Next generation phylogenetic inference @Evolution2016: Nearest neighbors of phylogenetic time-trees

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(joint work with Chris Whidden and Erick Matsen)

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Motivation

- General statistics is at least 5 years ahead of phylostatistics.

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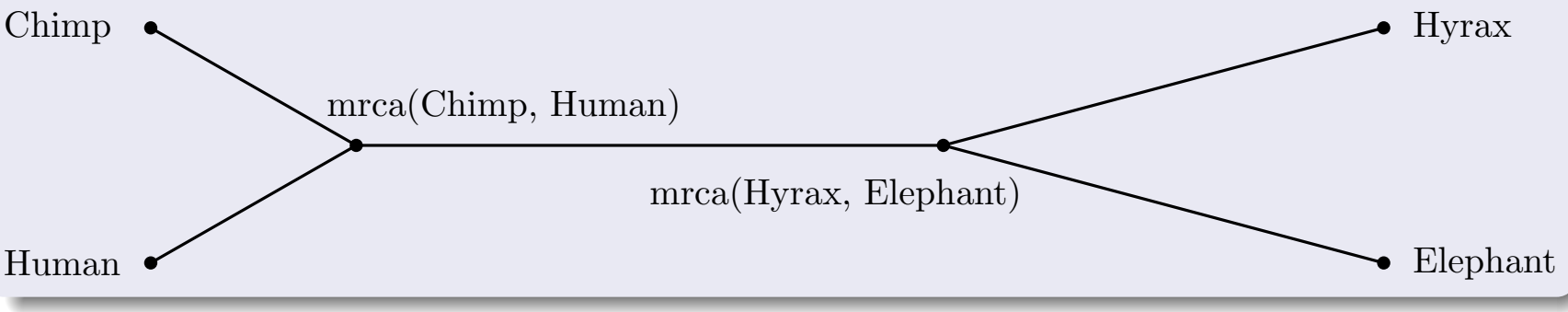
- What's wrong with trees?

Same as above but with a mortarboard on

- MCMC algorithms
  - Improving efficiency = smart proposals
  - Point estimates AKA posterior summary
- Tree search methods in general
  - Semi-convergence
  - Valleys
  - Terraces

