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Interareal coupling reduces encoding variability in multi-area models of spatial working memory

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, $j = 1, 2$ $j \neq k$. F $C_j(x) = c_j$ (x). $C_c(x) =$ c_c (x). $c_c \to 0$, $c_c \to$ (c_1, c_2), F $c_1 = c_2 =$ $c_c = 1$,

MULTIPLE-AREA MODEL OF SPATIAL WORKING MEMORY

N

$$\tau\, u_j(x,t) = \left[-u_j + \varepsilon^{1/2} \sum_{k=1}^{N} w_{jk} * f(u_k)\right] t + \varepsilon^{1/2}\, W_j(x,t) \quad (6)$$

u_j $j.$ $j =$ $1, \ldots, N$. A $\tau = 1$, 10 $w_{jk}(x-y)$ k y j x (E 2). F (E 3) (E 4) H. (E 5). A $W_j(x,t)$ $\langle W_j(x,t) \rangle = 0$

$$\langle W_j(x,t) W_k(y,s) \rangle = C_{jk}(x-y)\delta(t-s) \, t \, s,$$

$j, k = 1, \ldots, N$, $j = k$ $j \neq k$. F $C_{jj}(x) =$ (x) $C_{jk}(x) = c_c$ (x) $j \neq k$.

NUMERICAL SIMULATION OF STOCHASTIC DIFFERENTIAL EQUATIONS

(E 1) E M 10^{-4}, R 2000 $\langle \Delta_1(t)^2 \rangle$ 5000 Δ_j x j $u_j(x,t)$

RESULTS

(A, 1977; C, 1998; E,

1998). I P. I O. O.

BUMPS IN THE NOISE-FREE SYSTEM

E (1) $(\varepsilon \to 0)$. (E, 1998; H, 1998

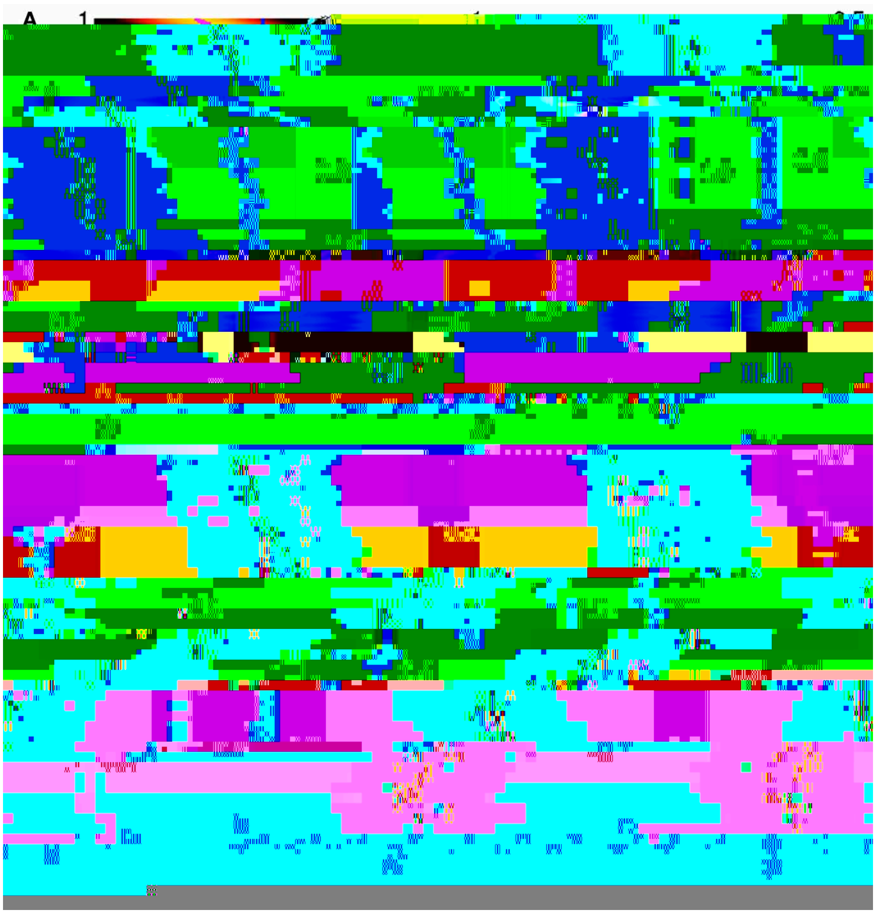

FIGURE 2 | Diffusion of bumps in the dual area stochastic neural field (Equation 1). (A) W e a ea c ec ($w_{12} = w_{21} \equiv 0$), eac b e ec e B a ab e d a , d e c a c. ce . **(B)** I e e e ce . e a ea c ec $\sqrt{\varepsilon}w_{12}(x) = \sqrt{\varepsilon}w_{21}(x) = 0.01(\cos(x) + 1)$, e b 1 (a e a) a ac ed e . b 2 (c a) a d ce e a. D e e e e . eac b e . e e , b b e. ec e a de ed a e . L ca c ec de c bed b e c e (E a 3); e . a e . c E a (5). O e a a e e a e e d $\theta = 0.5$ a d e a de $\varepsilon = 0.025$.

