Theoretical (In)Compatibilities between the Comparative Method and Cladistics

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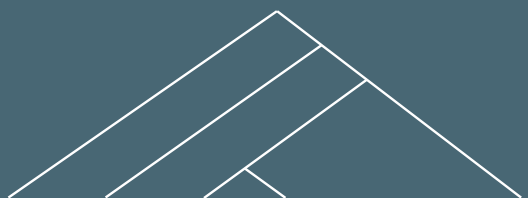
DfGS 2021



Phylogenetic analyses

- Computer assisted
- ~20 years old in linguistics (e.g. Gray & Atkinson 2003, Holden 2002, Rexová et al. 2003)
- Adapted from biology
- Utilize data generated by the comparative method

Phylogenetic analyses

Contents

- The Comparative Method and Issues
- Computer assisted phylogeny from biology
- Data from the comparative method in CAP
- Possible issues ”spilling over” from CM

The Comparative Method

- outline and issues

The Comparative Method

English	Sanskrit	Greek	Latin	Gothic
foot	pad-	pod-	ped-	fotus
father	pitár-	patér	pater	fadar
nephew	nápat	-	nepos	-

Examples modified from Campbell 2013, p. 136.

The Comparative Method

English	Sanskrit	Greek	Latin	Gothic
foot	pad-	pod-	ped-	fotus
father	pitár-	patér	pater	fadar
nephew	nápat	-	nepōs	-

Examples from Campbell 2013, p. 136.

The Comparative Method

English	Sanskrit	Greek	Latin	Gothic
foot	pad-	pod-	ped-	fotus

Sound correspondence set:

f	p	p	p	f

The Comparative Method

English	**Sanskrit**	**Greek**	**Latin**	**Gothic**
f	p	p	p	f

/p/ is reconstructed as the ”proto-sound”.

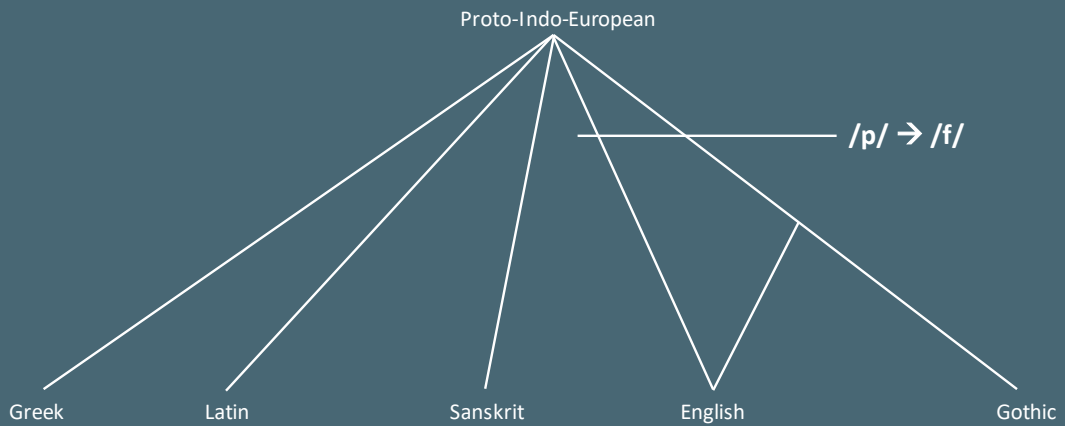
The Comparative Method

English	Sanskrit	Greek	Latin	Gothic
f	p	p	p	f

/p/ is reconstructed as the ”proto-sound”.

English and Gothic thus share an innovation, or apomorphy, and can be grouped together in a clade.

