New eyes on visual habituation in locust: an experiment description language for integrative neuroscience

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Neuroscientists have a vast array of instruments at their disposal to examine the function of neural tissue. For example, to investigate visuomotor integration, one can combine *in vivo* intracellular voltage recordings with visual presentations, focal stimulation of nerves and behavioural observation. While this technological diversity holds enormous promise, it introduces its own set of complexities: how does one control these instruments and ensure that they are configured to perform the experiments most likely to shed light on the hypothesis under consideration? We have developed a domain-specific programming language for describing experiments in cellular and sensory neuroscience. This language aims to let scientists with little programming experience focus on creating a specification of what should be done in an experiment and in the subsequent analyses. We can build complex experiments by combining elementary tasks including animations, sounds, extracellular or intracellular recordings and injection of somatic current waveforms. We have written a series of computer programs to execute these experiments on living animals, or on simulated networks of neurons. These programs allow us to directly compare models and experiments by automatically running the same protocol *in vivo* and *in silico*. The results of these trials are stored in a relational database together with the experiment description, information about the animal, and any other available metadata, and are retrieved with a simple custom-built query language.

We have used this new way of conducting experiments to reexamine the response of the descending contralateral movement detector (DCMD) in the locust to looming visual stimuli. The locust is a well-established experimental preparation which permits the study of cross-modal sensorimotor integration. We have measured the kinetics of habituation in the DCMD firing rate response to repeated presentations of similar looming stimuli, and the dependence of this time course on the stimulus amplitude. We have also investigated the influence of auditory stimuli on the visual looming response and the timecourse of its habituation. Finally, we aim to investigate the effect of manipulations of the looming object visual presentation, such as priming portions of the visual field, on the DCMD response. These experiments show how complex multi-modal protocols can be simply defined in an experiment description language and can reliably be carried out repeatedly in a living animal.