Development and Evaluation of an Operant-Based Reversal Learning Task in the Rat, Relevance of the Visual Cue

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Impairments in cognitive flexibility and/or executive functioning are a core symptom of many neurological and psychiatric diseases, for example Alzheimer's disease and schizophrenia. In rodents, the attentional set-shifting task is one of the most widely employed paradigms to tap into this important cognitive domain. However, due to its complexity, considerable study length (~12 weeks) and potential for operator bias, the aim of the present studies was to develop and evaluate an operant-based version on this test initially focusing on discrete discriminations.

Studies were conducted in standard rat operant chambers (MED Associates, USA) utilizing two nose poke response apertures (with 3 internal coloured cue lights), an additional cue light above the response apertures and a food dispenser/hopper situated at the rear of the chamber. Initial experiments aimed to train animals to perform a simple discrimination utilizing a light on/light off rule. Half of the animals were required to track the stimulus light presented pseudo-randomly between the left and right response apertures, whilst the remaining half were required to respond to the aperture where no stimulus light was present. Animals were trained in daily thirty minute session's until they reached a performance criteria of >90% correct responses for three consecutive days after which the rule was reversed. Significant differences were observed during initial acquisition of the light on/light off rule; with light on animals showing significantly improved acquisition demonstrating cue/response learning is dependent on saliency of the cue. However, once both groups had reached asymptote performance, there were no differences in performance prior to or following each of the reversals.

In a separate cohort of animals, attempts are made to train rats to discriminate between orange and green LED stimuli housed within the response apertures. Although rats were initially thought to be colour blind, recent behavioural experiments have shown that rats can indeed perceive ultraviolet light, and with training can distinguish between ultraviolet and visible light, and between different colours in the blue-green range (Jacobs et al. 2001). However, after ten daily sessions, performance remained static at chance level. This may be a consequence of the strain used (Lister Hooded) or more likely a consequence of the stimulus lights although surprising they are marketed and supplied for use with rodents MED associates (Part No: ENV-114M). This cohort was then transferred to a spatial discrimination protocol comprising of a light in/light above rule. Once again significant differences were observed during initial acquisition of the light in/light above rule; with light in animals showing significantly improved acquisition. However, once both groups had reached asymptote performance, there were no differences in performance prior to or following each of the reversals. In the final series of studies, the performance of three commonly used rat strains (Lister Hooded, Long Evans and Sprague Dawley) and the effects of sub-chronic phencyclidine (5mg/kg; ip; 7 days BID) were assessed on the reversal learning paradigm.