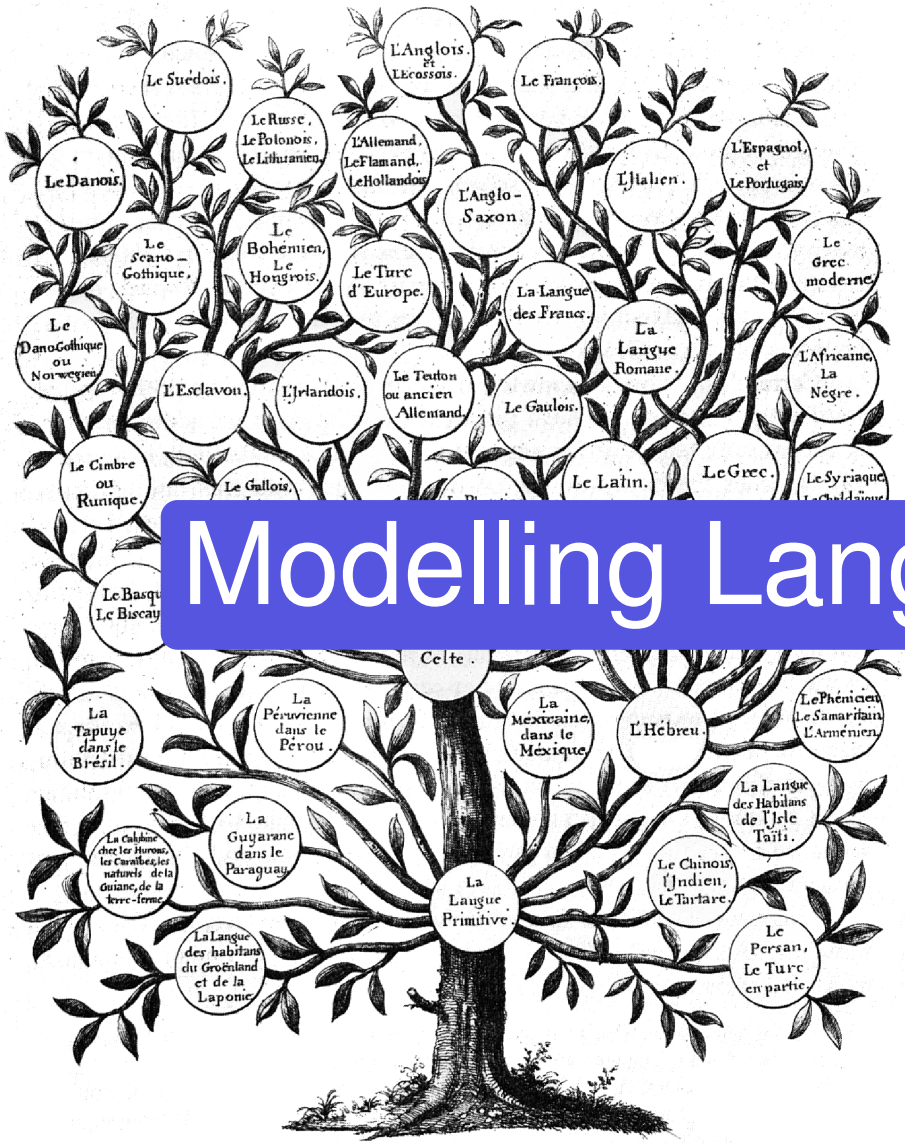
expected	Mandarin	[$ma_{55}po_{21}lou$]
attested	Mandarin	[$wan_{51}paw_{21}lu_{51}$]

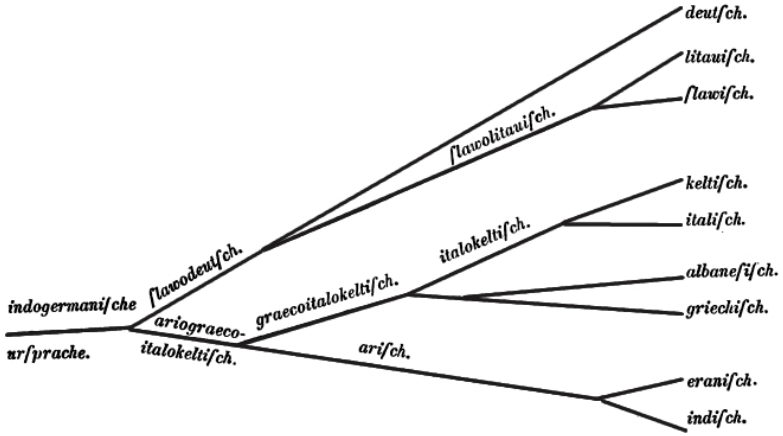
Change

expected	Mandarin	[$ma_{55}po_{21}lou$]
attested	Mandarin	[$wan_{51}paw_{21}lu_{51}$]
explanation	Cantonese	[$ma{:}n_{22}pow_{35}low_{32}$]

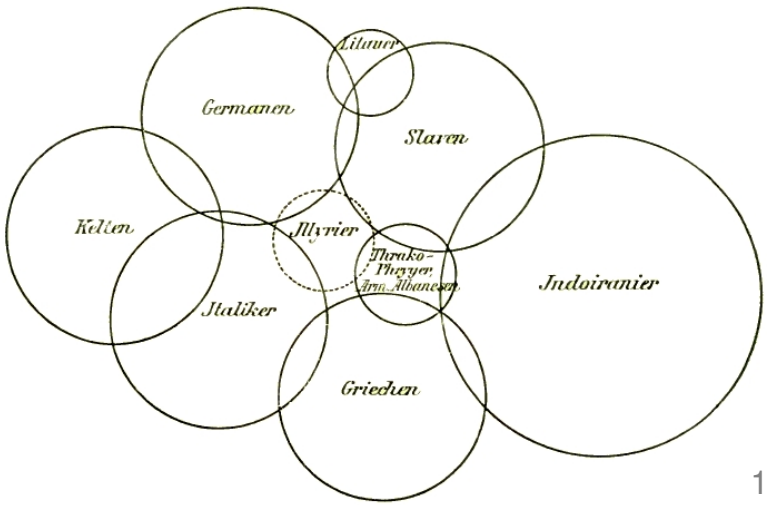
Change


English
Cantonese
Mandarin
maːlboʁo
maːn22pow35low32
wan51paw21lu51
Proper Name
“Road of 1000 Treasures”
“Road of 1000 Treasures”
万宝路





Modelling Language History



Dendrophilia

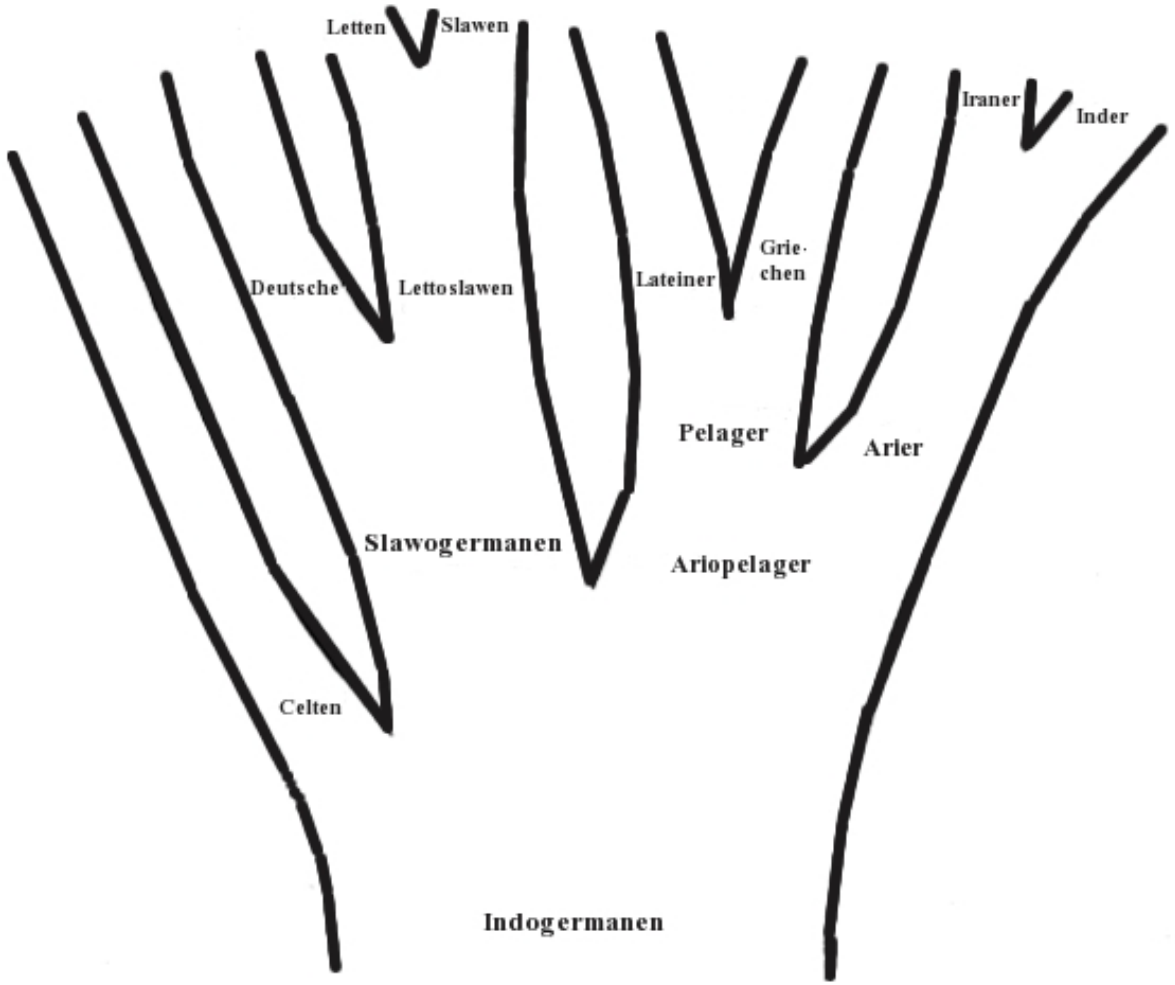
August Schleicher
(1821-1868)

Dendrophilia

These assumptions that logically follow from the results of our research can be best illustrated with help of a branching tree. (Schleicher 1853: 787, my translation)

August Schleicher (1821-1868)

Dendrophilia



Schleicher (1853)

Dendrophobia

Johannes Schmidt
(1843-1901)

Dendrophobia

No matter how we look at it, as long as we stick to the assumption that today's languages originated from their common proto-language via multiple furcation, we will never be able to explain all facts in a scientifically adequate way. (Schmidt 1872: 17, my translation)

