

Motivation
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Eco-devo-evo spatial dynamics on graphs

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Motivation
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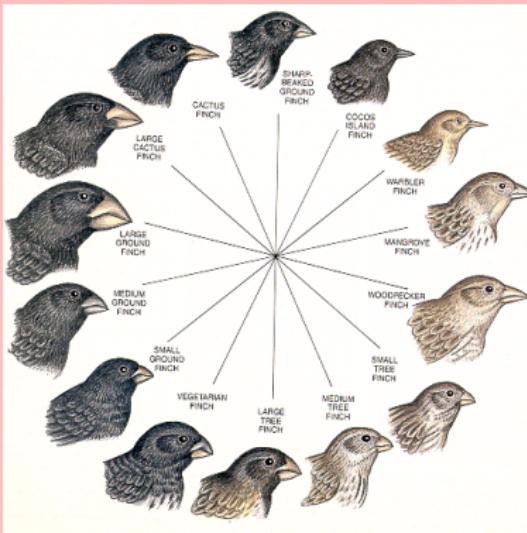
Radiations
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Speciation: a complex process

Darwin finches, Cichlids, Orchids and Moths



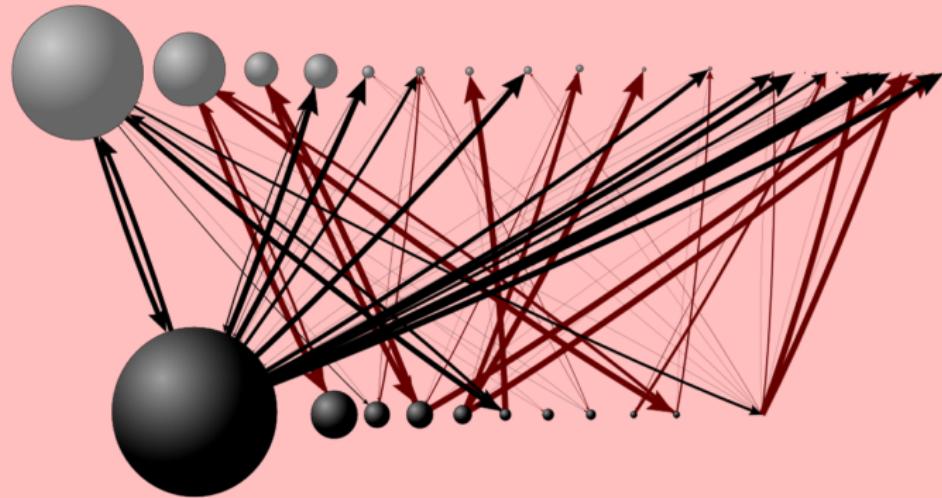
Darwin finches, Cichlids, Orchids and Moths



Darwin finches, Cichlids, Orchids and Moths



Darwin finches, Cichlids, Orchids and Moths



Questions

- Do we need to invoke niche driven mechanisms to predict radiations and biodiversity patterns?

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- Do quantitative genetics traits predict bimodal distributions in the absence of selection?

