

Dynamic regulation of resource transport induces criticality in interdependent networks of excitable units

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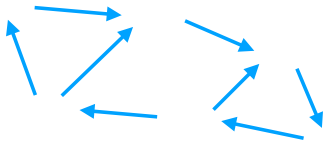
secondary glial network [10–12]. We emphasize, however, that our results could be applicable to other systems that operate at or near a critical point [13,14].

II. MODEL

Consider a network of N neurons and M glial cells. The neurons are represented by a set of nodes A and the glial cells by a set of nodes B . The network is defined by a set of nodes $\mathcal{N} = \{A, B\}$ and a set of edges \mathcal{E} (see Fig. 1).

A. Neural network dynamics

The dynamics of the neural network is governed by the following set of equations for $n = 1, 2, \dots, N$:



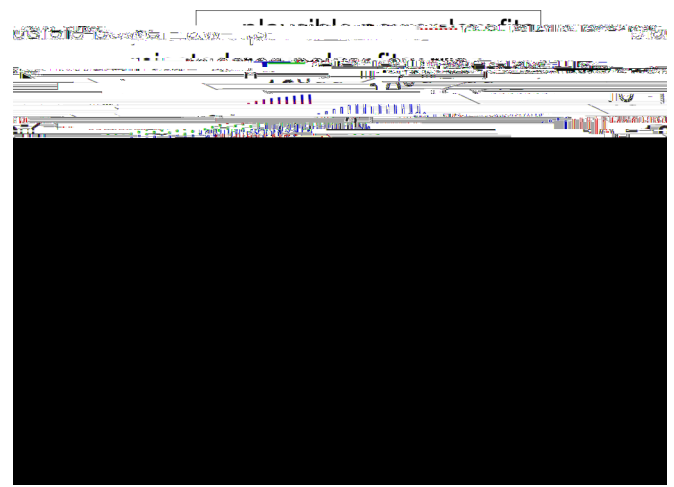
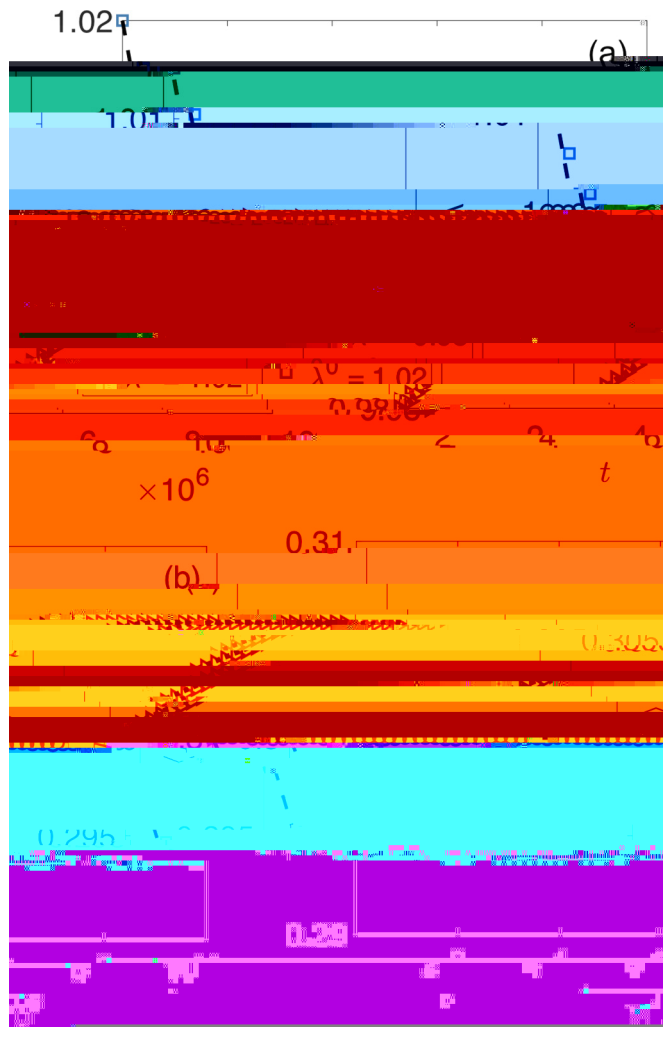


Fig. 2. (a) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (b) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (c) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (d) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (e) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (f) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (g) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (h) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (i) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (j) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (k) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (l) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (m) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (n) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (o) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (p) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (q) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (r) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (s) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (t) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (u) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (v) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (w) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (x) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (y) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$. (z) 3-D map with noise. $\lambda^0 = 1, 0.98, 1.02$.

Fig. 3. Probability distribution $P(L)$ of lengths L . C_1, B are constants. $P(L) \propto L^{-3/2}$. $\approx -3/2$. $C_2/C_1 = 1/6$. $S^* = 0.15$.

$$N \sum_{i=1}^{t_2} S^i, \quad (19)$$

$$D = D_G = D_S = 5 \times 10^{-5}, \quad C_1, C_2, B, 10^{-8}, 10^{-2}, S^* = 0.15, P(L),$$

$$R^t = \sum_i R_i^t / N, \quad (15)$$

$$S(t) = \sum_m s_m^t / N, \quad (16)$$

$$S^t < S^* \quad t < t_1, \quad t > t_2 \quad S^t \geq S^* \quad t_1 \leq t \leq t_2, \quad L$$

...; (.) ... w_{nm}
 R_{nm}
 $\langle w \rangle \sum_{n,m} w_{nm} R_{(n,m)}^t \approx \langle w \rangle \sum_{n,m} R_{(n,m)}^t$;
 (...)
 k (...)
 (...)
 t :

$$R^t = \frac{1}{T} \sum_i R_i^t. \quad (4)$$

A ... (2) ...

$$R^{t+1} = R^t + C_1 + \frac{D_S}{T} \sum_{i=1}^M R^t \sum_{i=1}^T G_i - \frac{D_S}{T} \sum_{i=1}^T R_i^t \sum_{i=1}^M G_i. \quad (5)$$

... $\sum_{i=1}^M G_i = k$...
 $\sum_{i=1}^T G_i = 1$...

$$R^{t+1} = R^t + C_1 + \frac{D_S}{T} \sum_{i=1}^M R^t - k D_S R^t. \quad (6)$$

T ... $\sum_{i=1}^M R$...
 w_{nm} ... R_{nm} (...)
 $W_{nm}^t = w_{nm} R_{nm}^t$...

$$\sum_{i=1}^M R^t = \frac{1}{\langle w \rangle} \sum_{n,m} W_{nm}^t. \quad (7)$$



6.4. $\frac{1}{\sqrt{(t-1)^2}}$ $C_1 \cdot T$ B $= 1$ B C_1 $-3/2$

$0 \leq S \leq 1$, $B C_1 / (k C_2)$

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