

# **Stochastic models of evidence accumulation and working memory: SDEs to SPDEs**

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### **Part 1: Stochastic accumulator models in static and changing environments**

**A. Two alternative forced choices:** discrete and continuous evidence, threshold decisions, first passage times

**B. Dynamic programming for optimal stopping:** known and unknown evidence reliability (collapsing bounds)

**C. Evidence accumulation in dynamic environments:** dynamics within and across trials, discrete and continuous evidence, formalizing doubly stochastic models

**References:** KP Nguyen, K Josic and ZP Kilpatrick. [Optimizing sequential decisions in the drift-diffusion model](#). J Math. Psychol. 88 (2019) pp. 32-47.

J Drugowitsch. [Normative solutions to the speed-accuracy trade-off in perceptual decision-making](#). FENS Winter School 2015 Tutorial Notes.

A Veliz-Cuba, ZP Kilpatrick, K Josic. [Stochastic models of evidence accumulation in changing environments](#). SIAM Rev. 58 (2016) pp. 264–289.

### **Part 2: Bump attractor models of working memory: Asymptotic dynamics of nonlinear stochastic PDEs**

**A. Dynamics of bumps in neural fields:** construction for Heaviside firing rates, stability, heterogeneities

**B. Impact of stochastic forcing:** diffusive wandering, pinning with heterogeneities, attractor transitions

**C. Multilayer models:** stabilization through coupling, Ornstein-Uhlenbeck reduction, delayed coupling

**References:** S. Amari, [Dynamics of pattern formation in lateral-inhibition type neural fields](#). Biol. Cybern., 27 (1977), pp. 77–87.

ZP Kilpatrick and B Ermentrout. [Wandering bumps in stochastic neural fields](#). SIAM J. Appl. Dyn. Syst., 12 (2013), pp. 61-94.

ZP Kilpatrick. [Interareal coupling reduces encoding variability in multi-area models of spatial working memory](#). Front. Comput. Neurosci., 7 (2013) 82.

ZP Kilpatrick. [Delay stabilizes stochastic motion of bumps in layered neural fields](#). Physica D 295 (2015) pp. 30-45.

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