

**Modelling animal motivation by means of a latent-state model with feedback**

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We describe a family of models developed for time series of animal feeding behaviour. The models incorporate both an unobserved state, which can be interpreted as the motivational state of the animal, and a mechanism for feedback to this state from the observed behaviour. We discuss methods for evaluating and maximizing the likelihood of an observed series of behaviours, and thereby estimating parameters, and for inferring the most likely sequence of underlying states. We indicate several extensions of the models, including the incorporation of random effects. We apply these methods in an analysis of the feeding behaviour of the caterpillar *Helicoverpa armigera*, and thereby demonstrate the potential of this family of models as a tool in the investigation of behaviour.