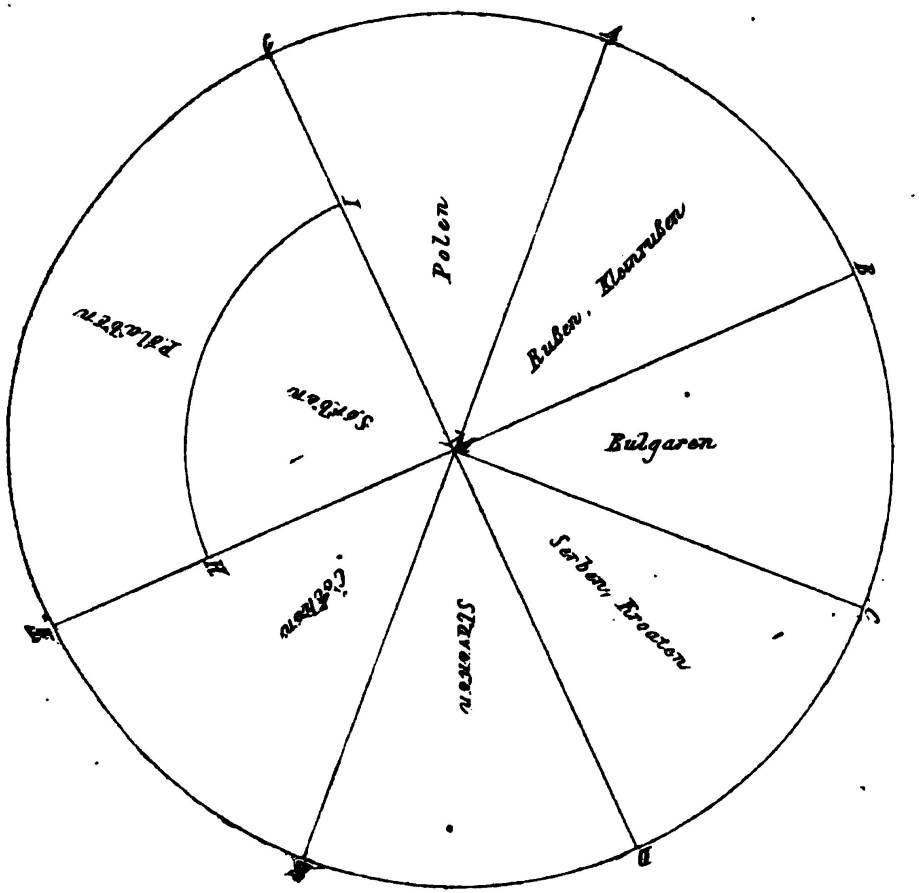
Johannes Schmidt
(1843-1901)

Dendrophobia

I want to replace [the tree] *by the image of a wave that spreads out from the center in concentric circles becoming weaker and weaker the farther they get away from the center.*
(Schmidt 1872: 27, my translation)

Johannes Schmidt
(1843-1901)

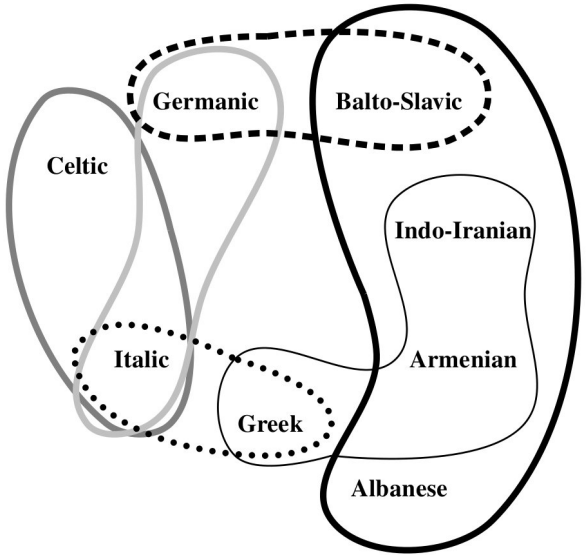
Dendrophobia



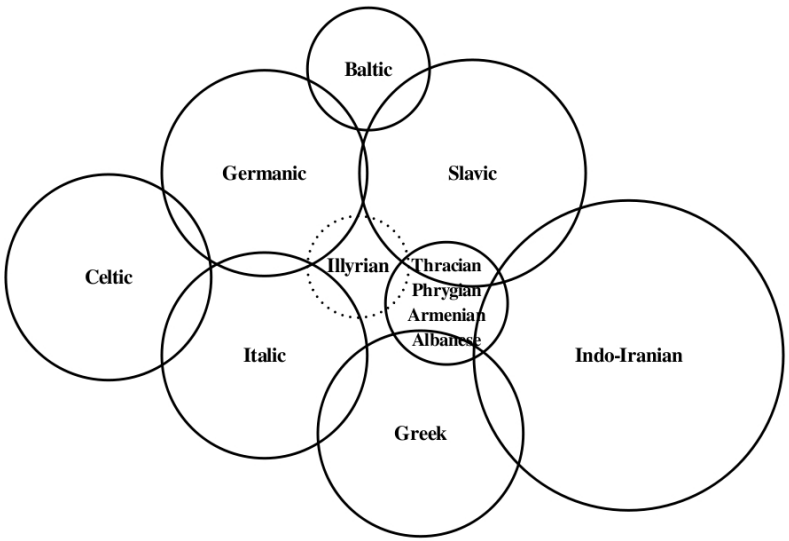
Schmidt (1875)

Dendrophobia

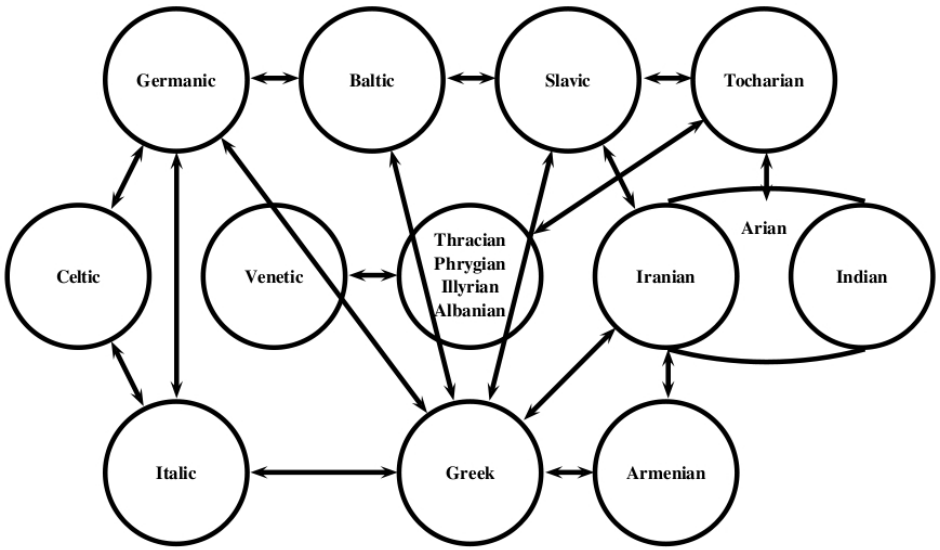
Meillet (1908)



Bloomfield (1933)



Hirt (1905)



Bonfante (1931)

Phylogenetic Networks

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Phylogenetic Networks

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- languages still separate, even if not in split processes

Phylogenetic Networks

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- they are difficult to reconstruct
- languages do not separate in split processes
- they are boring, since they only capture certain aspects of language history, namely the vertical relations

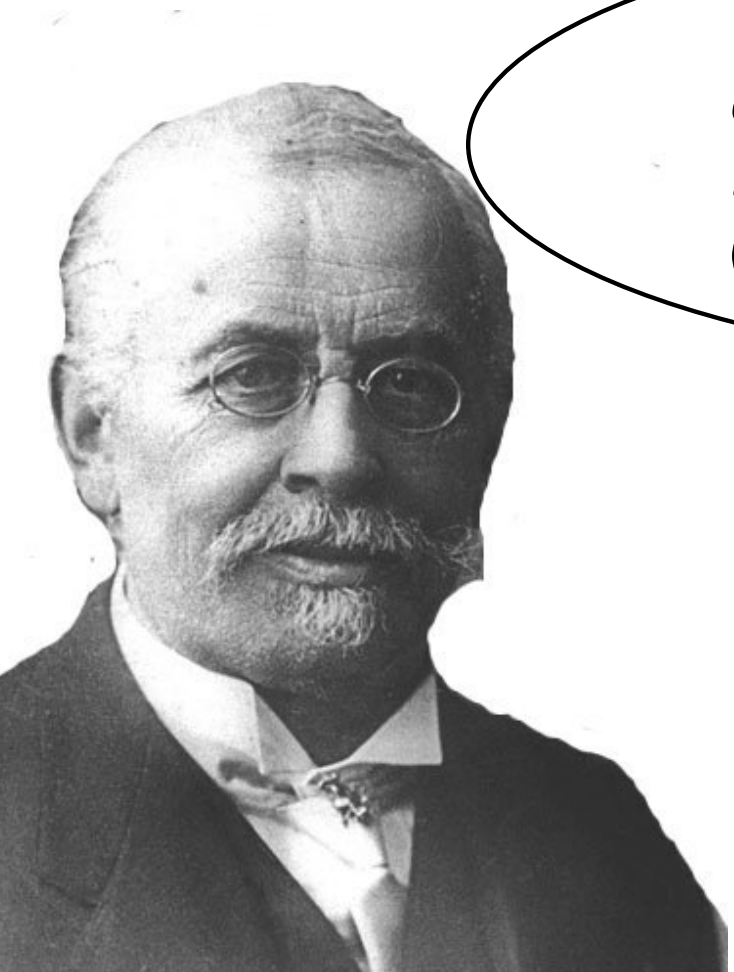
Waves are bad because

- nobody knows how to reconstruct them
- languages still separate, even if not in split processes
- they are boring, since they only capture certain aspects of language history, namely, the horizontal relations

Phylogenetic Networks

Hugo Schuchardt
(1842-1927)

