Statistical inference in theoretical models of cognition

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# 1 Figures

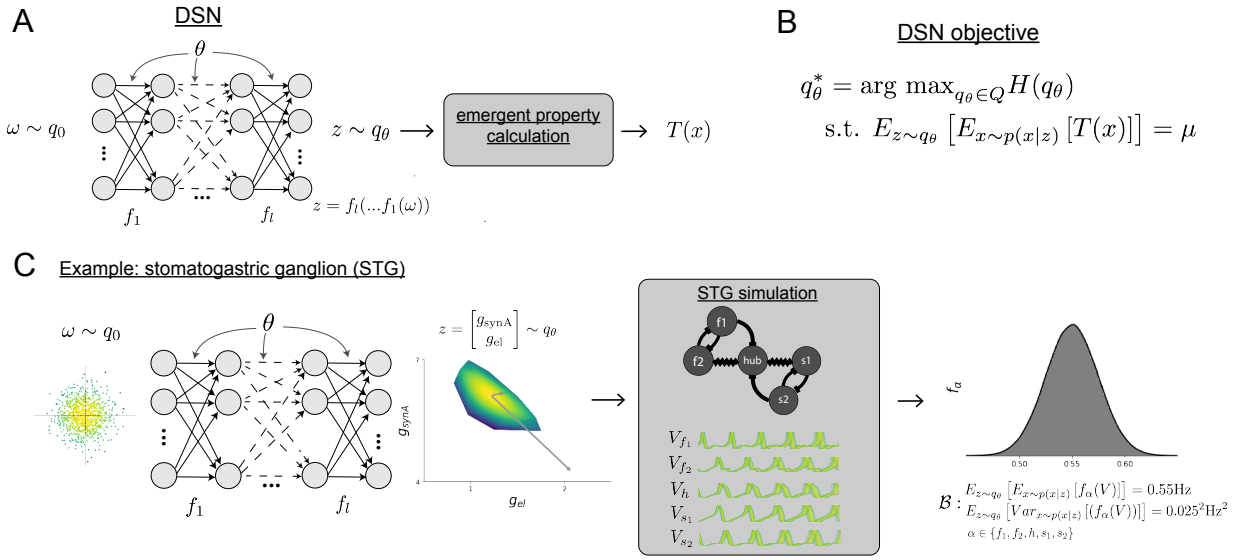
A
DSN
$\theta$
$\omega \sim q_0$
$z \sim q_\theta$
emergent property calculation
$T(x)$
$f_1$
$f_l$
$z = f_l(...f_1(\omega))$
B
DSN objective
$q^*_\theta = \arg\max_{q_\theta \in Q} H(q_\theta)$
s.t. $E_{z\sim q_\theta}\left[E_{x\sim p(x|z)}\left[T(x)\right]\right] = \mu$
C
Example: stomatogastric ganglion (STG)
$\omega \sim q_0$
$\theta$
$z = \begin{bmatrix} g_{\mathrm{synA}} \\ g_{\mathrm{el}} \end{bmatrix} \sim q_\theta$
$g_{synA}$
$g_{el}$
$f_1$
$f_l$
STG simulation
f1
f2
hub
s1
s2
$V_{f_1}$
$V_{f_2}$
$V_h$
$V_{s_1}$
$V_{s_2}$
$f_\alpha$
0.50
0.55
0.60
$\mathcal{B}: \begin{matrix} E_{z\sim q_\theta}\left[E_{x\sim p(x|z)}\left[f_\alpha(V)\right]\right] = 0.55\mathrm{Hz} \\ E_{z\sim q_\theta}\left[Var_{x\sim p(x|z)}\left[(f_\alpha(V))\right]\right] = 0.025^2\mathrm{Hz}^2 \\ \alpha \in \{f_1, f_2, h, s_1, s_2\} \end{matrix}$

Figure 1:

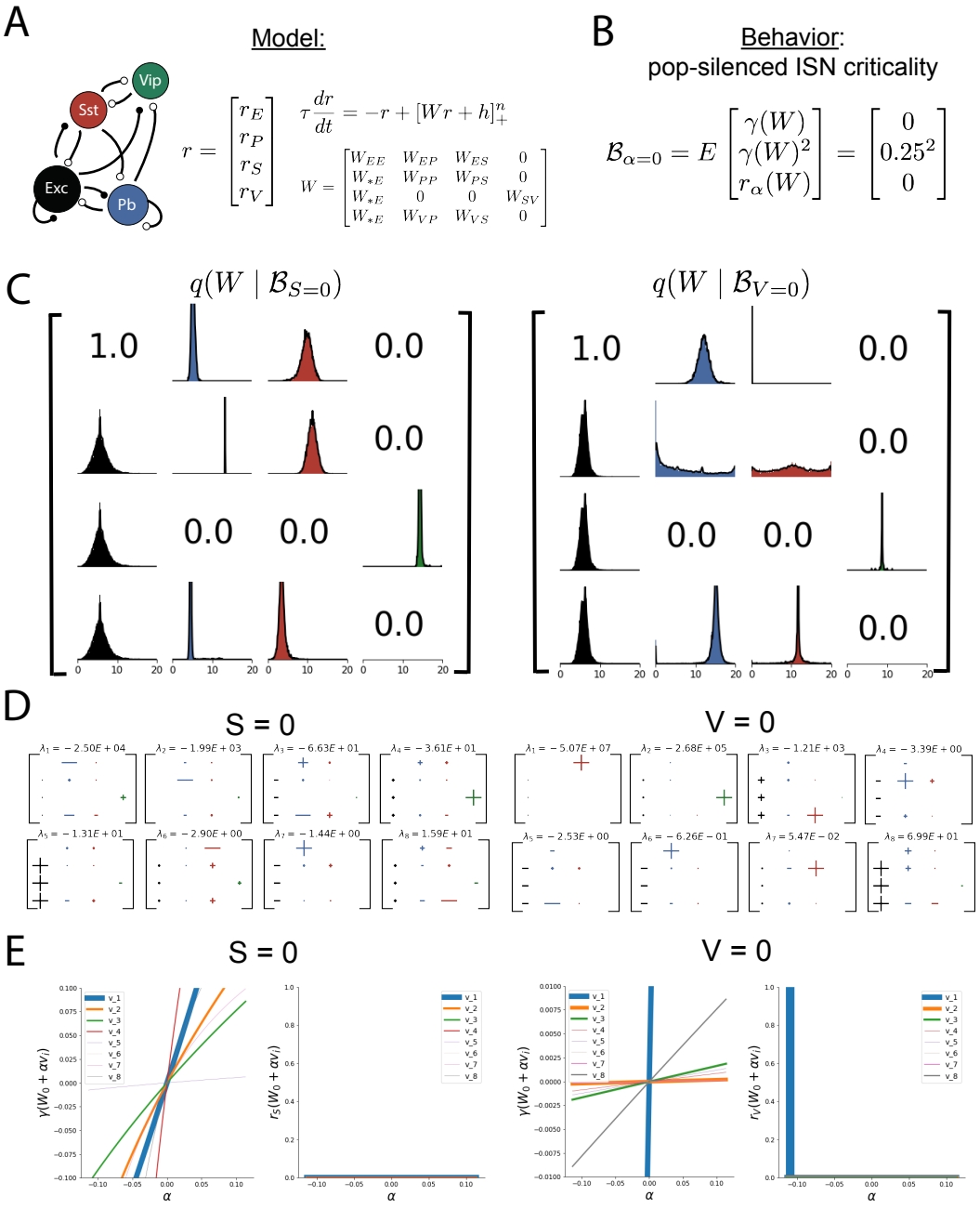


Figure 2: A.) Model of primary visual cortex (V1) Neurons: E - excitatory (black), P - parvalbumin- (blue), S - somatostatin- (red), and V - VIP-expressing (green). Parameters: weights of the dynamics matrix $W$. B.) The DSNs are conditioned on population-silenced ISN criticality. C.) DSN distribution of the parameters of the V1 model conditioned on population-silened ISN criticality. D.) Eigenmodes of the hessian of each DSN ordered by eigenvalue. E. Behavioral sensitivity of the model along each mode of the hessian.

