Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Distinguishing Similar Odor Stimuli in Nonlinear Recurrent Networks STUART WICK, Northwestern U, MARTIN WIECHERT, RAINER FRIEDRICH, Friedrich Miescher Inst., Basel, HERMANN RIECKE, Northwestern U — The olfactory bulb (OB) is the first processing stage for olfactory information and receives input in the form of activity patterns across an array of discrete input channels (glomeruli). Experiments show that the OB decorrelates similar olfactory inputs: the output patterns are more distinct than the input patterns, which is likely to be important for downstream computations. The high dimensionality of odor space implies a fractured representation of odors on the two-dimensional array of glomeruli. The neural circuits achieving the decorrelation must therefore be non-trivial; their connectivity is, however, poorly known. We investigate what connectivities are optimally suited for this task. For neural networks with linear dynamics the connectivity can be given explicitly. Experiments indicate, however, that the bulbar dynamics are strongly nonlinear and must be minimally modeled by a piece-wise linear rectifier. We investigate the impact of the rectifier on two types of connectivities which are optimal for linear networks, but only one of which accomodates the rectifier. We test the performance of both types of networks by adapting them to an ensemble of odors and assessing their ability to decorrelate these and related odors at the same and other concentrations.

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Date submitted: 27 Nov 2007 Electronic form version 1.4