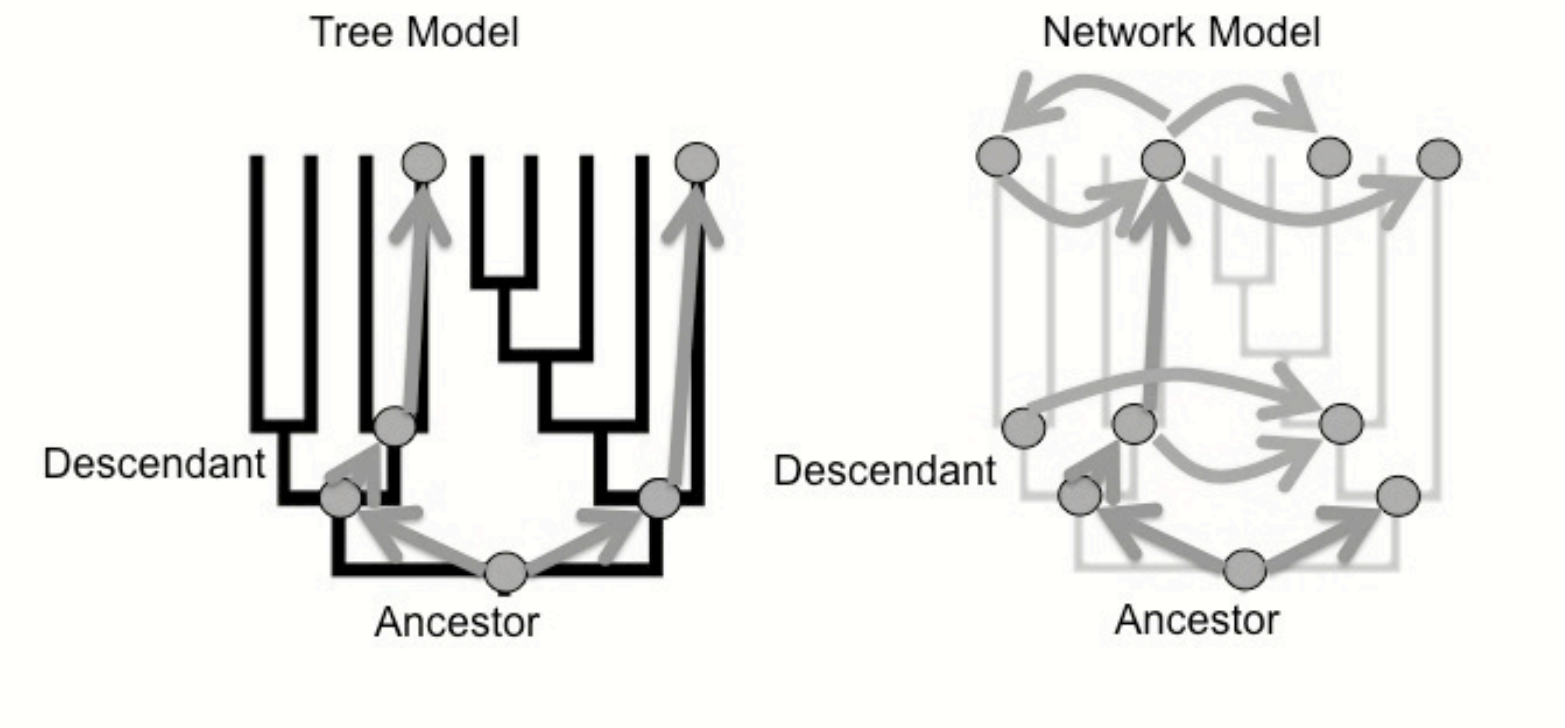
Phylogenetic Networks



We connect the branches and twigs of the tree with countless horizontal lines and it ceases to be a tree (Schuchardt 1870 [1900]: 11)

Hugo Schuchardt (1842-1927)

Phylogenetic Networks



魚  ?

Modelling Chinese Dialect History

首   

Data

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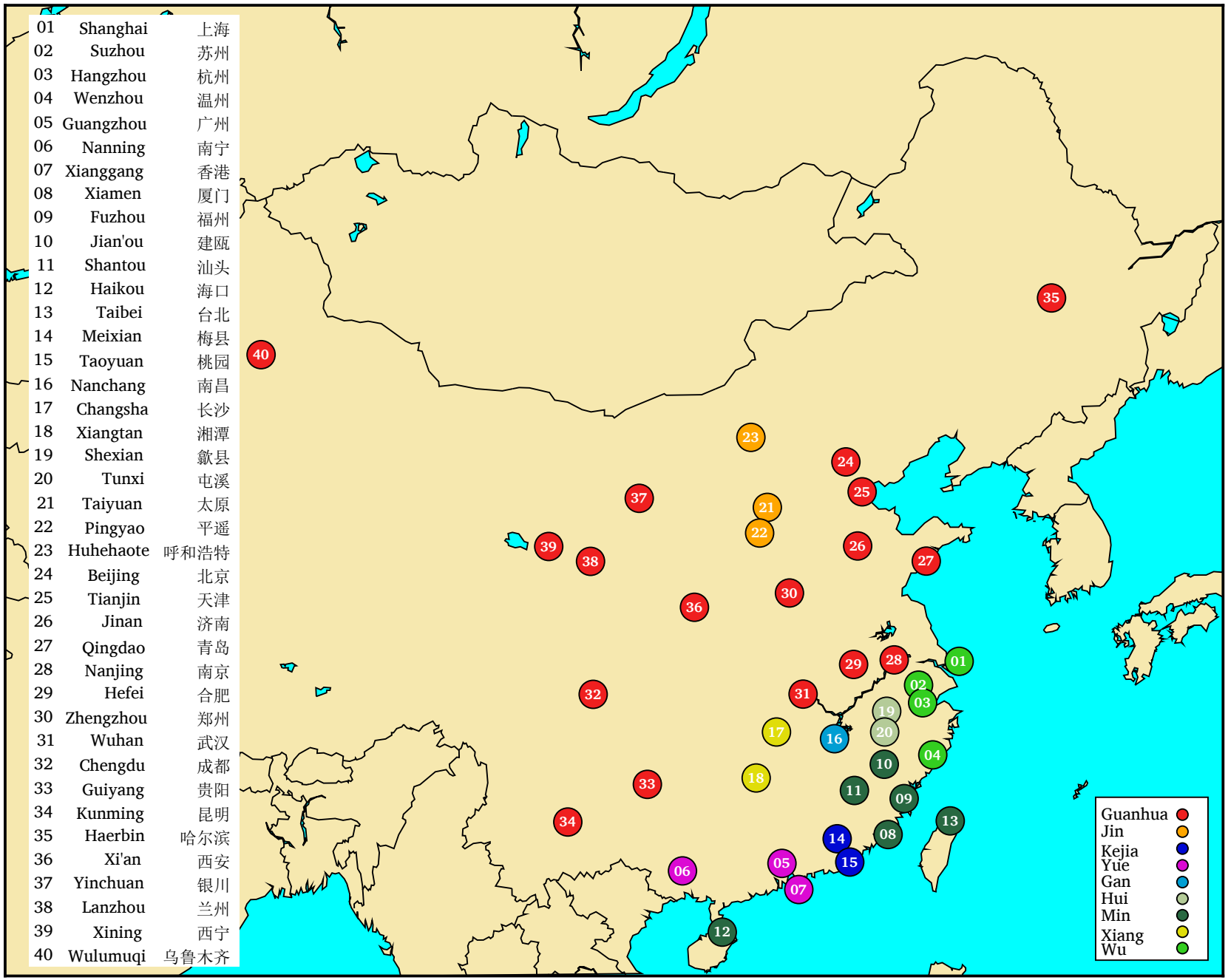
- The data is available on a CD in RTF format along with recordings for all dialect entries.
- For this study, the transcriptions in RTF were converted to Unicode.
- Every word was compared with the recordings in order to minimize errors resulting from the extraction process and the original encoding itself.

Data

ITEM 太阳 *tàiyáng* “sun”

Dialect	Pronunciation	Characters	Cognacy
Shanghai	$t^ha^{34\text{-}33}ɦiã^{13\text{-}44}$	太阳	1
Shanghai	$ɲjɪʔ^{1\text{-}11}dɤ^{13\text{-}23}$	日头	2
Wenzhou	$t^ha^{42\text{-}22}ji$	太阳	1
Wenzhou	$ɲi^{213\text{-}22}dɤu$	日头	2
Guangzhou	$jit^2t^hɐu^{21\text{-}35}$	热头	3
Guangzhou	$t^hai^{33}jœŋ^{21}$	太阳	1
Haikou	zit^3hau^{31}	日头	2
Beijing	$t^hai^{51}iɑŋ^1$	太阳	1

