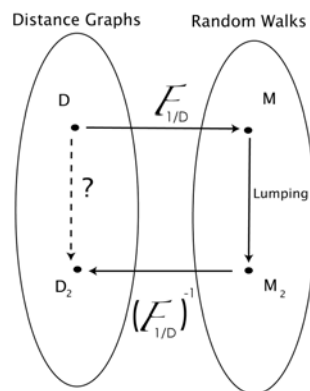


Category theory and the notion of **natural** in bioinformatic models

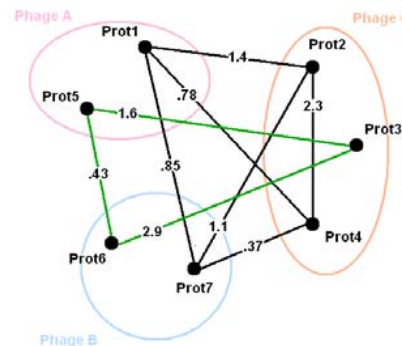
Peter Salamon, James Nulton, David Aaby, Andrew Detzel
and Barbara Bailey
San Diego State University



The Problem

- Given a distance structure on a set S , we want to come up with a “**natural**” way to extend it to a distance structure on any partition of S .

?



The General Goal

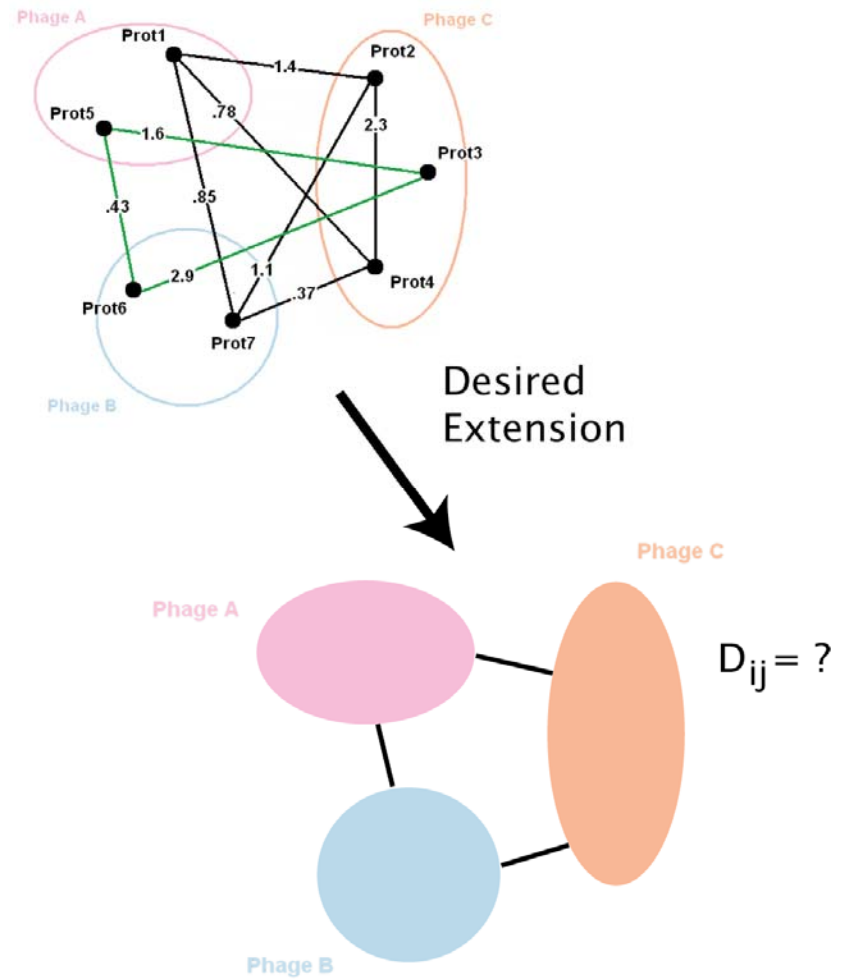
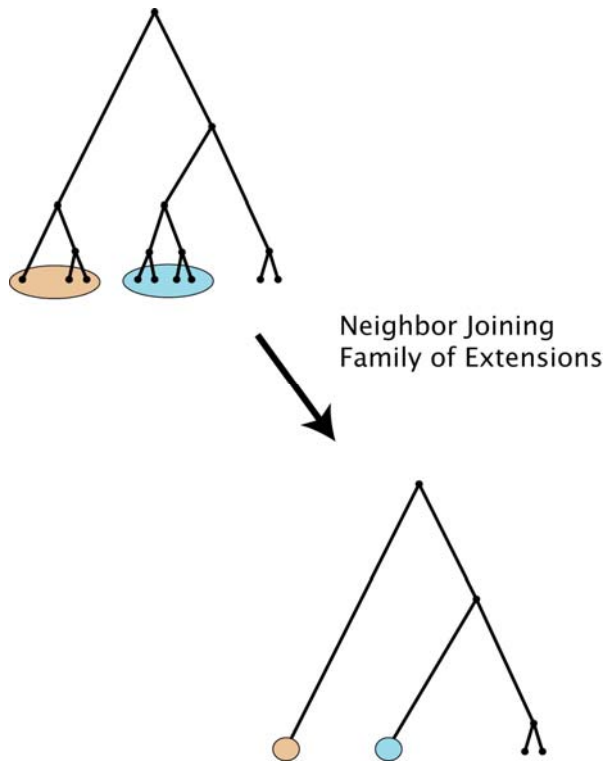


- Provide objective criteria (besides matching data and robustness) for the quality and appropriateness of definitions within a model.
 - Define **NATURAL**



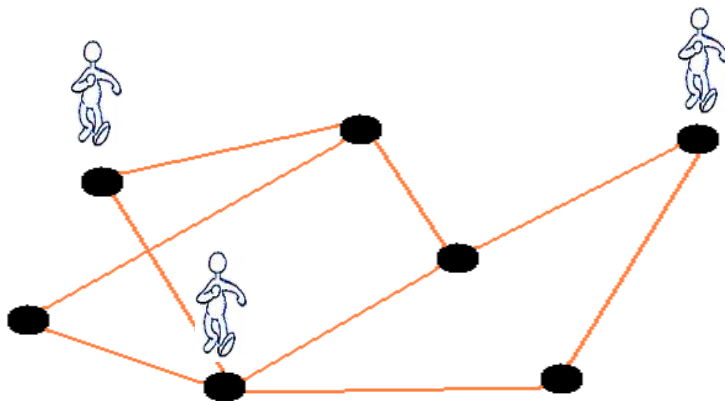
R. Crumb

The Specific Goal



EvoHop: a random walk on phage proteins mimicking evolution

- D_{ij} in protein homology measures time
- $1/D_{ij}$ is a rate
- Assigns Google Ranks



Want $P_{ij} \propto 1/D_{ij}$

The Answer

- Ask for extension to be **functorial**.

$$(D_2)_{ij} = \frac{|\phi_i| \times |\phi_j|}{\sum_{\ell \in \phi_i, m \in \phi_j} \frac{1}{D_{\ell m}}} x$$