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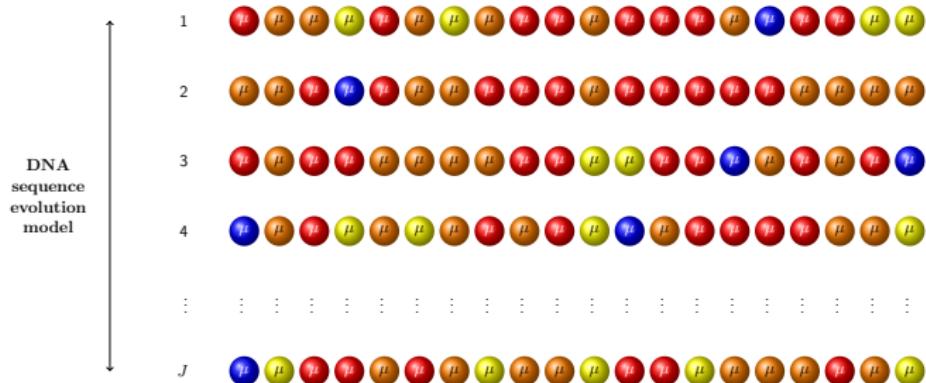
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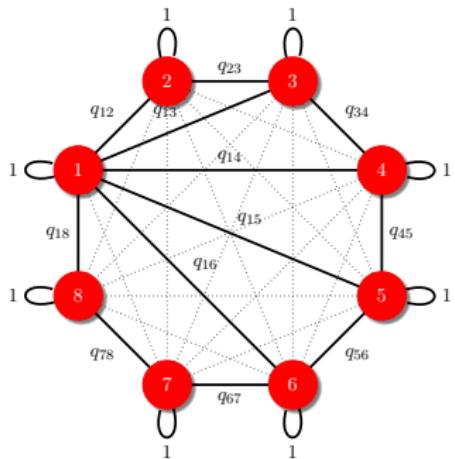
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Genomes



Genomes in a mating graph



$$\mathbf{Q} = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\ 1 & 1 & q_{12} & q_{13} & q_{14} & q_{15} & q_{16} & 0 & q_{18} \\ 2 & q_{21} & 1 & q_{23} & 0 & 0 & 0 & 0 & 0 \\ 3 & q_{31} & q_{32} & 1 & q_{34} & 0 & 0 & 0 & 0 \\ 4 & q_{41} & 0 & q_{43} & 1 & q_{45} & 0 & 0 & 0 \\ 5 & q_{51} & 0 & 0 & q_{54} & 1 & q_{56} & 0 & 0 \\ 6 & q_{61} & 0 & 0 & 0 & q_{65} & 1 & q_{67} & 0 \\ 7 & 0 & 0 & 0 & 0 & 0 & q_{76} & 1 & q_{78} \\ 8 & q_{81} & 0 & 0 & 0 & 0 & 0 & q_{87} & 1 \end{bmatrix}$$

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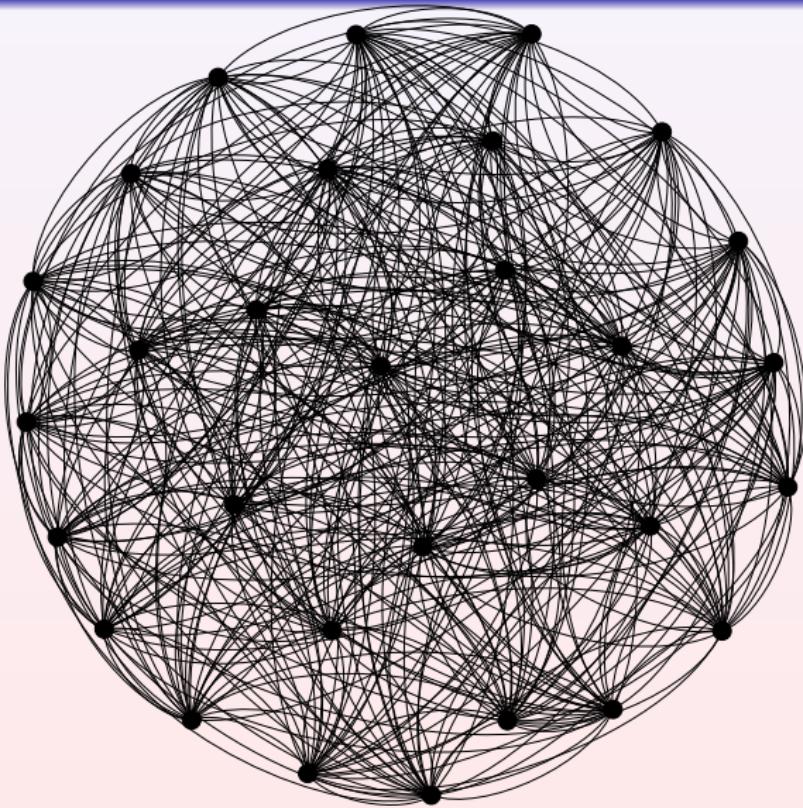
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Genomes in spatial landscapes