Dialect Locations in the Xiàndài Hànyǔ Fāngyán Yīnkù



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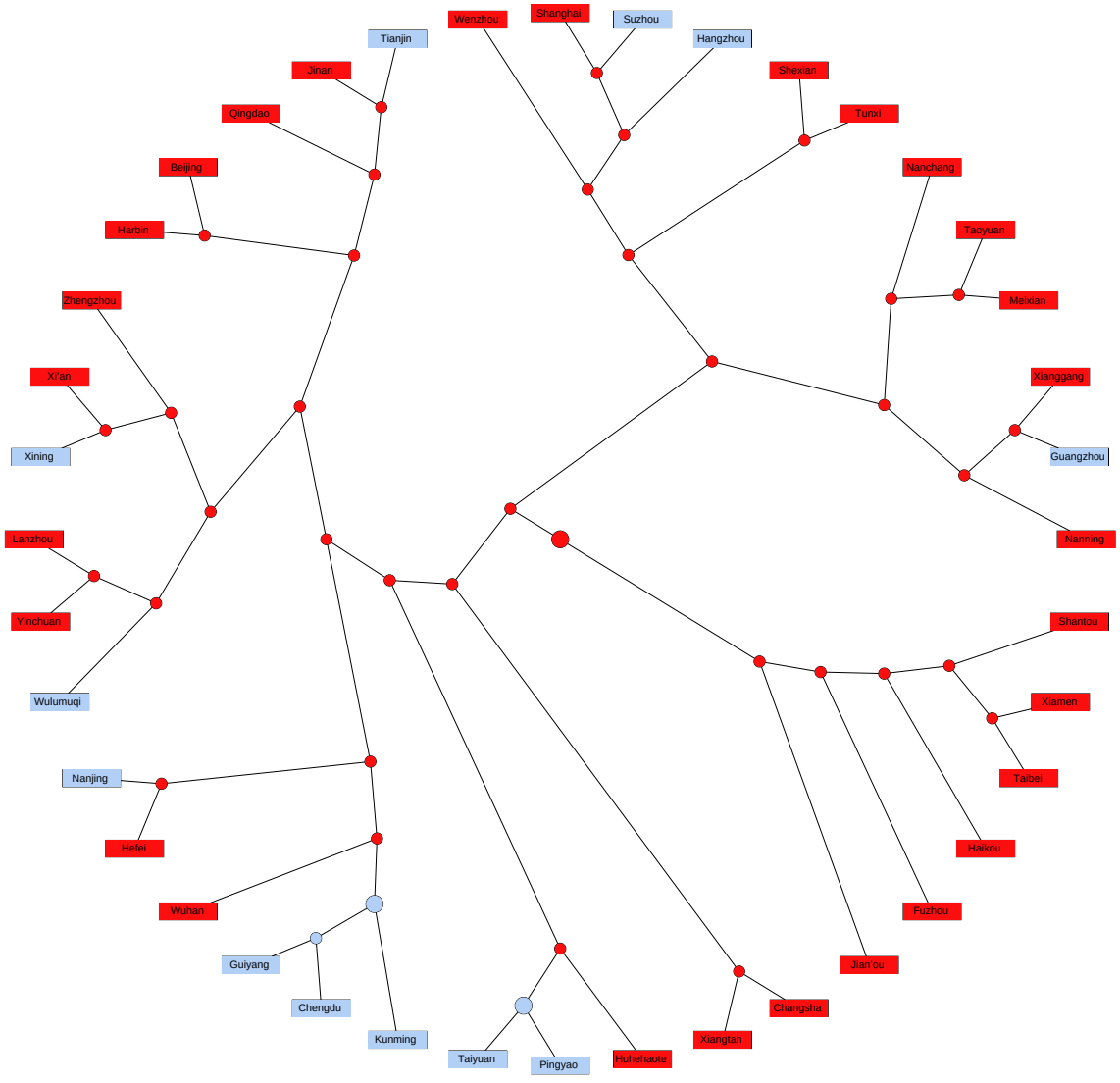
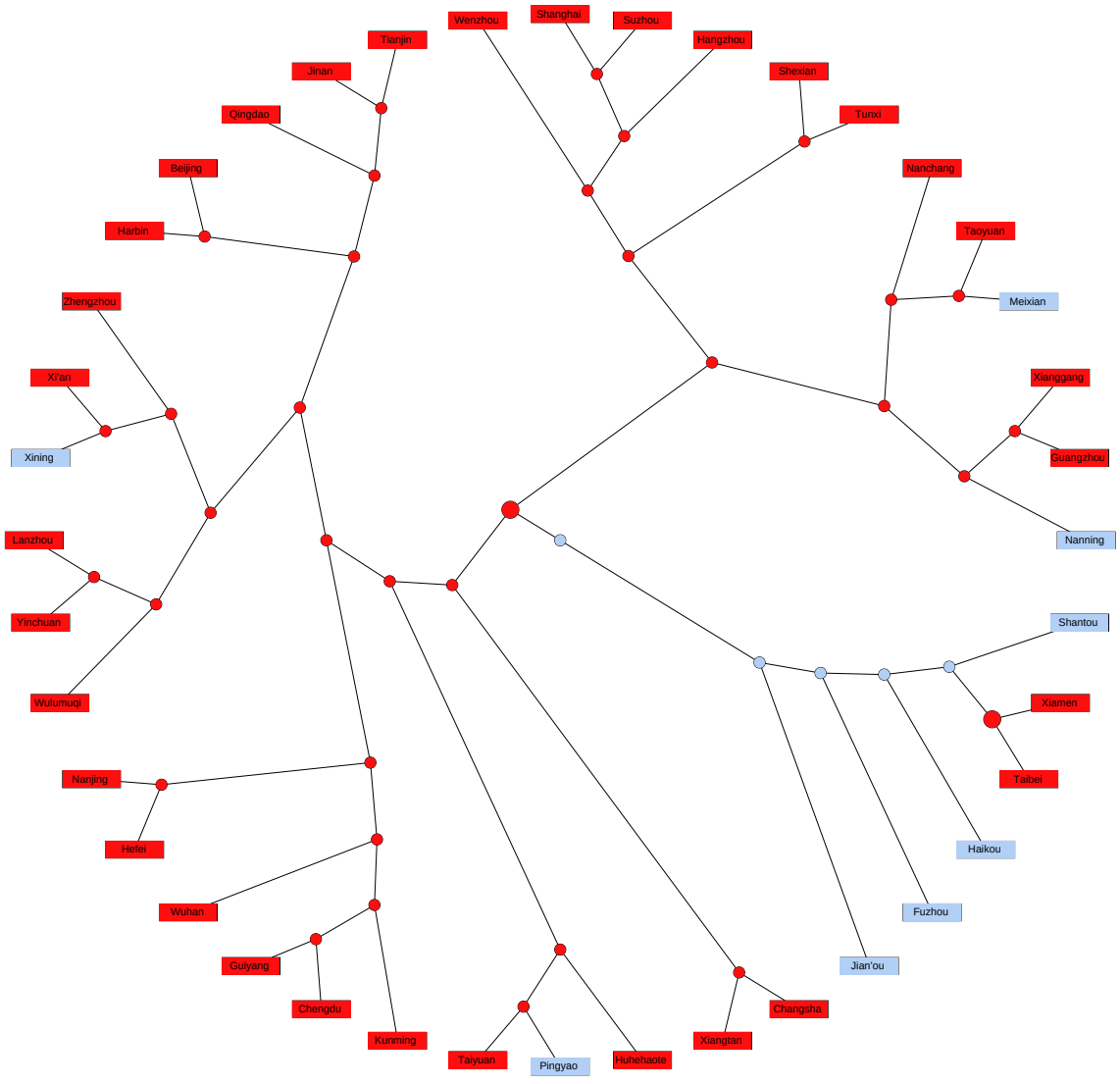
- The reconstruction of horizontal relations is done by seeking specific evolutionary models (loss and gain of characters) that fit the given distribution best.
- The main criterion by which the fitness of the distributions is evaluated is the "vocabulary size", i.e. the distribution of word forms over a set of meanings. Comparing the vocabulary sizes of different models that infer different amounts of lateral events, the model that comes closest to the vocabulary sizes of the contemporary languages is chosen.

