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# Priming Causal Conditionals

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## Introduction

We describe two experiments designed to examine the mental representations that people construct of causal relations. We examined the possibilities people think about when they understand different sorts of causes by measuring the length of time it took them to read conjunctions after priming them with causal conditionals. The results support the idea that people think about different possibilities to understand different sorts of causes.

## Experiments

We examined three sorts of causes. Strong causes, such as ‘cutting his finger causes it to bleed’ (p causes q) are consistent with two true possibilities, p and q, not-p and not-q (Johnson-Laird & Byrne, 2002). Weak causes such as ‘rain causes a person to get wet’ are consistent also with a third possibility, not-p and q. Enabling conditions, such as ‘exercise causes weight loss’ are consistent with a different third possibility, p and not-q. We relied on a priming paradigm to examine reading times for a conjunction (such as ‘p and q’) after it was primed by a conditional (if p then q) compared to a baseline that contained no conditional (Santamaria, Espino, & Byrne, 2005).

## Method

In Experiment 1 we examined reading times for conjunctions primed by conditionals which contained enabling relations. In Experiment 2 we examined conjunctions primed by conditionals which contained strong and weak causes. We tested 22 (Experiment 1) and 29 (Experiment 2) participants. The participants read short stories presented on a computer screen, e.g.:

*‘Martin was telling Laura about his medicine bottle.*

*He told her that the lid had to be squeezed for it to open.*

*He also said*

*If the lid was twisted then the bottle opened.*

*When Martin showed Laura the bottle, she saw that*

*The lid was twisted and the bottle opened.*

*Laura went to get a drink.’*

They pressed the space bar to see each sentence and their latencies were recorded. Participants in Experiment 1 were assigned to two conditions: enabling and baseline. In the enabling condition, the third sentence was a conditional containing an enabler; the baseline condition received instead a sentence describing the color or location of the conditional’s antecedent. Participants in Experiment 2 were assigned to three conditions: strong cause, weak cause, and baseline. The key measure was the length of time participants took to read the four sorts of conjunction.

## Results and Discussion

Experiment 1 shows participants read the conjunctions p and q, and p and not-q more quickly when primed by an enabling conditional compared to the baseline,  $t(21) > 2.8$ ,  $p < .01$ , as Table 1 shows. Experiment 2 shows participants read the conjunctions p and q, not-p and q, p and not-q more quickly when they were primed by a weak cause compared to the baseline,  $t(28) > 2.1$ ,  $p < .05$ . They read the conjunctions p and q, not-p and not-q, and p and not-q more quickly when primed by a strong cause,  $t(28) > 2.5$ ,  $p < .02$ .

Table 1: The mean reading times (in milliseconds) for the different conditions of the two experiments (reliable differences asterisked)

Conjunction	p & q	not-p& not-q	not-p & q	p& not-q
<i>Experiment 1</i>				
Baseline	2610	2962	3206	2960
Enabler	2145	2735	2874	2556
Difference	465*	227	332	404*
<i>Experiment 2</i>				
Baseline	2607	3288	3405	2966
Weak	2229	2895	2697	2416
Strong	2099	2740	2953	2443
Difference (weak)	378*	393	708*	550*
Difference (strong)	508*	548*	452	523*

The two experiments show that people keep in mind different possibilities when they understand different sorts of causes, as we expected. Enablers primed two true possibilities, p and q, and p and not-q; strong causes primed two true possibilities, p and q, and not-p and not-q; and weak causes primed two true possibilities, p and q, and not-p and q. Strong and weak causes also primed the possibility p and not-q compared to the baseline and further examination of false possibilities may be fruitful.

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