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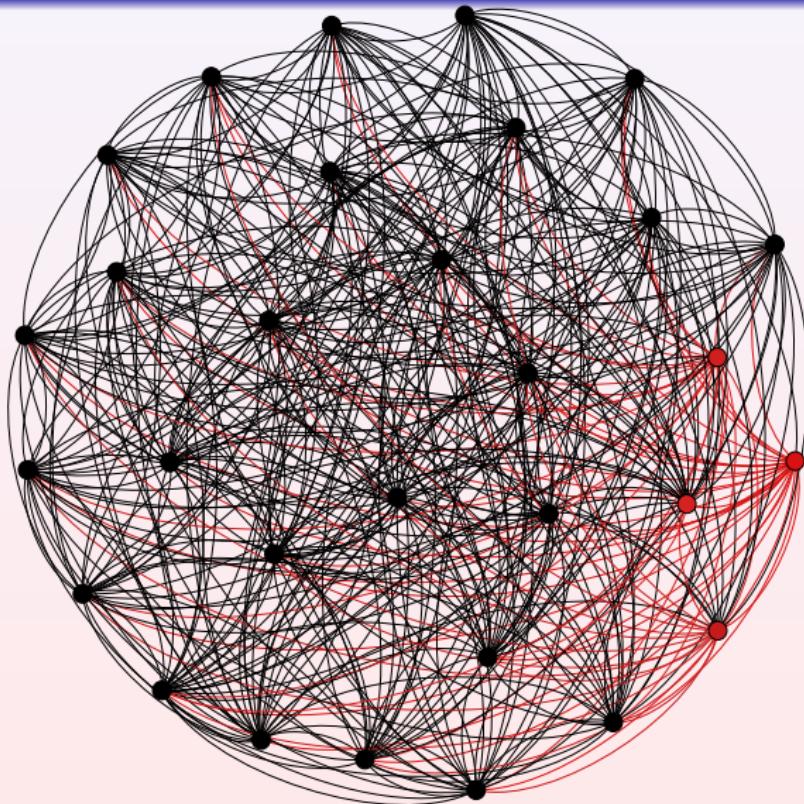
Questions