$\Phi = (\Phi_1(x,t), \Phi_2(x,t))^T$; … $\mathcal{L}$ …

$$\mathcal{L} = \begin{pmatrix} -u(x) + w(x) * [f'(U_1(x))u(x)] \\ -v(x) + w(x) * [f'(U_2(x))v(x)] \end{pmatrix}$$

… $= (u(x)\ v(x))^T$ … $(U_1', 0)^T$ … $(0, U_2')^T$, … $\mathcal{L}$ … E … (10). … E … (12) … $|\Delta_1 - \Delta_2|$ …

$$f(U_j(x + \Delta_k - \Delta_j)) \approx f(U_j(x)) + f'(U_j(x))U_j'(x) \cdot (\Delta_k - \Delta_j),$$

… $j = 1, 2$ … $k \neq j$. … E … (12) …

… $\mathcal{L}^*$, …

$$\int_{-\pi}^{\pi} {}^T\mathcal{L}\, x = \int_{-\pi}^{\pi} {}^T\mathcal{L}^*\, x,$$

… $= \left(p(x)\ q(x)\right)^T$. I …

$$\mathcal{L}^* = \begin{pmatrix} -p(x) + f'(U_1(x))[w(x) * p(x)] \\ -q(x) + f'(U_2(x))[w(x) * q(x)] \end{pmatrix}. \tag{13}$$

$_1 = (f'(U_1)U_1', 0)^T$ … $\mathcal{L}^*$ … E … (13) …

$$\mathcal{L}^*\, _1 = \begin{pmatrix} -f'(U_1)U_1' + f'(U_1)[w * [f'(U_1)U_1'] \\ 0 \end{pmatrix} = \mathbf{0}$$

(t) E (17). E (19), $^T = (\ ]^{-1})^T \Lambda\ ^T$,

$^T t = (\ ^{-1}$

... Φ_j. ... Δ_j. N ...

$$u_j = U_j(x - \Delta =$$

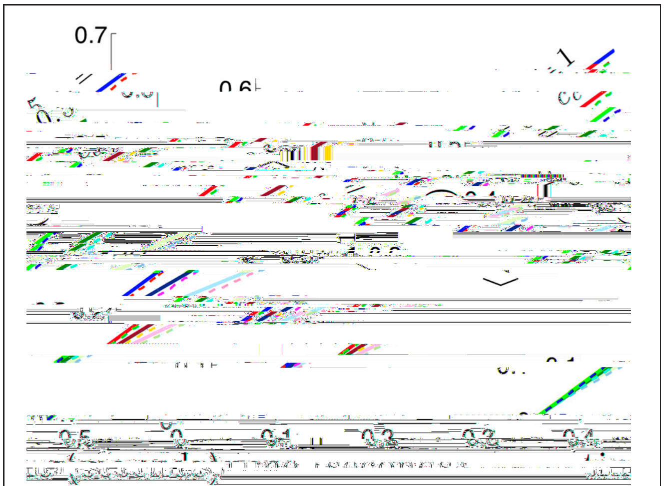

FIGURE 6 | Variance in the position of bumps as noise correlation between areas is increased. ... (29) ... ($c_c = 0$) ... ($c_c = 0.5, 1$) ... $c_c = 1$ ... $\langle\Delta(t)^2\rangle$ ... (29) ... $c_c \to 1$). ... **Figure 2**.

(E 30). E (31) $|\Delta_k - \Delta_j|$ j, k. E (31), $\mathcal{L}^*$.

$$\int_{-\pi}^{\pi} \Upsilon^T \mathcal{L} \Psi \, x = \int_{-\pi}^{\pi} \Psi^T \mathcal{L}^* \Upsilon \, x$$

$\Upsilon = (\Upsilon_1(x), \ldots, \Upsilon_N(x))^T$

$$\mathcal{L}^* \Upsilon = \begin{pmatrix} -\Upsilon_1(x) + f'(U_1(x))[w * \Upsilon_1] \\ \end{pmatrix} .$$

$$= \kappa J_N - N\kappa I$$

J_N ... $N \times N$ ... I ... J_N ... N, ... $N-1$. ... $= \kappa J_N - N\kappa I$ ... $\lambda_1 = 0$ ... $_1 = (1, \ldots, 1)^T$. A ... $\lambda_j = -N\kappa$ ... $j \geq 2$, ... $_j = {}_1 - {}_j$, ... j

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