Configural and Elemental Approaches to Causal Learning

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The nature of stimulus representation in associative networks is a hotly debated issue. On one hand we have elemental theories (e.g. Rescorla & Wagner, 1972) that propose that stimulus compounds are decomposed into their constituent elements, and that learning accrues to representations of these elements. The conditioned responding shown to a stimulus compound is then found by simply adding together the individual associative strengths of each of the elements of that compound. Configural theories (e.g. Pearce 1987) instead posit that a compound stimulus is best viewed as a unitary event separate from its elements, but able to generalise to them. Thus a compound AB is represented by a unit representing the unique configuration "AB". If AB is paired with reinforcement it is this configural unit that develops an association to the outcome (unconditioned stimulus, US). Generalised responding to other stimuli occurs to the extent that these stimuli are similar to experienced configurations.

In our poster we present evidence from a study of human causal learning that bears on this elemental versus configural debate. This study also relates to work on the phenomenon of retrospective revaluation, another research area currently receiving much attention. This involves changes in the strength of previously learned cue-outcome associations in the absence of those cues.

The results of our experiment pose difficulty for some models of human associative learning, particularly those that rely on a configural representation for the cues involved in learning. Taken in conjunction with other work from this laboratory (Le Pelley and McLaren, this issue) that cannot be easily accommodated by elemental theories (e.g. Rescorla & Wagner, 1972), the challenge posed by the data is now sufficiently severe as to require a model employing adaptive parameterisation to govern generalisation (McLaren, 1993, 1994).

The basic design of our experiment is shown in the Table below (other cues were also included so that there were equal numbers of reinforced and nonreinforced single cues and compound cues). Our experiment used an allergy prediction paradigm. This type of paradigm has been used successfully in a number of studies of phenomena of associative learning. However, in order to avoid problems with ceiling effects we adapted this normal allergy prediction paradigm. Thus during training, instead of being asked to judge whether or not an allergic reaction would occur following consumption of a meal, subjects were asked to rate the risk of allergic reaction resulting from these foods (using a four-point scale). Following training, subjects are asked to rate the probability with which a number of individual foods and food compounds will cause allergic reactions. The foods, then, represent the cues, and the allergic reaction is the US. The causal judgment ratings given on test are our index of associative strength.

Stage 1	Stage 2	Test
AB+	A+	A, B, E
CD+	C+	AB, AC, BD,
	EF+	BC, EF, CE&DF

The results are shown below (averaging over equivalent cues). The key findings are (i) retrospective revaluation of cues B&D (backward blocking), (ii) the low rating given to compound BD relative to BC, and the higher rating given to AC, (iii) the high rating of AC relative to EF, and (iv) the fact that CE > BC > DF. These ratings are consistent with revaluation on an elemental basis, but not with configural models employing fixed generalisation coefficients.

References

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