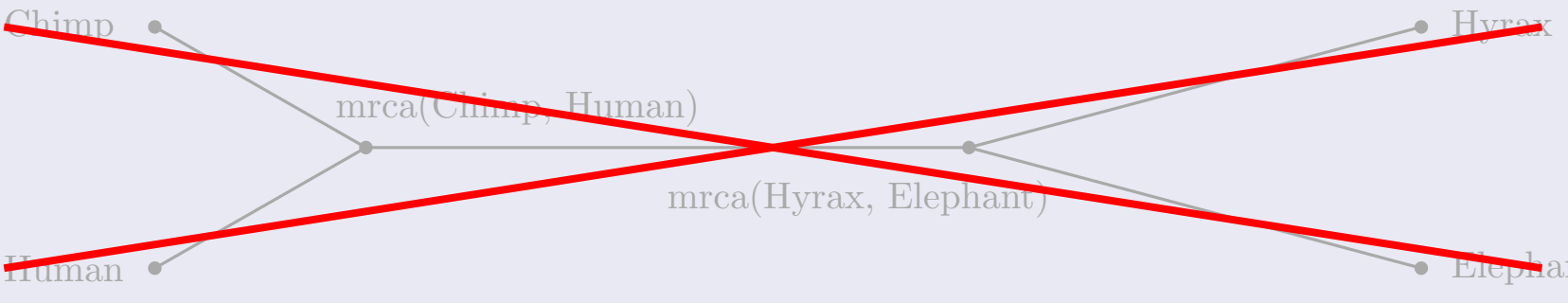
Introduction

Phylogenetic tree

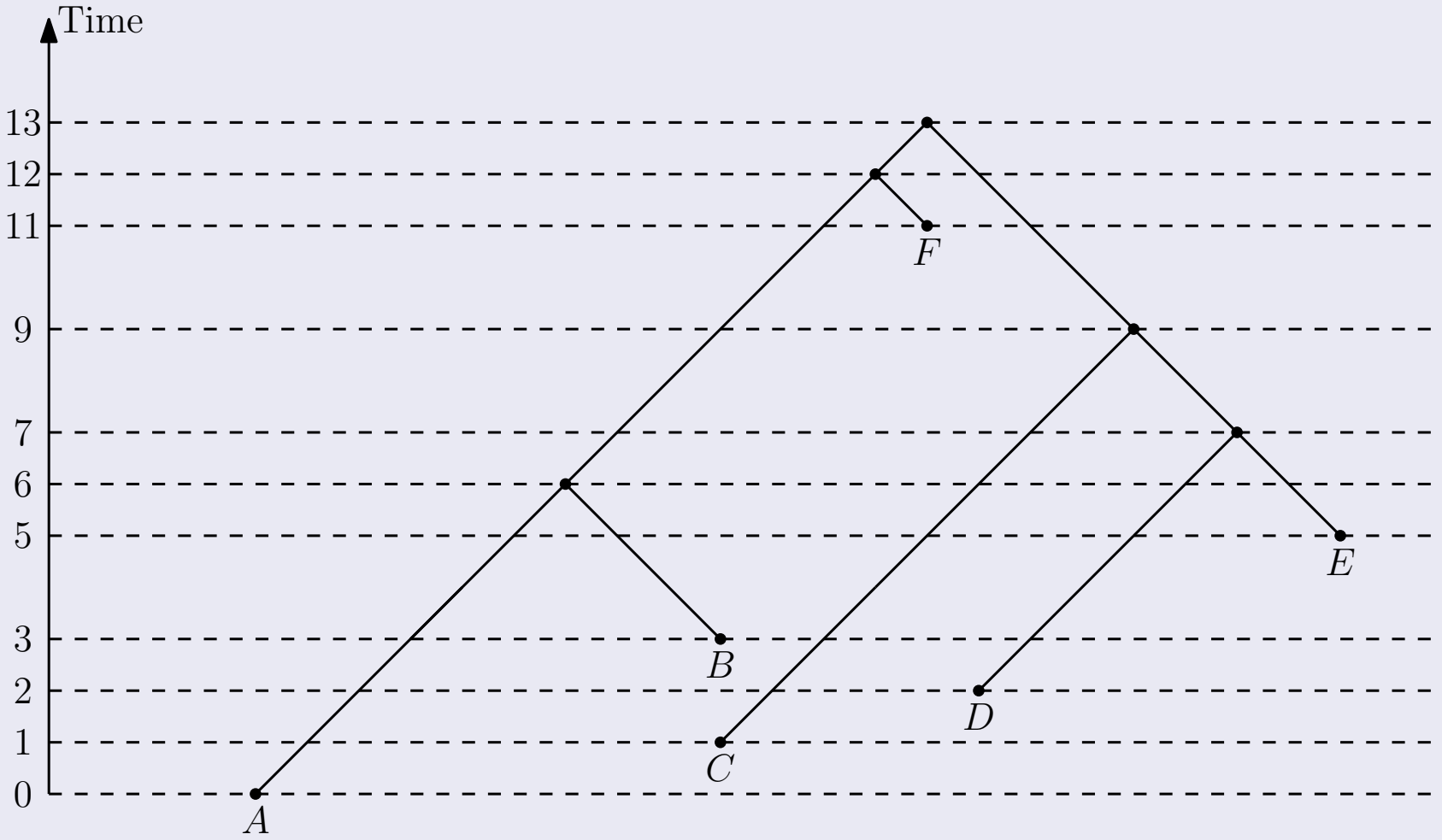


Introduction

Not in this talk

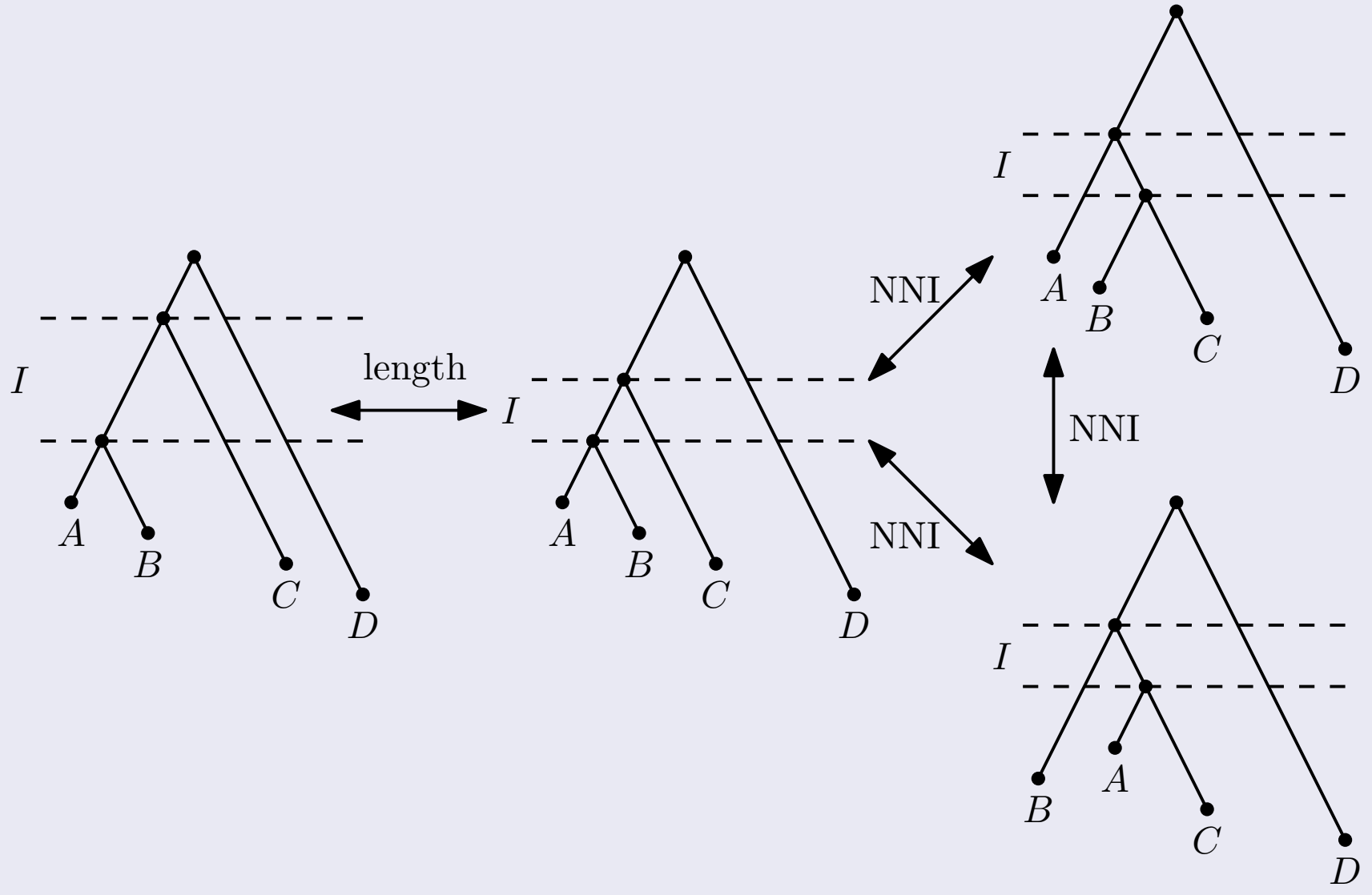


(Discrete) Time-tree



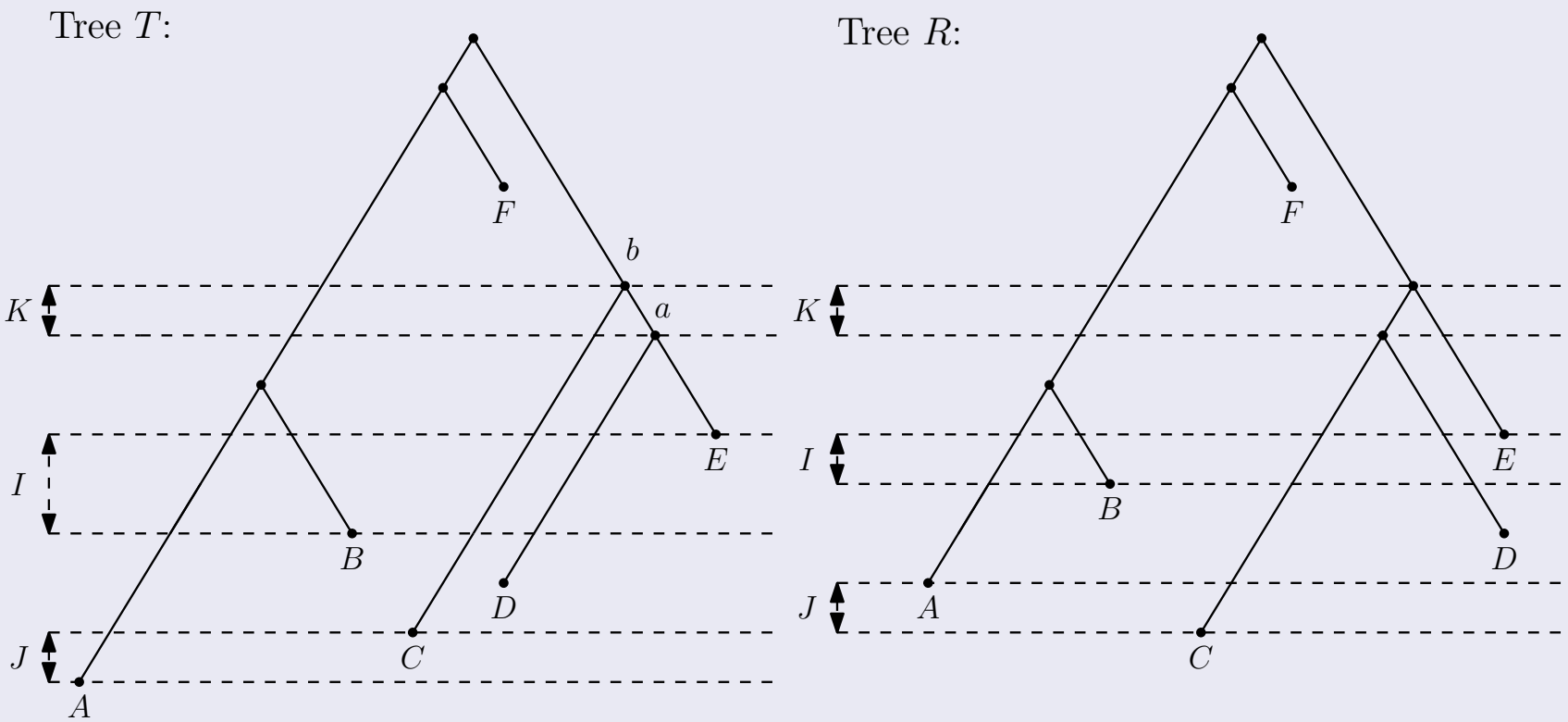
Main definition

Discrete time-tree space



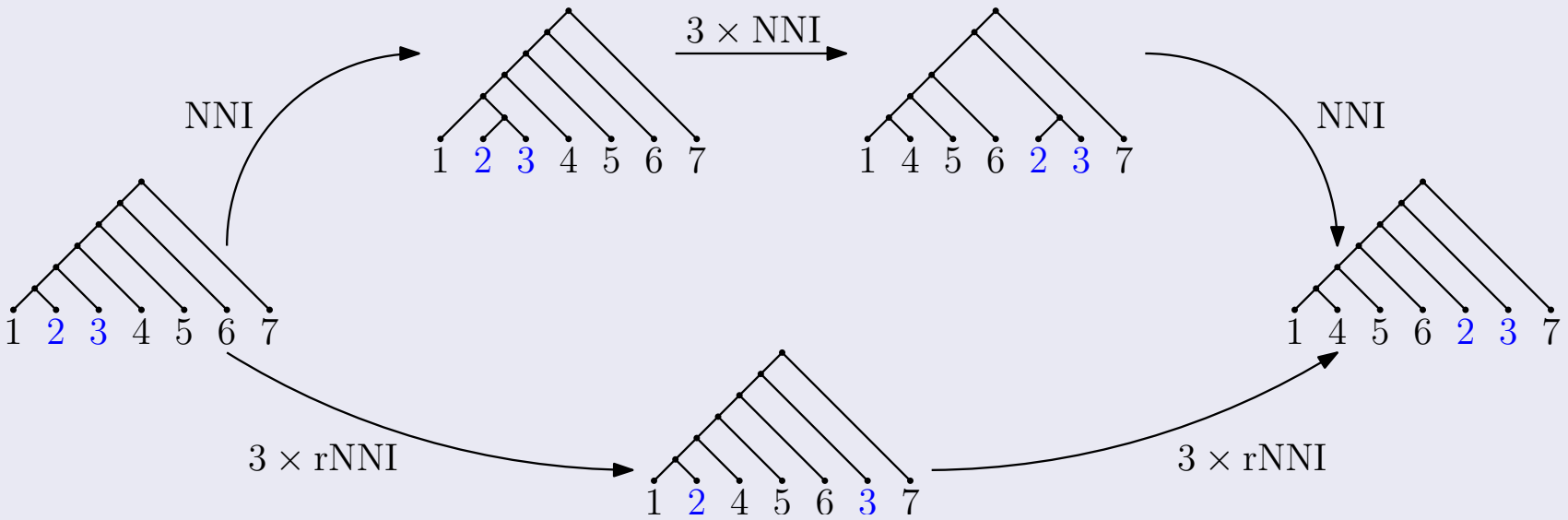
Main example

Trees at distance 3