The Comparative Method



The Comparative Method

1. Combined homology hypotheses - which words and sounds are homologous?

2. Ancestral state reconstruction for the MRCA

3. Estimate phylogeny by shared apomorphies

4. Improve reconstruction and phylogeny assessment

Ancestral State Reconstruction

- The reconstruction depend on the tree

In fact:

- ”[…] the tree being used is the true tree […]” – Omland 1999

- Reconstructions *without* a tree topology must lead to assumptions of said topology

Ancestral State Reconstruction

English	Sanskrit	Greek	Latin	Gothic
f	p	p	p	f

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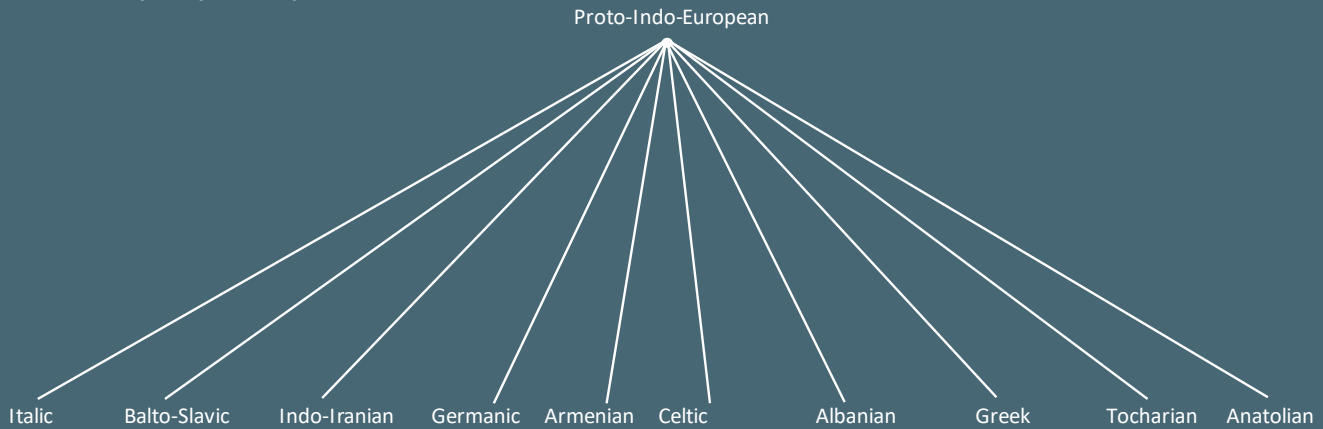
Ancestral State Reconstruction

English	Sanskrit	Greek	Latin	Gothic
f	p	p	p	f

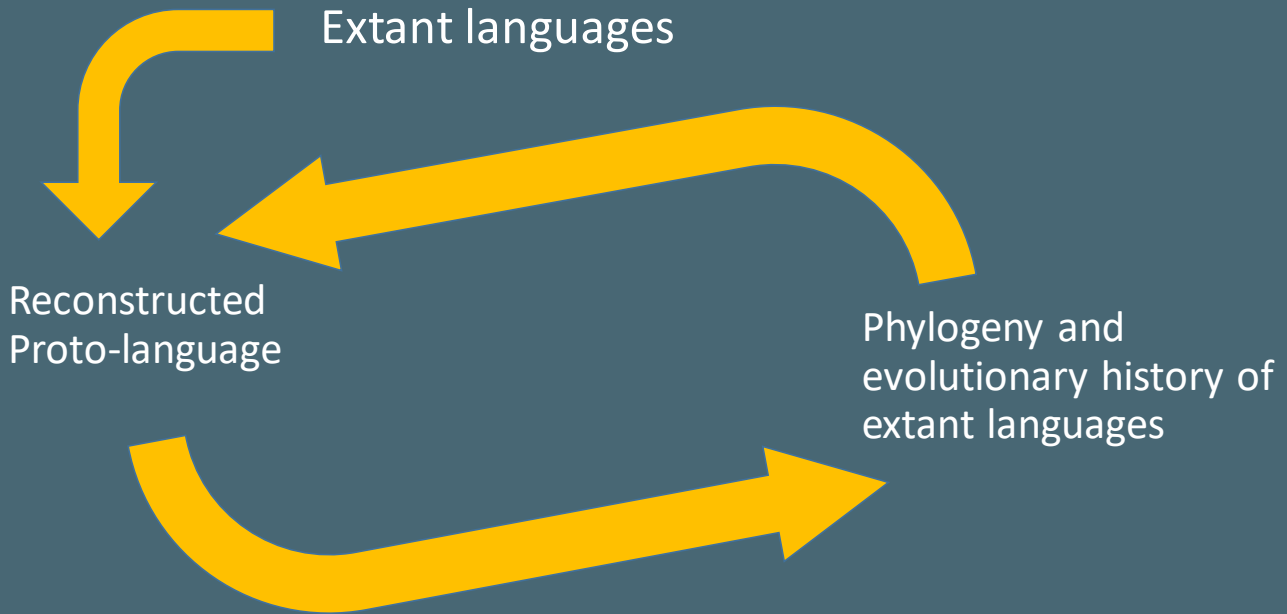
/p/ is reconstructed as the ”proto-sound”.

