(from Nature, Vol 435, 19 May 2005)

JOURNAL CLUB

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The director of UCL's Gatsby Computational Neuroscience Unit recommends some gainful reading.

Who of us lacking an anorak could admire an article with 60 equations and 15 instances of "piecewise linear"? But skip this paper — in the press at the *International Journal of Bifurcation and Chaos* — and you'll miss an important, if obscure, treat. It addresses a venerable question, which has long troubled me, in the neuroscience and psychology of decision-making: the role of neuromodulators.

Neuromodulators are an important class of transmitter. From a biophysical perspective, they seem to regulate general properties such as the excitability or 'gain' of their target neurons. Thus, many see them merely as widespread irrigants (or irritants, as our less charitable colleagues would have it).

But behavioural neuroscience studies suggest that neuro-modulators can play a key role at specific times in decision-making tasks. The transmitters regulate competition between populations of neurons that represent choices. This allows a subject to integrate noisy sensory information with past experience about rewards to make almost optimal decisions.

Previous attempts to reconcile the general function with the specific were a bit too heuristic to convince me. I buried my head in the sand or muttered jeremiads — complaining that the necessary tests were impossible.

However, this paper squares the biophysics with the behaviour. The researchers use a model to show that changing the gain of neurons is precisely the right thing to do to achieve optimal decisions. Along the way, they link classical and modern suggestions about the mechanisms of decision-making, an area under intense behavioural and electrophysiological scrutiny.

So buy your anorak, and let this theory reign.

www.math.nyu.edu/~ebrown/papers/simple_networks.pdf