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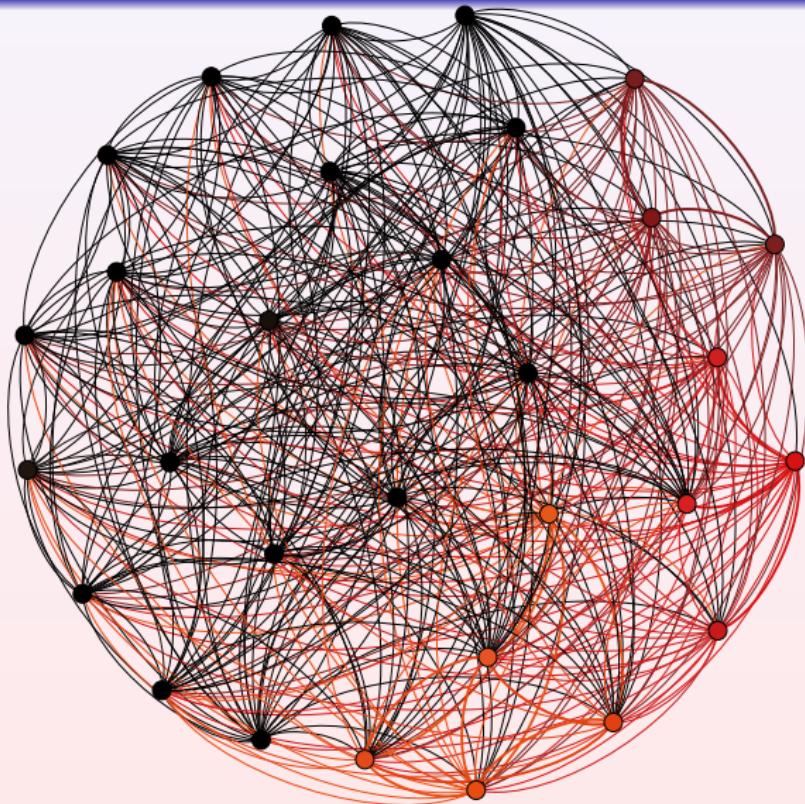
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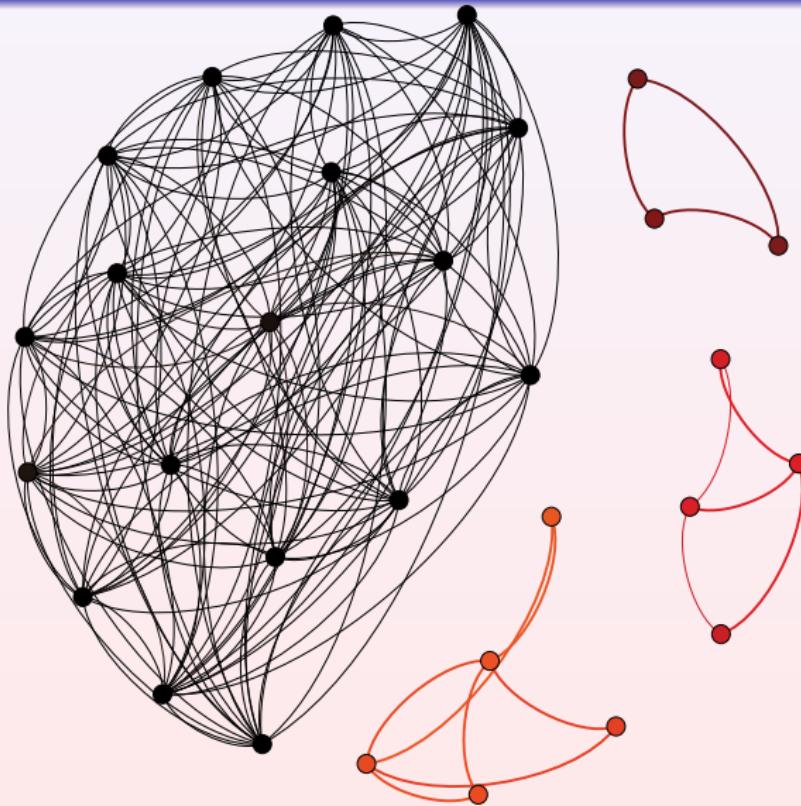
Genomes in spatial landscapes