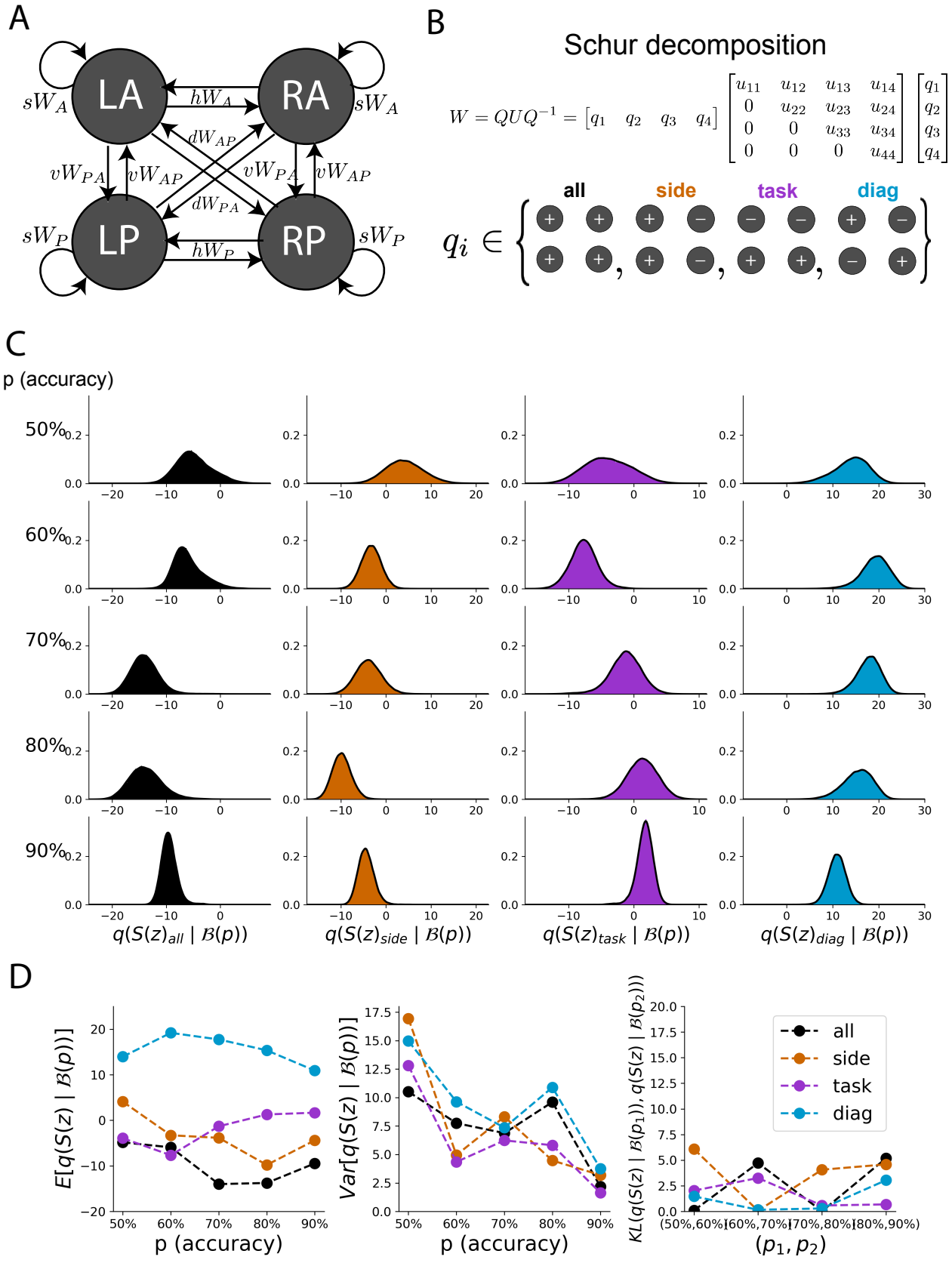


Figure 3: A.) Model of superior collicullus (SC). Neurons: LP - left pro, RP - right pro, LA - left anti, RA - right anti. Parameters: sW - self, hW 4 horizontal, vW -vertical, dW - diagonal weights. B.) Schur decomposition of W. C.) DSN distribution of schur mode eigenvalues $S(z)$ with task learning. D.) DSN means and variances (left and center, respectively) and step-wise KLs.