Analysis



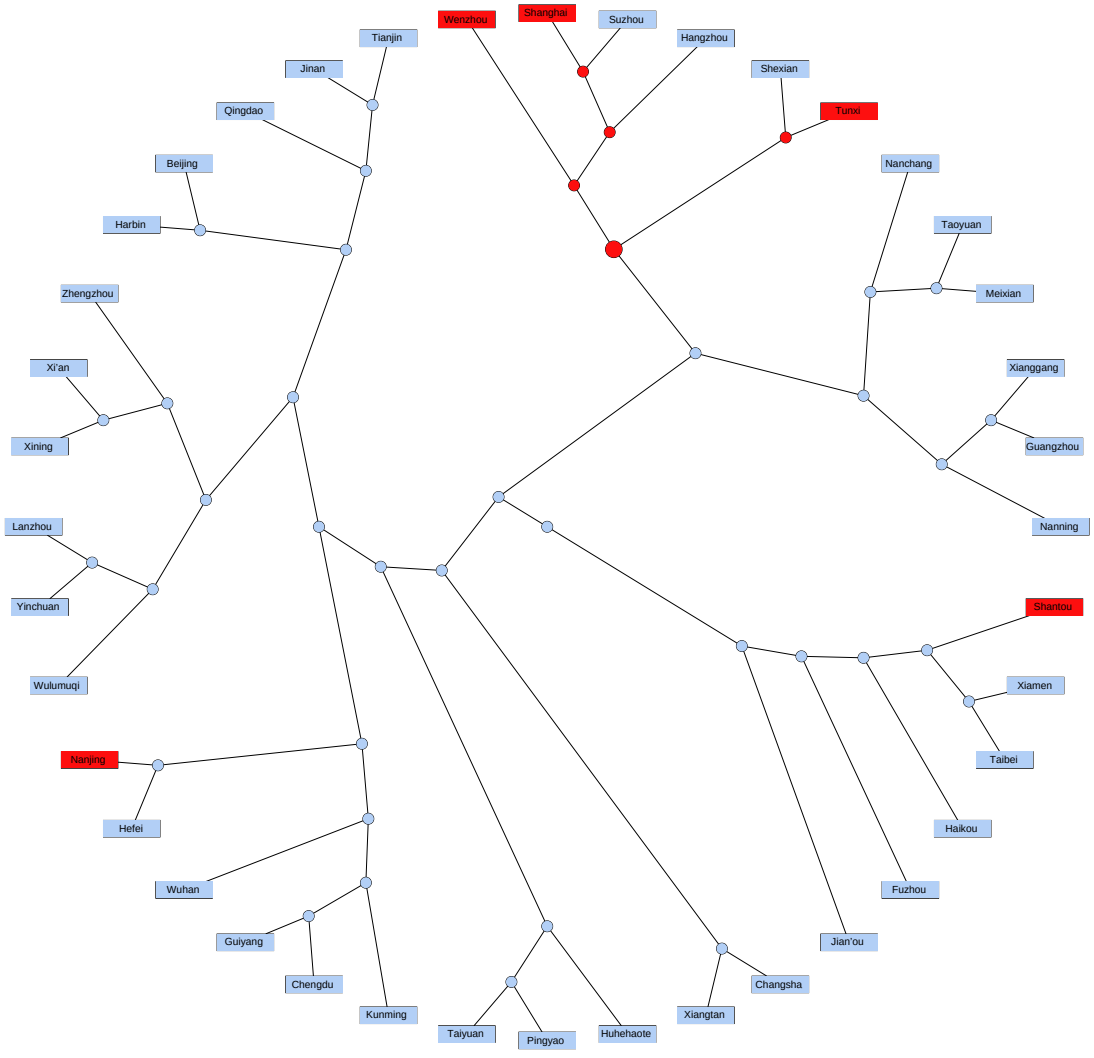
"sun" 日头 *ritou*

Analysis



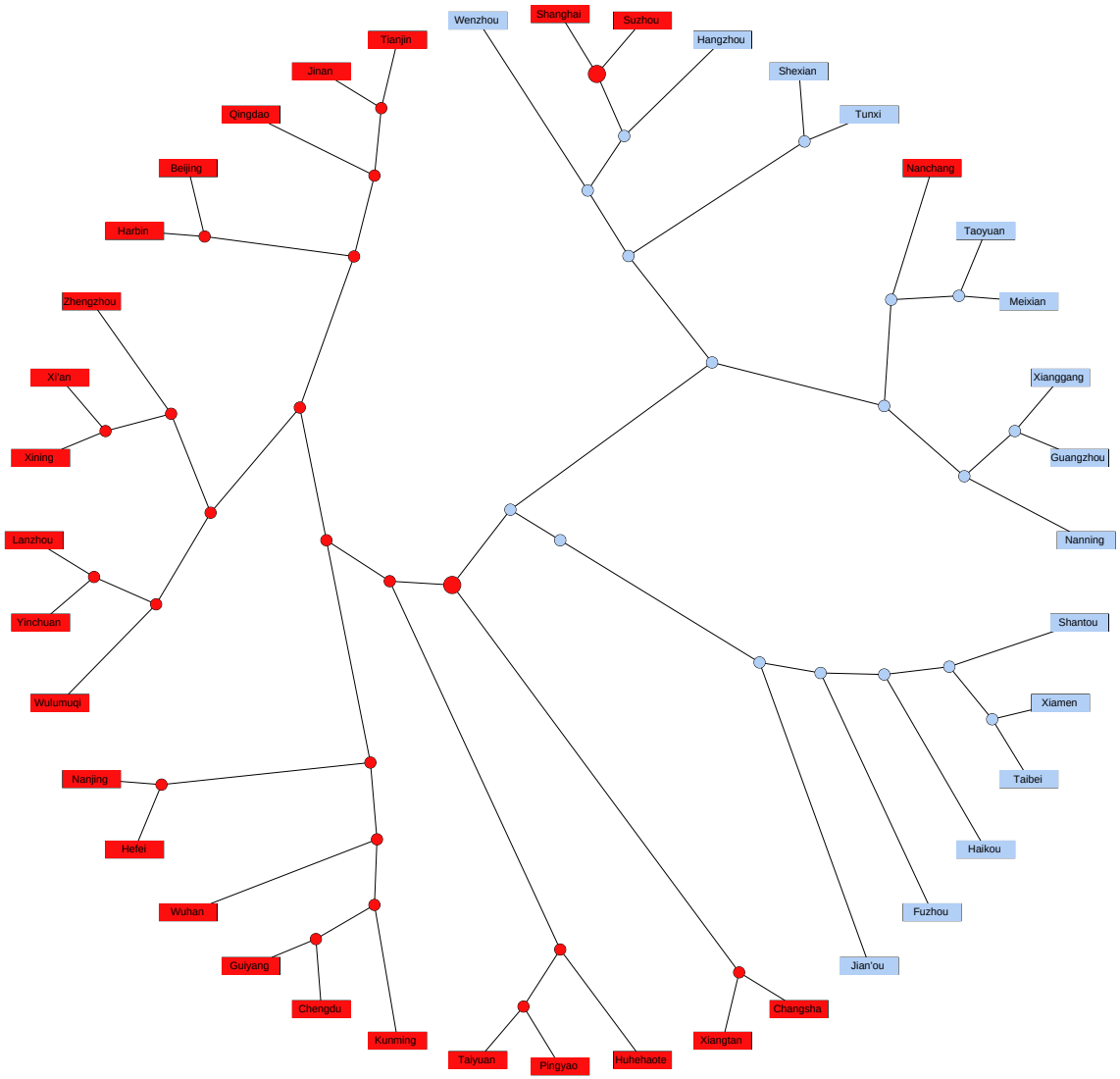
"sun" 太阳 *tàiyáng*

Analysis



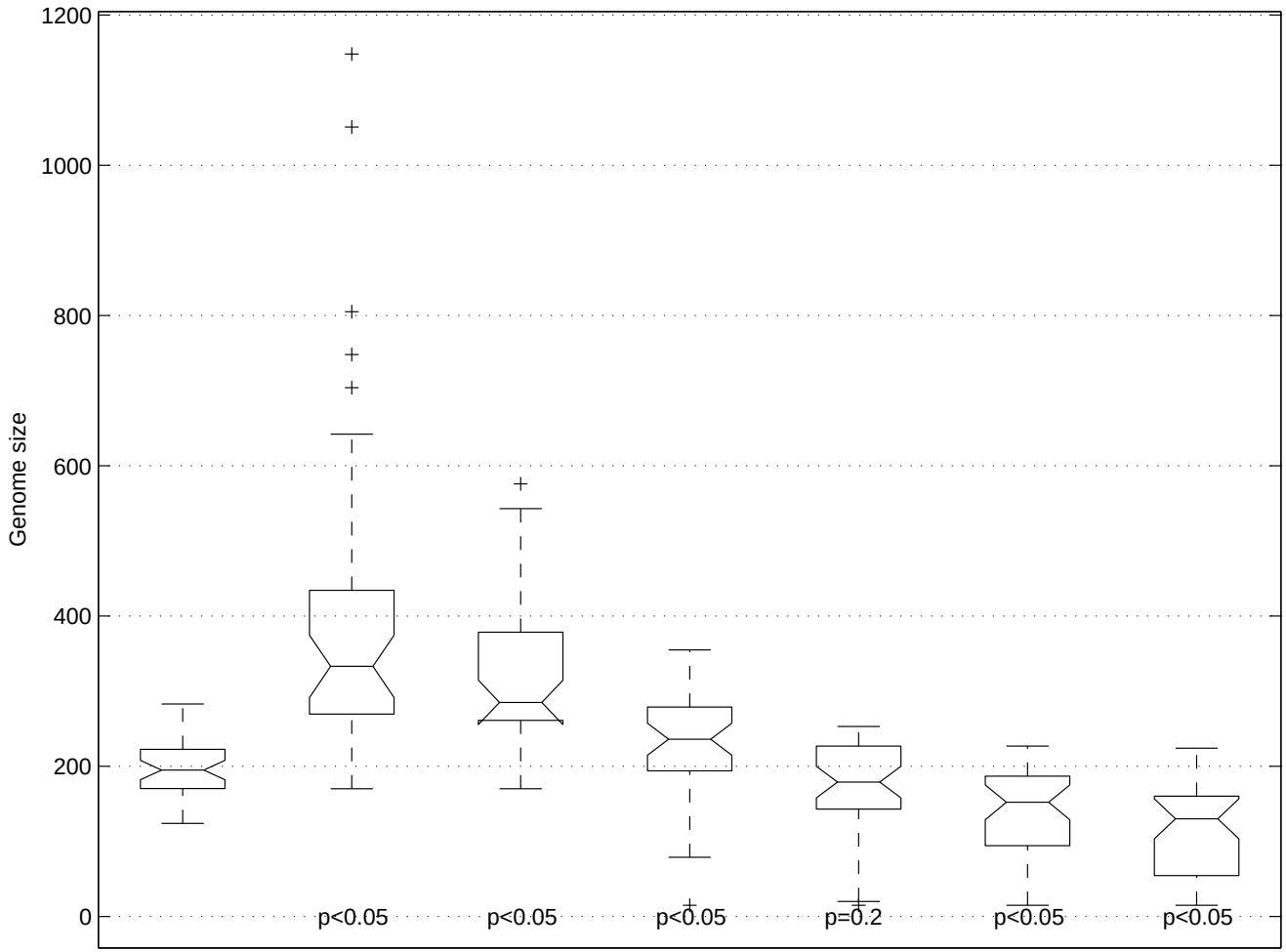
"become sick" 生病 *shēngbìng*

Analysis



"aubergine" 茄子 *qiézi*

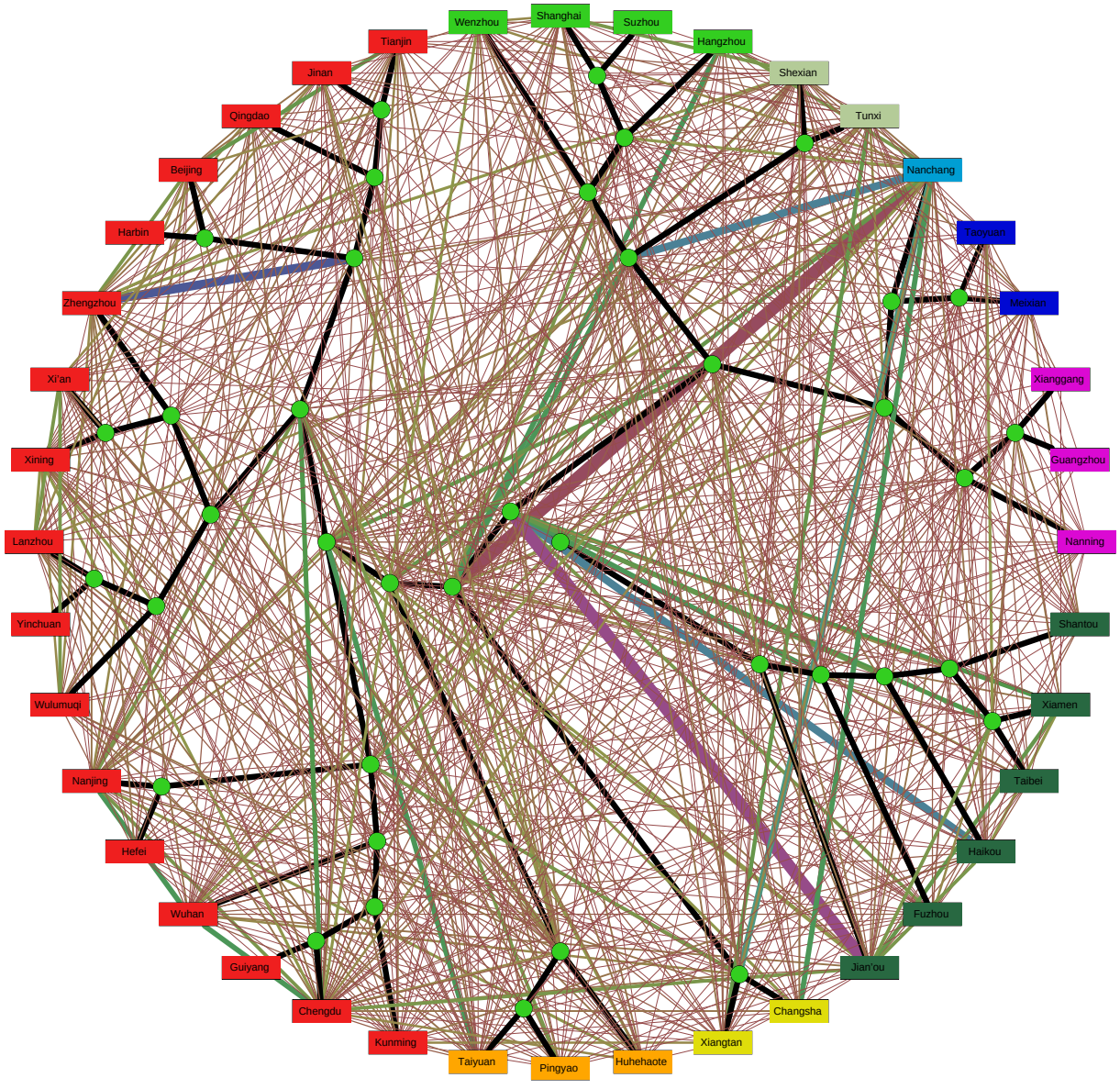
Results


1200
1000
800
600
400
200
0
Genome size
p<0.05
p<0.05
p<0.05
p=0.2
p<0.05
p<0.05

Results

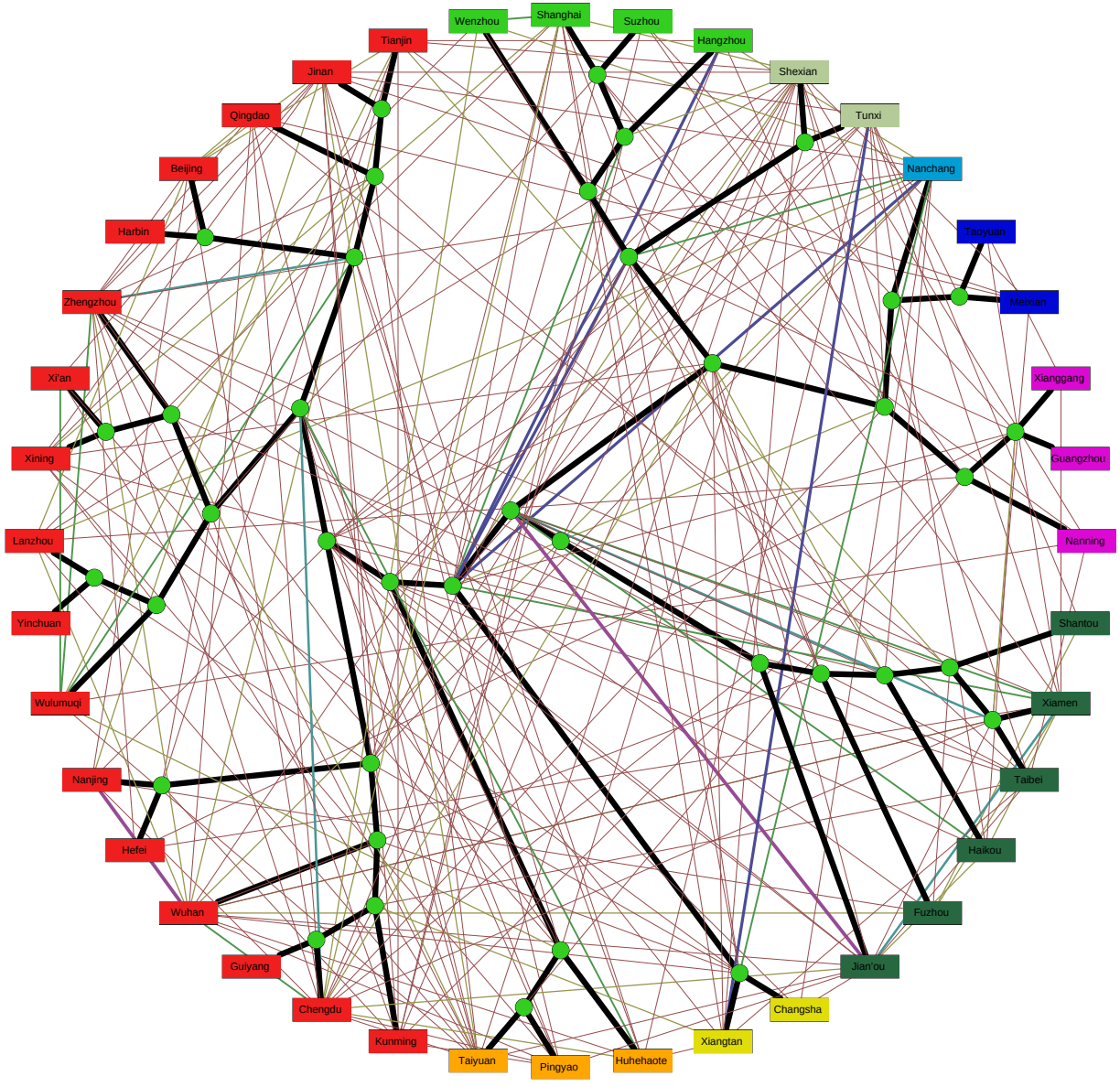
- The BOR3-model fits the distribution best. It allows up to three lateral connections per homolog.
- Out of 1152 homologs distributed over the Chinese dialects, 264 are monophyletic, 328 require one, 355 two, and 177 three lateral links in order to explain the distribution neatly.
- This corresponds to a borrowing rate of 0.5286 borrowing events per homolog per lifetime.
- For 78 percent of all homologs in the dataset the method reconstructs lateral links and therefore suggests that these have been involved in borrowing events during their history.
- Suprisingly, the 48 homologs that correspond to basic vocabulary concepts in the dataset do not show significant differences in their borrowing rates compared to the non-basic items.