Possible effects on results?

Giant polytomy:



Possible effects on results?



Computer assisted phylogeny

- practices in biology

Computer assisted phylogeny - Biology

1. Vertebrate scapula
2. Variation in the Scapula → Character states
3. Infer phylogeny
4. Ancestral state of scapula in the MRCA and other internal nodes

Computer assisted phylogeny - Biology

1. Homology hypotheses a) - which characters are homologous?
2. Homology hypotheses b) – which character states are homologous?
3. Estimate phylogeny by tree search and optimality criteria
4. Ancestral state reconstruction

Computer assisted phylogeny - Biology

No assumption of tree topology in the coding (ideally)

Phylogeny & Ancestral States - Comparison

Comparative Method

1. Combined homology hypotheses - which words and sounds are homologous?
2. Combined homology hypotheses - which words and sounds are homologous?
3. Ancestral state reconstruction for the MRCA
4. Estimate phylogeny by shared apomorphies

Biology

1. Homology hypotheses a) - which characters are homologous?
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Phylogeny & Ancestral States - Comparison

Cognate data (homologous words) come without assumptions of topology:

English	**Sanskrit**	**Greek**	**Latin**	**Gothic**
foot	pad-	pod-	ped-	fōtus
f	p	p	p	f

→ /p/ is reconstructed

Phylogeny & Ancestral States - Comparison

Comparative Method

1. Combined homology hypotheses - which words and sounds are homologous?
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Biology

1. Homology hypotheses a) - which characters are homologous?
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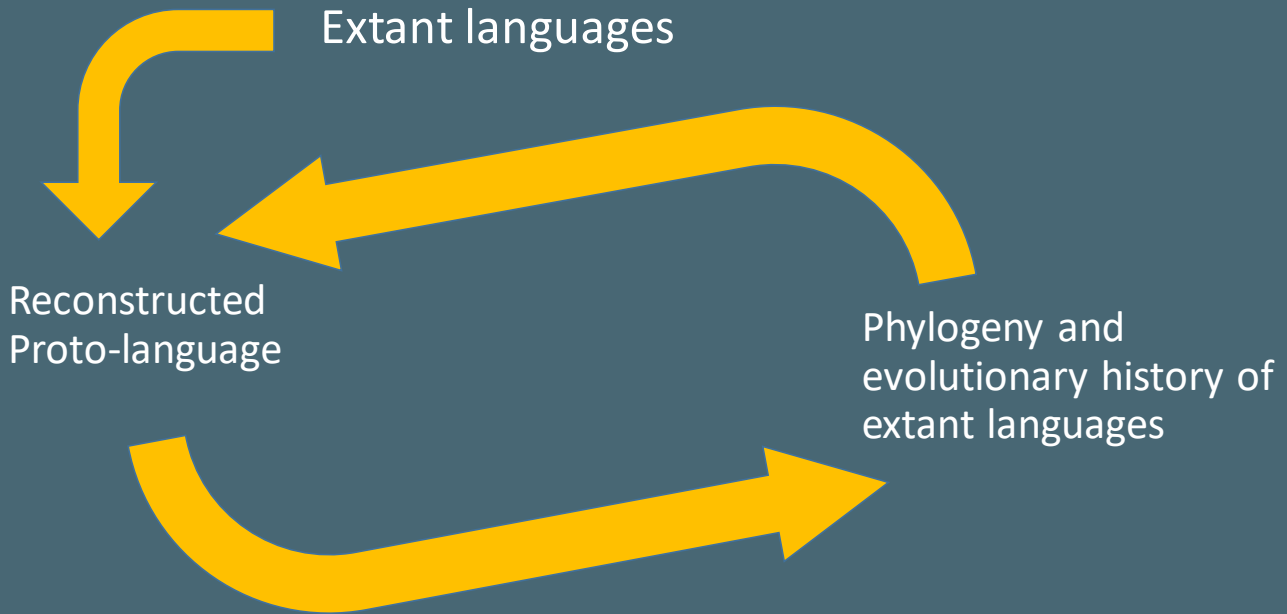
Problem or not?

