

SIMULATION CODE FOR INFORMATION NICHE and COMPUTATION NICHE MODEL RESULTS

PURPOSE

The code and data contained in this repository are supplied as supporting material for the submitted PhD thesis titled, “Pathways to Autopoiesis”.

All simulations were written in MATLAB r2016b.

INSTRUCTIONS

The following tables provide information on the MATLAB file to execute to reproduce the results described in Chapters 4 – 9.

Each of the files listed simply needs to be run from the MATLAB environment. All dependent functions and data sets are provided in the same folder, so ensure that you have added the folder path to your MATLAB environment.

Chapter 4 – One State Information Niches (reproduced publication)

Figure	Filename	Description
3a	nicheA_fig3a.m	1-state well-mixed population, no influx
3b	nicheB_fig3b.m	1-state zero-diffusivity population, no influx
3c	nicheC_fig3c.m	1-state well-mixed population, $\Phi_{in}=0.25$
3d	nicheD_fig3d.m	1-state zero-diffusivity population, $\Phi_{in}=1$
3e	nicheE_fig3e.m	1-state zero-diffusivity population, $\Phi_{in}=0.08$
3f	nicheF_fig3f.m	1-state well-mixed population, $\Phi_{in}'=0.25$
6a	nicheAperturbed_fig6a.m	nicheA -> nicheB -> niche X
6b	nicheCperturbed_fig6b.m	niche C -> niche B -> niche C
6c	nicheBperturbed_fig6c.m	niche B -> niche X -> niche B
6d	nicheFperturbed_fig6d.m	niche F -> niche Y -> niche F

Chapter 5 – Two-State Information Niches

Figure	Filename	Description
5.1	fig5_1.m	2-state well-mixed population, no influx
5.6	fig5_6.m	2-state zero-diffusivity population, no influx
5.7	fig5_7.m	2-state well-mixed population, influx at $0.7 < \Phi_{in} < 0.9$
5.8	fig5_8.m	2-state well-mixed, influx at $\Phi_{in} > 0.9$

Chapter 6 – Spatial Patterns

Figure	Filename	Description
6.1a	fig6_1a.m	1-state zero-diffusivity lattice
6.4d	fig6_4d.m	2-state zero-diffusivity lattice

Chapter 7 – Interacting Niches

Figure	Filename	Description
7.3	fig7_3.m	Joint one-state/two-state population, well-mixed, no influx
7.4	fig7_4.m	Joint one-state/two-state population, zero diffusivity, no influx
7.6	fig7_6.m	Niche 1A and niche 2B uniformly distributed at $t=1$
7.7	fig7_7.m	Niche 1A and niche 2B distributed at $t=1$ as per their original niche configurations
7.8	fig7_8.m	Replacement of niche 1A automata with niche 2B automata at $\Phi_{in}=0.05$
7.9a	fig7_9a.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.05$
7.9b	fig7_9b.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.5$
7.9c	fig7_9c.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.8$
7.9d	fig7_9d.m	Joint one-state/two-state population, well-mixed, $\phi=0.95$
7.10a	fig7_10a.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.85$ to 2×10^6 , $\Phi_{in}=0$ from 2×10^6 to 5×10^6
7.10b	fig7_10b.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.95$ to 2×10^6 , $\phi=0$ from 2×10^6 to 5×10^6
7.10c	fig7_10c.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.85$ to 2×10^6 , $\Phi_{in}=0$ from 2×10^6 to 3.5×10^6 , $\Phi_{in}=0.65$ from 3.5×10^6 to 5×10^6
7.10d	fig7_10d.m	Joint one-state/two-state population, well-mixed, $\Phi_{in}=0.95$ to 2×10^6 , $\Phi_{in}=0$ from 2×10^6 to 3.5×10^6 , $\Phi_{in}=0.65$ from 3.5×10^6 to 5×10^6

Chapter 8 – Computation Niche

Figure	Filename	Description
8.3a	fig8_3a.m	One-state automata population under influence of membrane with no environmental noise ($\Phi_{in}=0$)
8.3b	fig8_3b.m	One-state automata under the influence of random, varying environmental noise ($\Phi_{in}=1$)
8.3c	fig8_3c.m	One-state automata under the influence of constant '0' environmental noise ($\Phi_{in}=1$)

8.3d	fig8_3d.m	One-state automata under the influence of constant '1' environmental noise ($\Phi_{in} = 1$)
8.10a	fig8_10a.m	One-state automata population with no structural coupling with the environment ($\Phi_{in} = 0, \Phi_{out} = 0$)
8.10b	fig8_10b.m	One-state automata population with partial coupling with the environment ($\Phi_{in} = 0.5, \Phi_{out} = 0.5$)
8.10c	fig8_10c.m	One-state automata population with partial coupling with the environment ($\Phi_{in} = 1, \Phi_{out} = 0.75$)
8.10d	fig8_10d.m	One-state automata population with complete coupling with the environment ($\Phi_{in} = 1, \Phi_{out} = 1$)

Chapter 9 – Novelty in a Multi-State Computation Niche

Figure	Filename	Description
9.2	fig9_2.m	Seed population only over 200 generations
9.3	fig9_3.m	Novel and seed population over 50 generations