Results: General Results



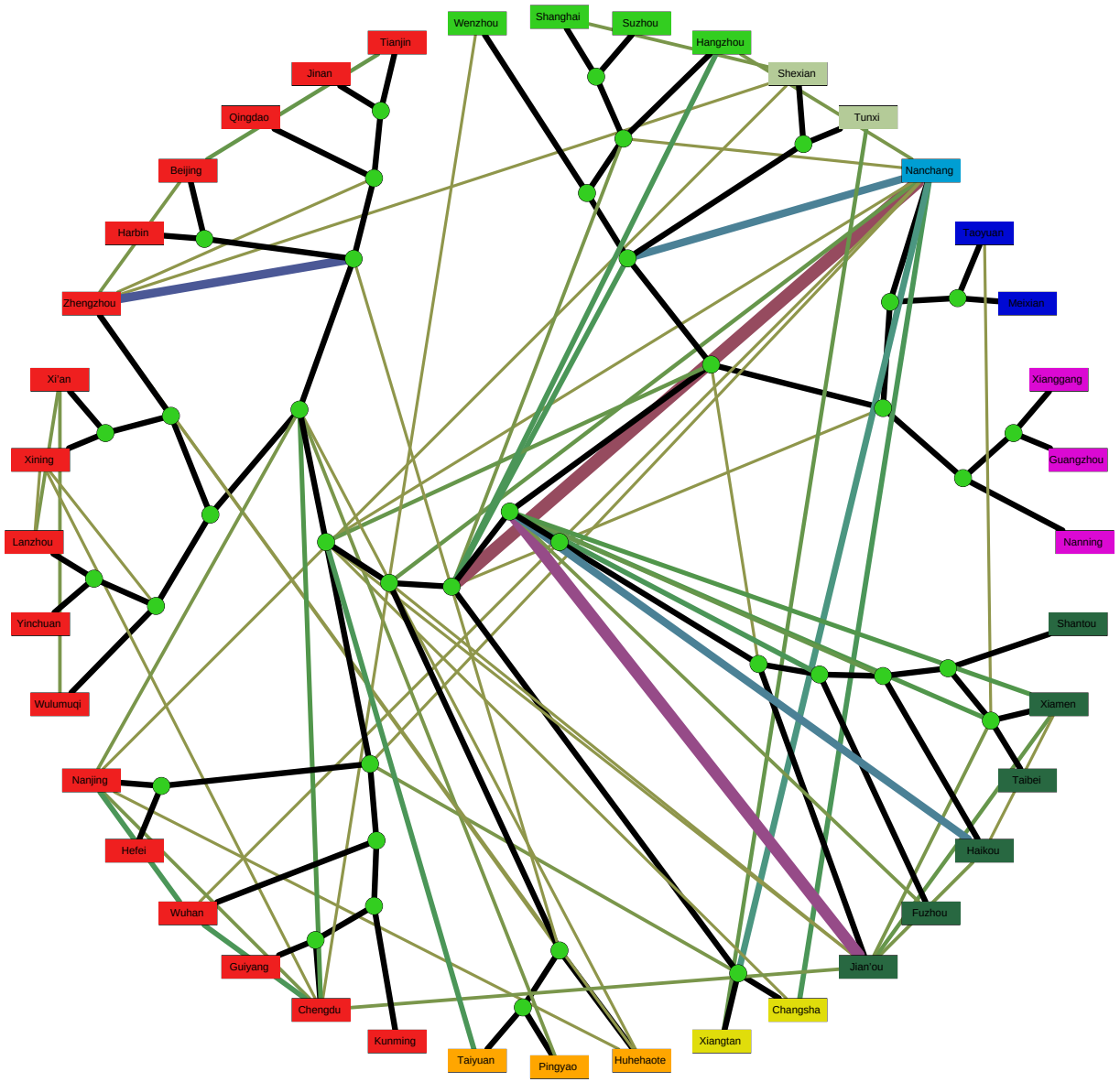
Whole Dataset

Results: General Results



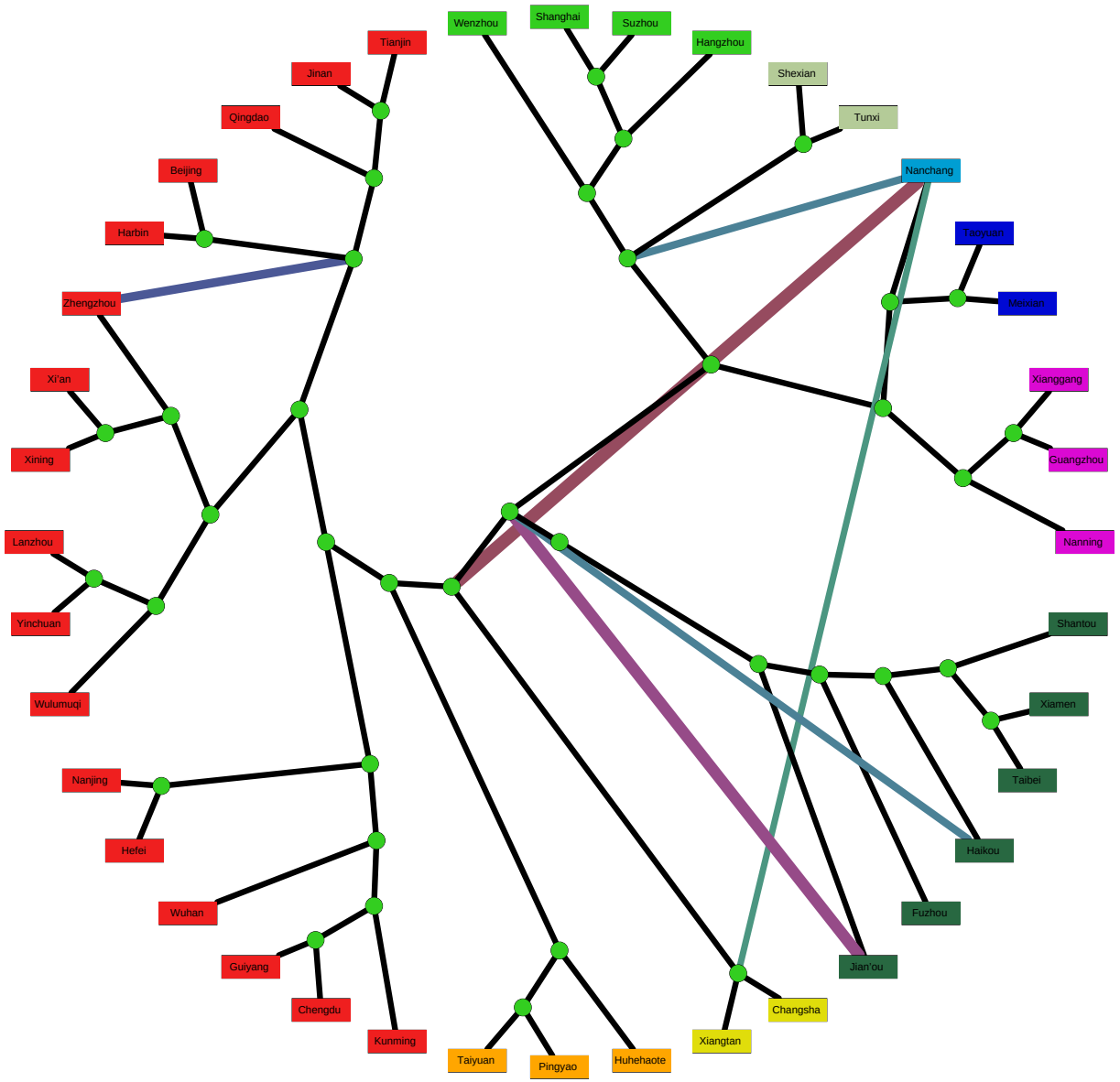
Swadesh Subset

Results: General Results



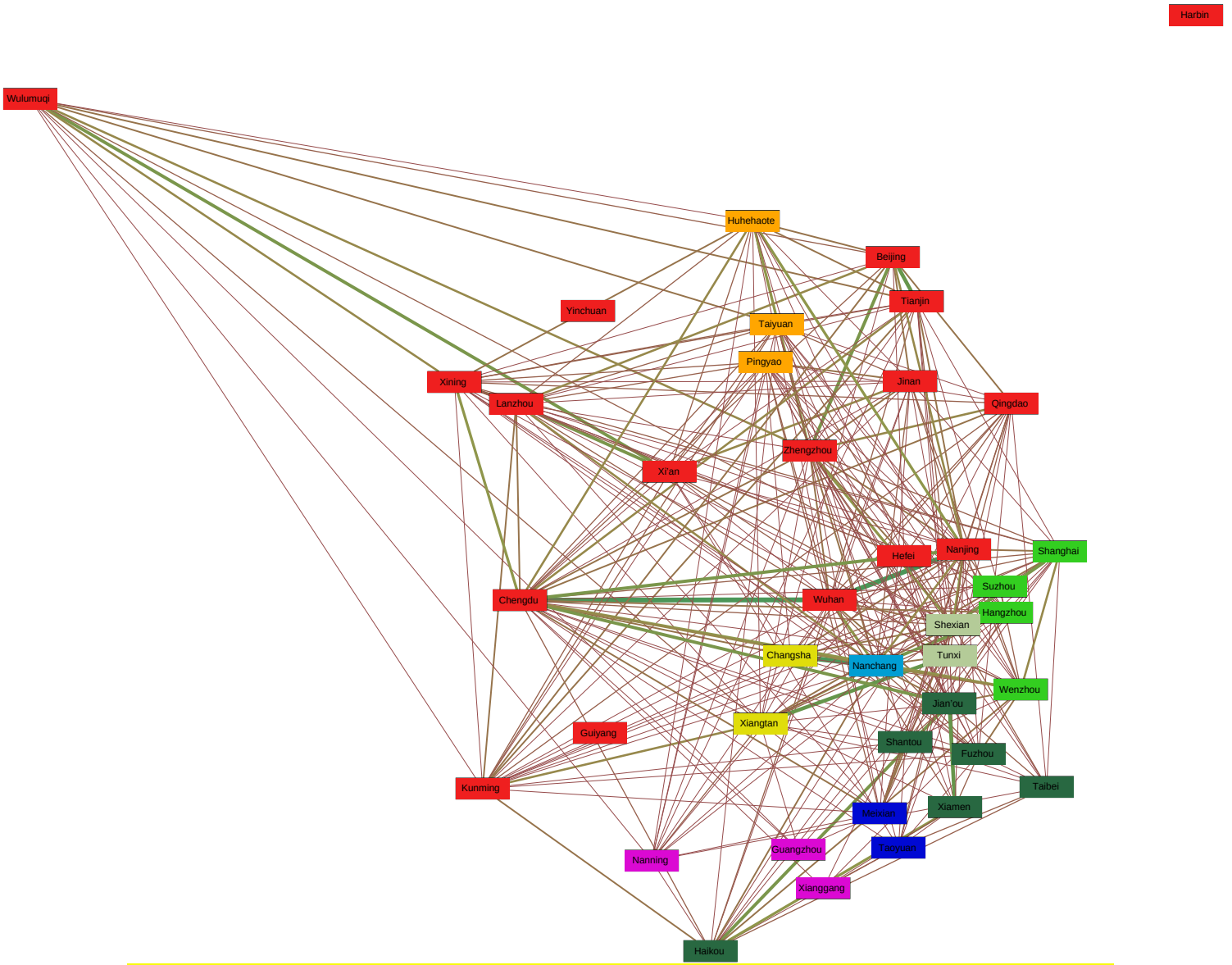
Whole Dataset (Cutoff 5)

Results: General Results



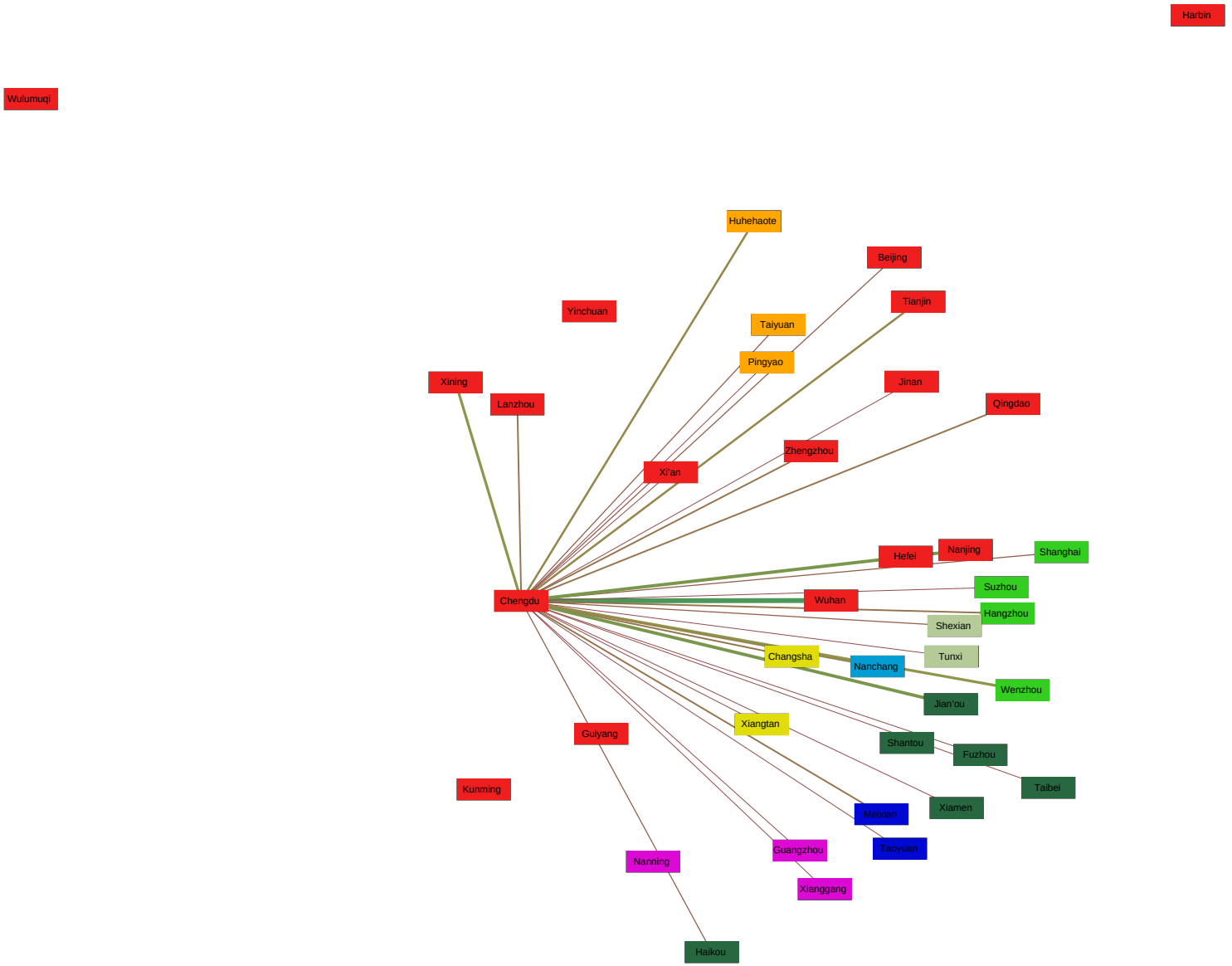
Whole Dataset (Cutoff 10)

Results: Chengdu



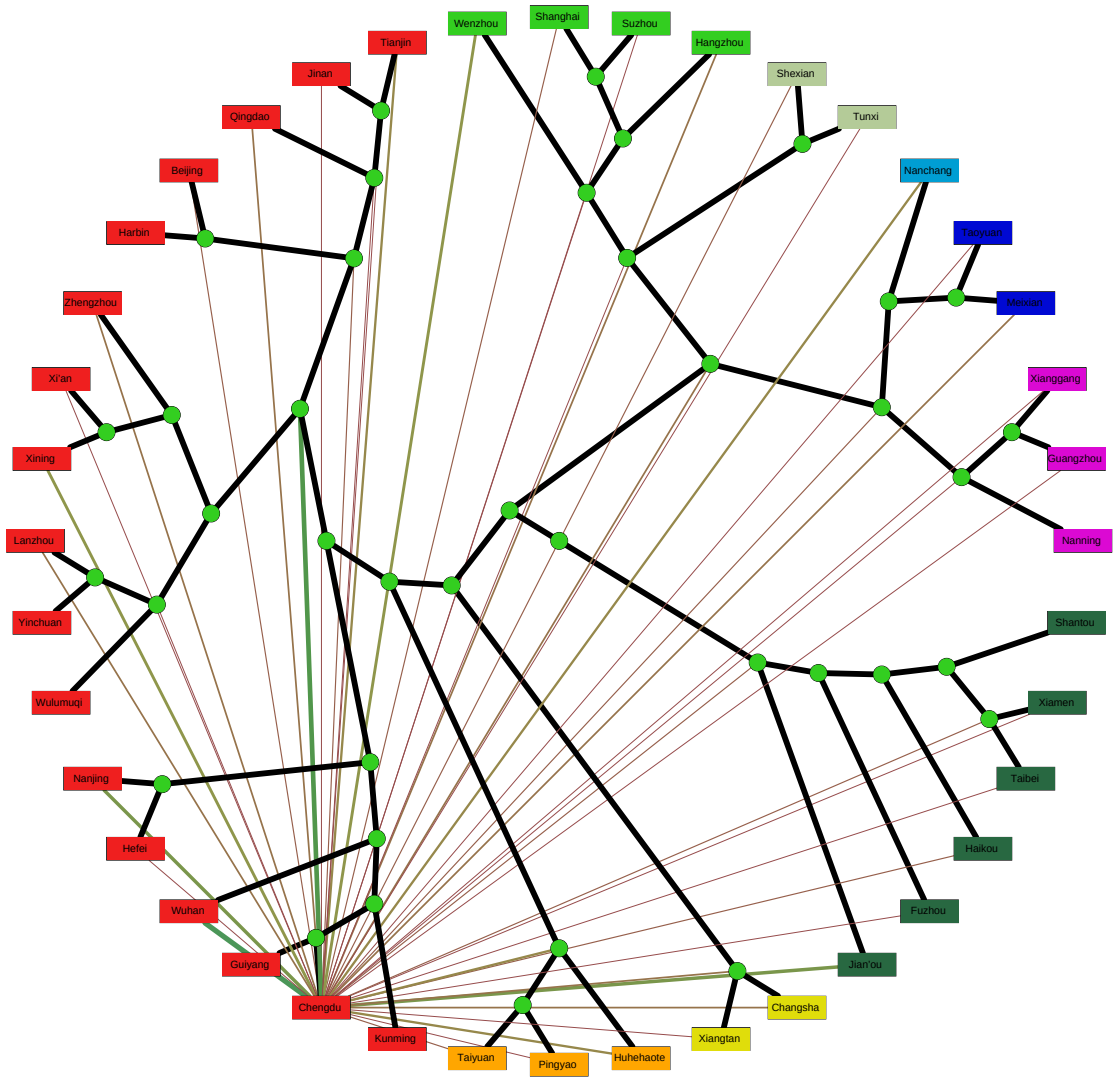
Contemporary Links Mapped to Coordinates

