Inhibitory Associations in Causality Judgements

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Knowledge about the mechanisms underlying contingency judgements may further our understanding of human cognition. A recently established finding is the retrospective revaluation of causality judgements in the light of new experience. During a typical retrospective revaluation experiment, compounds AB and CD are presented with reinforcement. Next, A is presented with reinforcement, whereas C is presented alone. On test, B is typically found to be less causally effective than D. It therefore seems that some change in the representations of B and D occurs during their absence to account for their different ratings.

Prior to this work, it was unclear whether retrospective revaluation would occur with cues that are absent and predicted not to occur. The experiments reported here examined the consequence of inhibitory associations, formed through negative correlations of cues during pre-exposure, on later learning episodes.

Experiments

Subjects played the role of a medic and were asked to diagnose a series of hypothetical patients. They were divided into 3 groups (A+, A- and X+) as shown in Table 1.

Table 1: Letters=symptoms, "+"=illness, "-"=no illness.

Gp	Stage 1	Stage 2	Stage 3	Test
A+	AX	A+	Q+	A, B, C, D
	BX	C-	D-	Q, X, BQ
A-	AX	A	Q+	A, B, C, D
	BX	C	D-	Q, X, BQ
X+	AX	X+	Q+	A, B, C, D
	BX	C-	D-	Q, X, BQ

In stage 1, subjects familiarized themselves with the patterns of symptoms that occurred by typing in the initial letters of each symptom. During stages 2 and 3, subjects diagnosed, with feedback, a series of patients with either "Coullands disorder" or "No illness". The 3 groups differed only during stage 2 when: symptoms A and C appeared with feedback (A+); or symptoms A and C appeared without feedback and subjects entered the initials of each symptom (A-); or symptoms X and C appeared with feedback (X+). Causality judgements were then collected after stage 3.

My analysis is that during stage1, A and X become positively associated on AX trials, and similarly for B and X on BX trials. After some training, the presence of X, on AX trials, evokes a representation of B. However, A and B are negatively correlated, and an inhibitory association will form from A to B. Similarly, on BX trials, X evokes A, and as a consequence, an inhibitory association forms from B to A. Thus symptoms A and B develop mutually inhibitory associations.

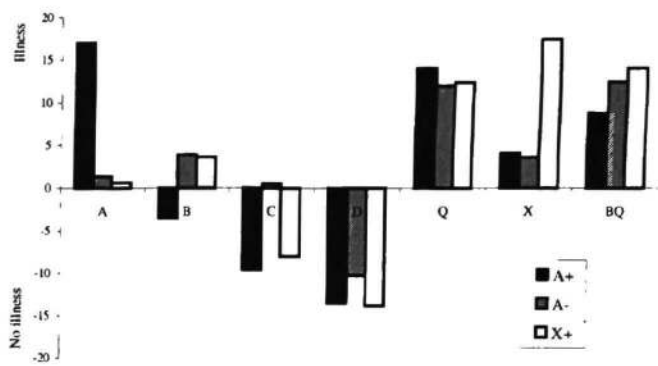

Figure 1: Subjects' beliefs about symptom-illness contingency

The results (Figure 1) show that following conditioning of A to illness (A+), B becomes less associated with illness. The results are problematic for standard error correction models but are entirely consistent with my modified learning algorithm predictions.

Modeling

I propose that within-compound associations formed during pre-exposure mediate the retrospective revaluation of judgements during subsequent learning. Thus if cues were more highly correlated, therefore having greater within compound associations, presenting one cue alone would induce more internal activation for the associated but absent cue, and hence produce greater retrospective revaluation. I will discuss a modified LMS network that can account for these results. The algorithm uses a learning rate parameter that depends on the error term observed minus expected internal input (c.f. McLaren, Kaye, & Mackintosh, 1989).

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References

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