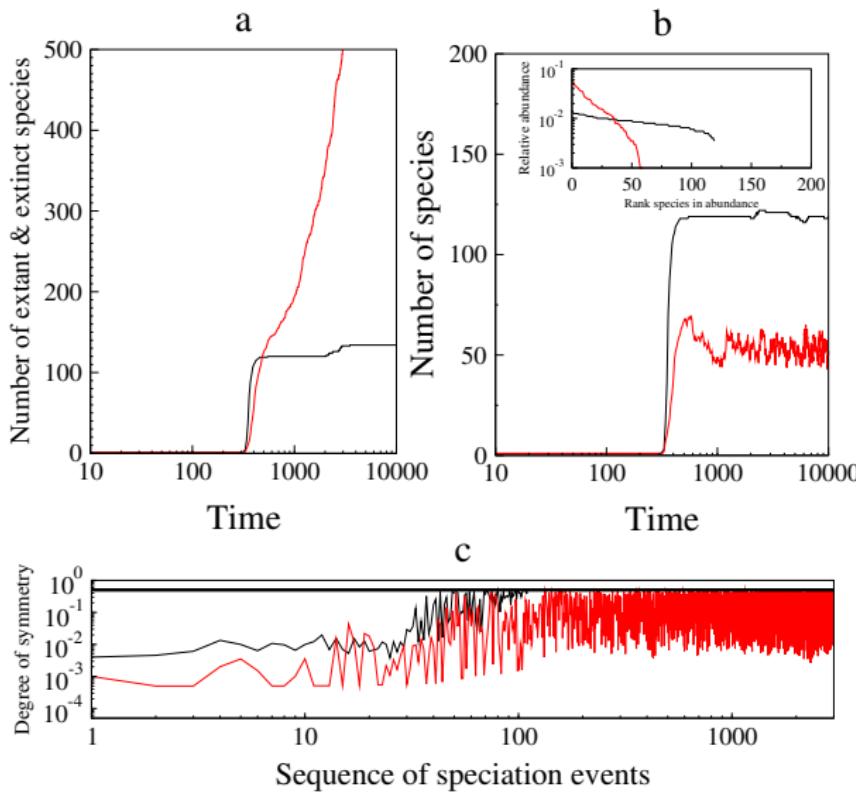
Genomes in spatial landscapes



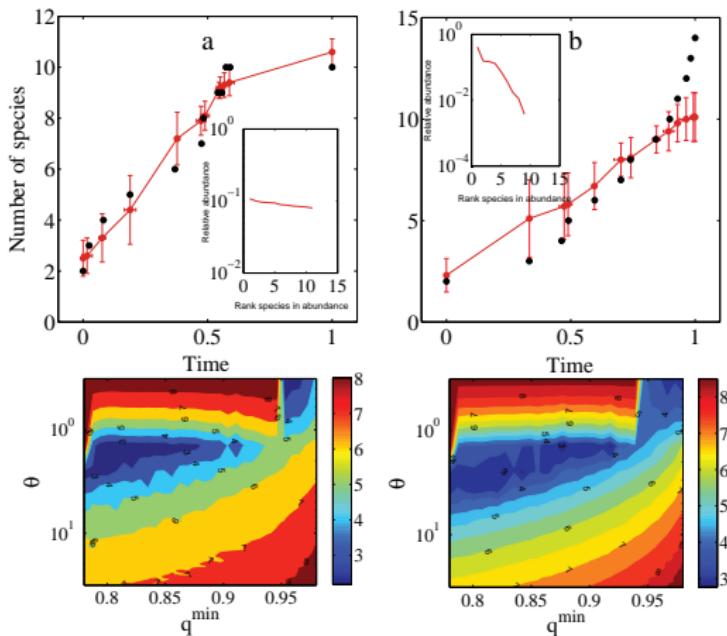
Genomes in spatial landscapes



Radiations: theory



Radiations: data



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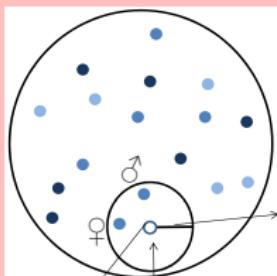
Radiations
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Ecological, developmental, and evolutionary processes

Eco-devo-evo spatial dynamics

A (d_{max})

A: death
B: sex (if *)
C: recombination
D: mutation
E: phenotype
F: birth
* $d^{\delta\varphi} < d_{max}$ & $q^{\delta\varphi} > q_{min}$
(d = physical distance;
q = genetic similarity)

1	-1	-1	-1	1	1	1	-1	1	1	-1
-1	1	-1	-1	-1	1	1	1	-1	1	-1

or

1	-1	-1	-1	1	1	1	-1	-1	1	-1
-1	1	-1	-1	-1	1	1	1	1	1	-1

1	-1	1	-1	-1	1	-1	-1	1	-1	-1
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$$z_i = g + N(\mu, \sigma^2)$$