Results: Chengdu



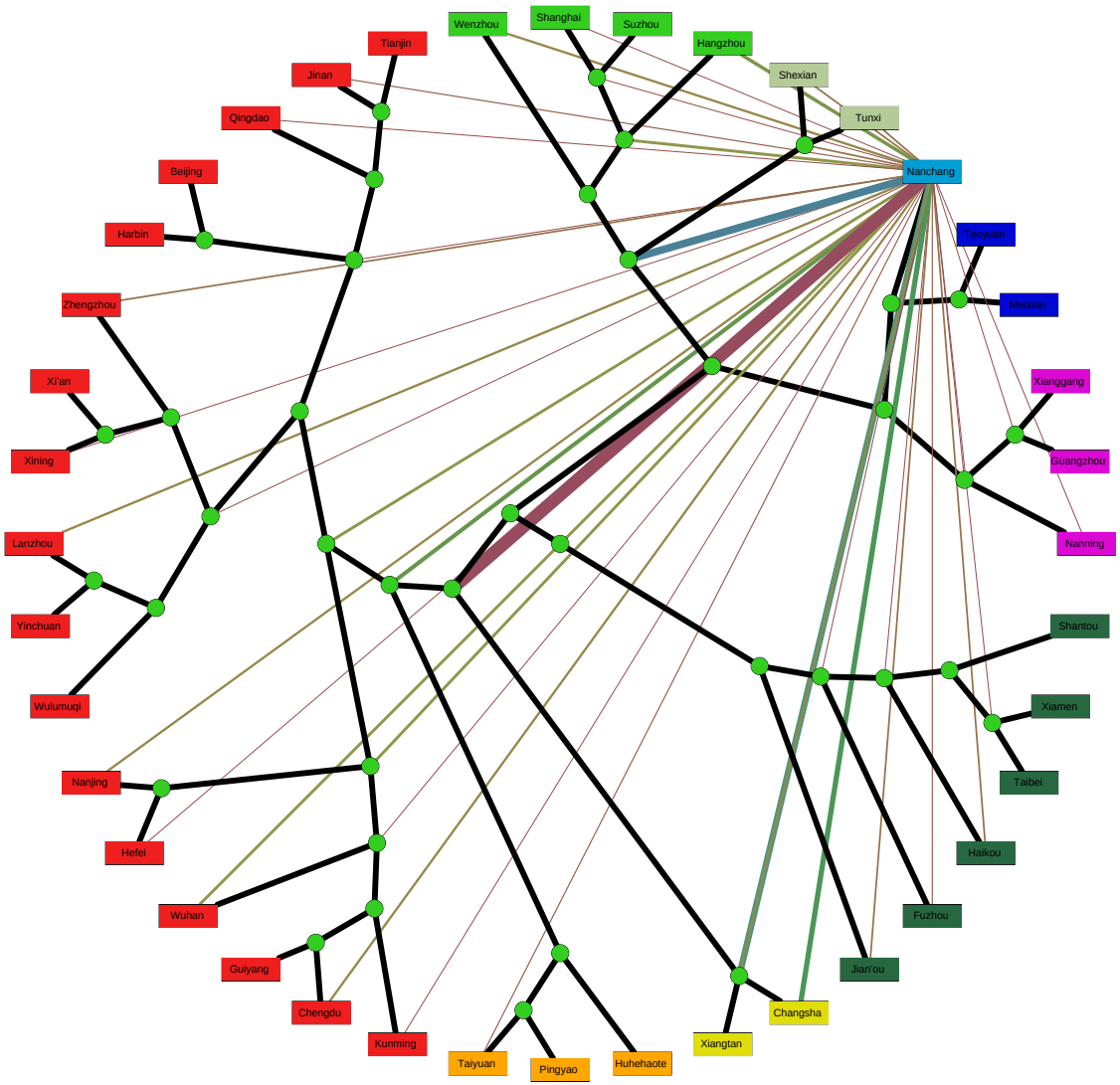
Contemporary Links of Chengdu

Results: Chengdu



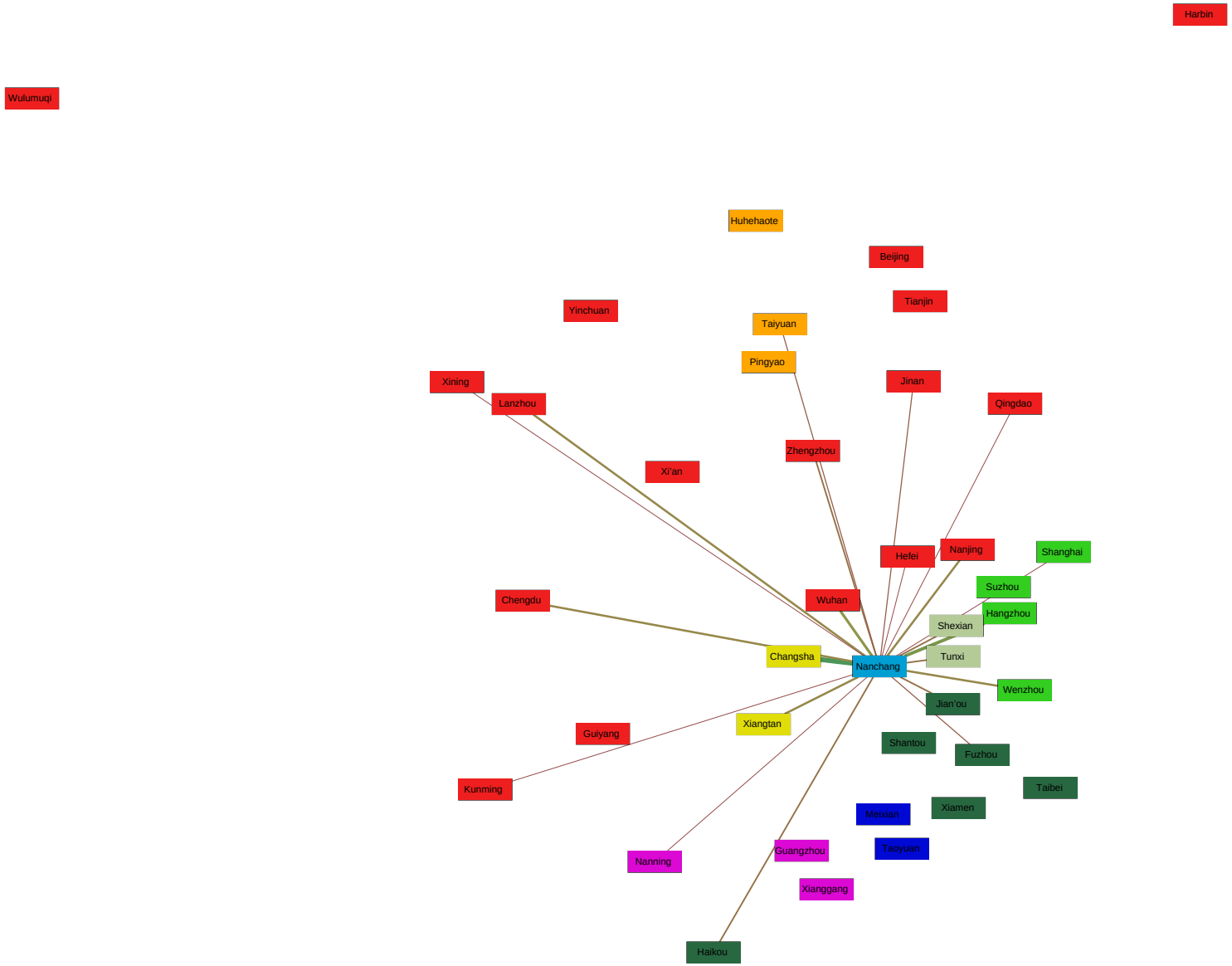
Links of Chengdu

Results: Nanchang



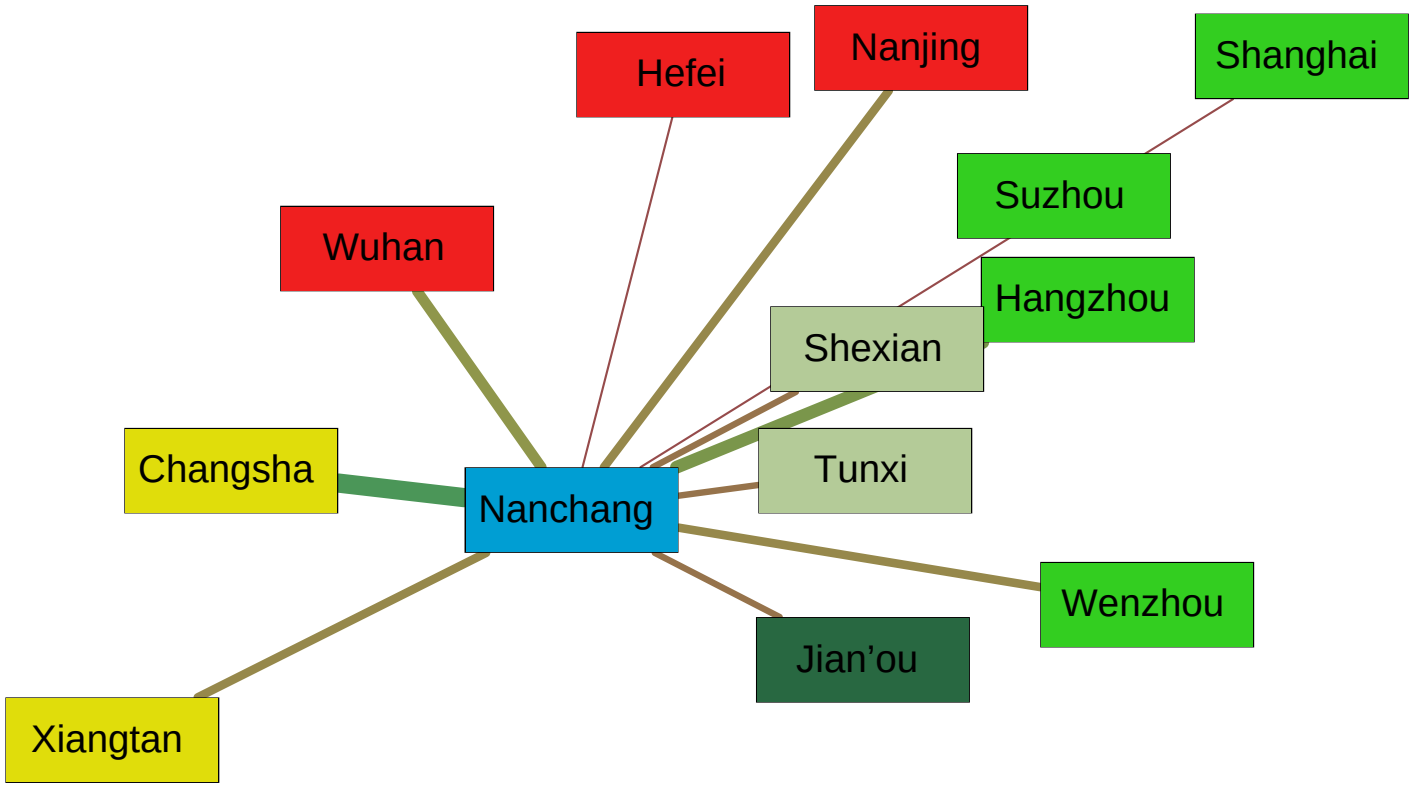
Links of Nanchang

Results: Nanchang



Contemporary Links of Nanchang

Results: Nanchang



Links between Nanchang and its Neighbors

Concluding Remarks

- Phylogenetic networks look nice.
- Phylogenetic networks are – if properly reconstructed – a valid alternative to both the tree and the wave model.
- We need to test the method by Dagan and Martin (2008) on more data and in more detail in order to be able to give an account on its full potential and its limits.

Concluding Remarks

谢谢大家！

Thank you!