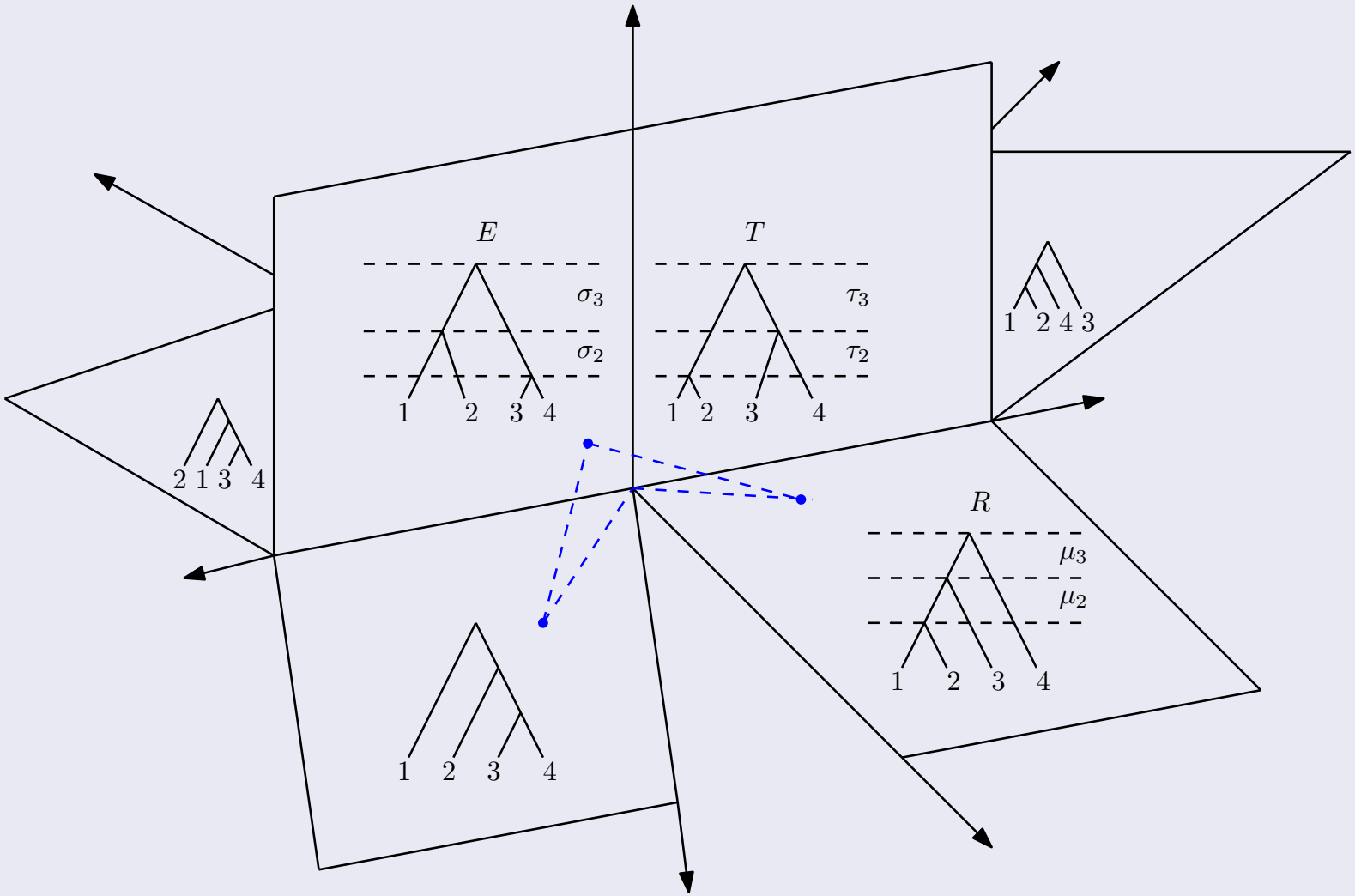
Looks promising!

G, Whidden, and Matsen. *arXiv*, to appear in July 2016



Promising indeed

G and Drummond. *JTB*, 2016



More results

Mathematical insight

- Geometry of discrete time-trees
  - Diameter
  - Micro- and macro-geometry
- Random walking
  - Bottle necks
  - Curvature

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Surprise!

A better bound for the size of r-neighborhoods in NNI.

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Surprise!

A better bound for the size of r-neighborhoods in NNI.

This is gonna be fun!

A *very* fertile ground for mathematical, computational, and phylogenetic/phylodynamic results.

Thank you for your attention!

Alex Gavryushkin and Alexei Drummond
The space of ultrametric phylogenetic trees
Journal of Theoretical Biology, Vol. 402, 197–208, 2016

Alex Gavryushkin, Chris Whidden, and Frederick A. Matsen IV
Combinatorics of discrete time-trees: algorithmic insights and open problems
To appear on the *arXiv*, July 2016

`https://github.com/gavruskin/tauGeodesic`

`https://github.com/gavruskin/tTauCurvature`