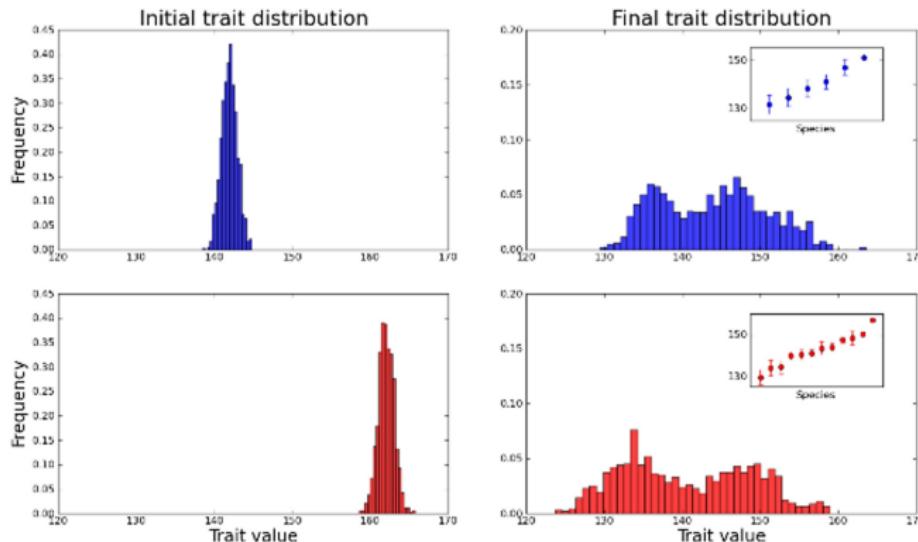
E phenotype

C genotype

D

E

Genotype-phenotype: theory



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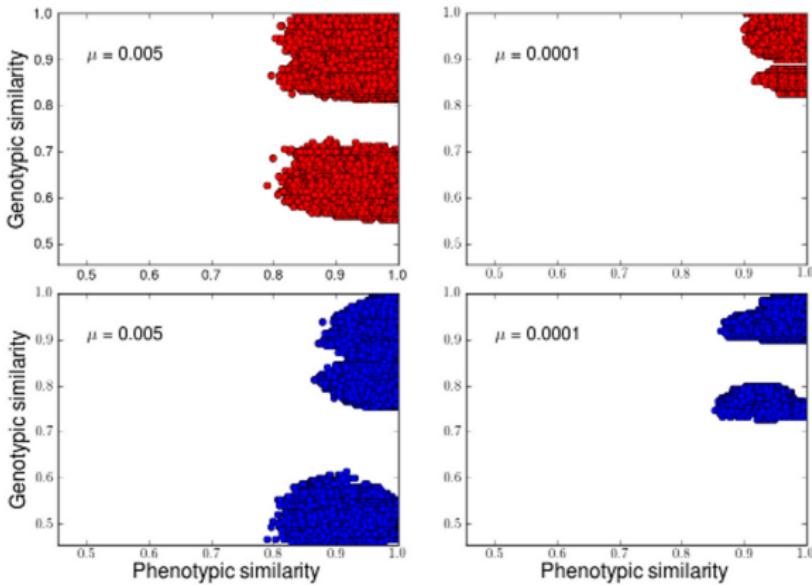
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Genotype-phenotype: theory



Outlook

- ① In addition to adaptive radiations driven by natural selection, just drift or negative frequency-dependent sexual selection may both predict some radiations.

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- ① In addition to adaptive radiations driven by natural selection, just drift or negative frequency-dependent sexual selection may both predict some radiations.
- ② An incipient and testable framework to connect quantitative traits, speciation and biodiversity dynamics in ecological networks.

Thank you!

- Computing-scientist staff at NCEAS, University of California Santa Barbara.
- Microsoft Research Ltd., Cambridge, UK.
- Two generations of postdocs at NCEAS.
- Francisco Encinas-Viso and Rampal S. Etienne, Center for Ecological and Evolutionary Studies, University of Groningen, The Netherlands