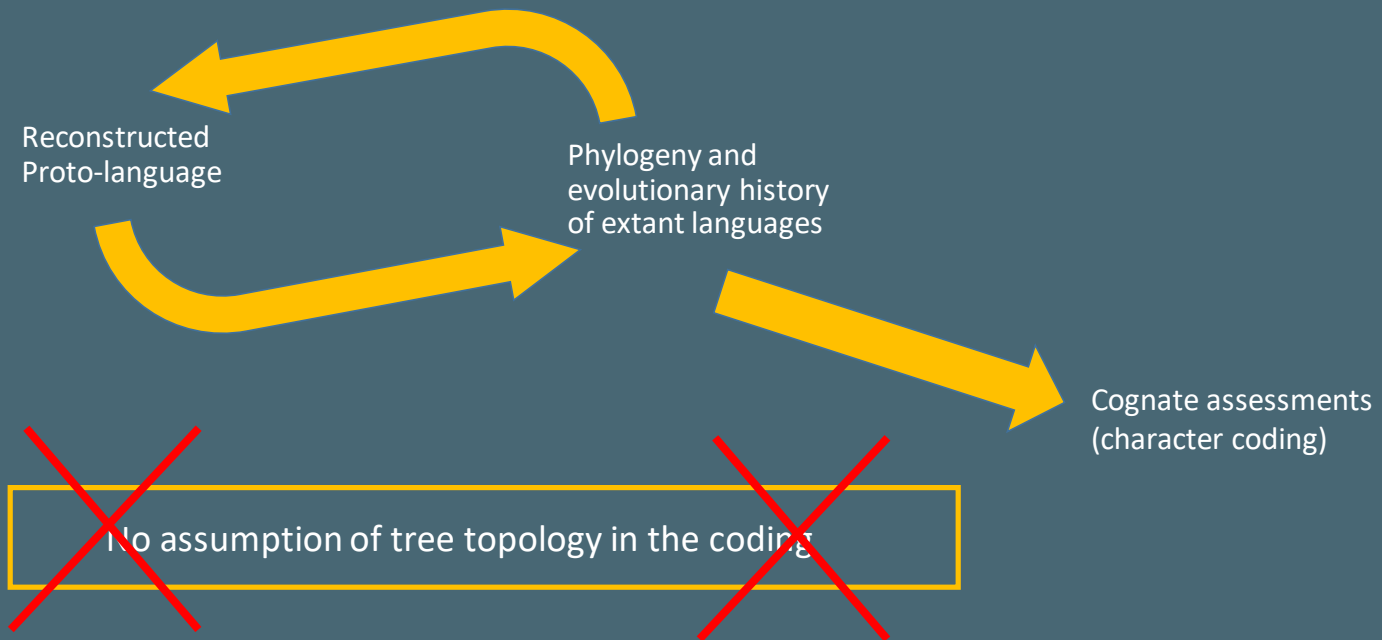
Phylogeny & Ancestral States - Circularity

1. Combined homology hypotheses - which words and sounds are homologous?
2. Ancestral state reconstruction for the MRCA
3. Estimate phylogeny by apomorphies
4. Improve reconstruction and phylogeny assessment

Phylogeny & Ancestral States - Circularity



Phylogeny & Ancestral States - Circularity



Phylogeny & Ancestral States - Circularity

Cognate data (homologous words) come without assumptions of topology

- This is true only if solely based on joint hypothesis of cognates and sound correspondences
- What are the effects if that isn’t the case?

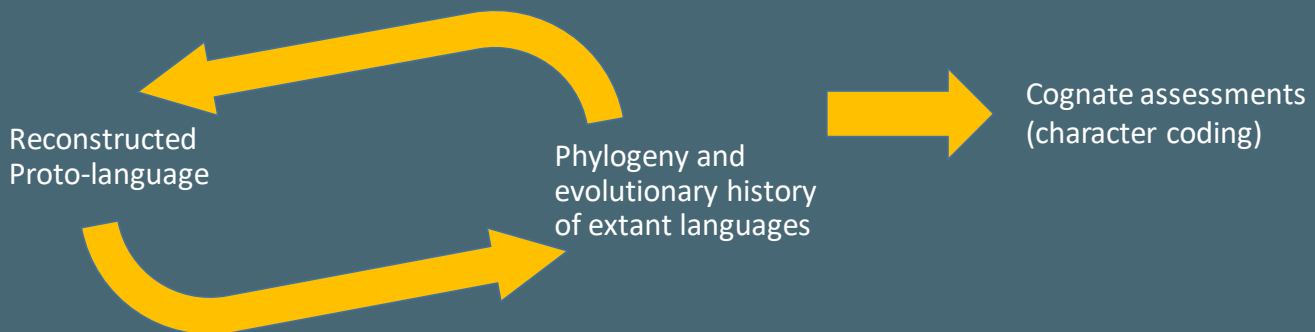
Possible effects on results?

- Wrong tree
  - Topology congruent with assumptions
  - Unclear what this means

Possible effects on results?

English	Sanskrit	Greek	Latin	Gothic
f	p	p	p	f

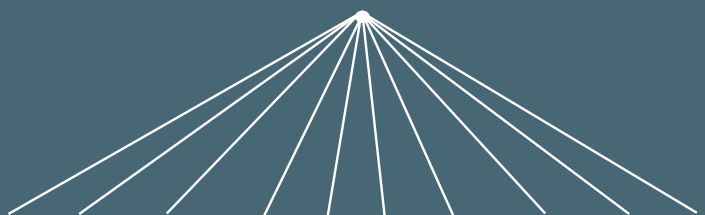
/p/ is reconstructed as the ”proto-sound”.



Possible effects on results?

- Wrong tree
  - Topology congruent with assumptions?
  - Unclear what this means

- Polytomy?



Conclusions

- Comparative method crucial for homology assessments
- When used for reconstruction it comes with assumptions on tree topology
- Reconstructions depend on the tree → don't use them to estimate the tree
- Cognate data (homologous words) can be used if they are independent of the reconstructed proto-language
- Next step: Do this in practice

Conclusions

- Next step: Do this in practice:

    1. Use cognate assessments done without reconstructions and circular ”improvement”

    2. Run phylogenetic analysis

    3. Reconstruct ancestral states

Conclusions

- Why?

    1. Circularity moved higher up in the hierarchy of assumptions

    2. Hypotheses that are more testable

    3. (hopefully) Better tree and thus better reconstructions

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