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The probability of causal conditionals

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Abstract

Conditionals in natural language are central to reasoning and decision making. A theoretical proposal called the Ramsey test implies the conditional probability hypothesis: that the subjective probability of a natural language conditional, P(if p then q), is the conditional subjective probability, P(q|p). We report three experiments on causal indicative conditionals and related counterfactuals that support this hypothesis. We measured the probabilities people assigned to truth table cases, P(pq), P(p¬q), P(¬pq) and P(¬p¬q). From these ratings, we computed three independent predictors, P(p), P(q|p) and P(q|¬p), that we then entered into a regression equation with judged P(if p then q) as the dependent variable. In line with the conditional probability hypothesis, P(q|p) was by far the strongest predictor in our experiments. This result is inconsistent with the claim that causal conditionals are the material conditionals of elementary logic. Instead, it supports the Ramsey test hypothesis, implying that common processes underlie the use of conditionals in reasoning and judgments of conditional probability in decision making.

Keywords: Causal conditionals; Counterfactuals; Conditional probability; Ramsey test; Covariation; Causation; Delta-p rule

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1. Introduction

Conditional statements are ubiquitous in both ordinary and scientific discourse. They are used for many purposes, from laying down rules for guiding behaviour to expressing scientific hypotheses (Evans & Over, 2004). One basic use of conditionals is to express uncertainty. We are unsure about the weather, and so we say that we will have an alfresco lunch *if* it is sunny. We are unconvinced by our colleagues' arguments, but conclude that their theory will be confirmed *if* there is a significant result in an experiment. Uncertainty is always with us in human affairs, and indicative conditionals are of great importance for this reason alone. It is unsurprising that so much research has been done on them since the ancient Greeks (Sanford, 1989).

Though people often use a conditional to express uncertainty, they can of course be uncertain about the conditional itself. They can have high or low confidence in it, judging it to have high or low probability. For a Saturday in the summer, our friends can be fairly confident that, if it is sunny, we will have an alfresco lunch. Our colleagues would be less confident that, if we are given a deadline for finishing our marking, then we will meet it.

1.1. The subjective probability of a conditional

Consider an ordinary indicative conditional, of the form 'if p then q,' in natural language:

(1) If the cost of petrol increases (p), then traffic congestion will improve (q).

Suppose (1) is asserted about a possible increase in the cost of petrol (or gasoline) at a particular time in the UK (or the USA). People make subjective probability judgments about conditionals like (1) all the time in ordinary affairs. The question is how they do it. Ramsey (1990, p. 247) hypothesized that people could judge 'if p then q' by '...adding p hypothetically to their stock of knowledge and arguing on that basis about q...' By these means, they would then fix '...their degrees of belief in q given p...,' which would be their degrees of conditional subjective probability, P(q|p). This suggested procedure for making a probability judgment about a conditional came to be known as the *Ramsey test*. It implies that common processes underlie judgments about conditionals and conditional probability. At one extreme, people can deduce q from p with valid inferences in a Ramsey test, and then P(if p then q) and P(q|p) will be 1. At the other extreme, people will judge p and q to be inconsistent, and then P(if p then q) and P(q|p) will be 0. In many more cases, people will use inductive inferences, heuristics, or causal models in a Ramsey test, and then P(if p then q) and P(q|p) will be between 0 and 1. Explaining how the Ramsey test is actually implemented—by means of deduction, induction, heuristics, causal models, and other processes—is a major challenge, in our view, in the psychology of reasoning.

The consequence of the Ramsey test, that P(if p then q) is P(q|p), has been very influential in philosophical logic. Leading philosophical logicians (Adams, 1975, 1998; Bennett, 2003; Edgington, 1995, 2003; Stalnaker, 1968) have long argued for this consequence. A famous proof in philosophical logic by Lewis (1976) established that P(if p then q) cannot be identical with P(q|p) if we accept some prominent analyses of conditionals, e.g., that of Stalnaker (1968), though it can if we accept others, e.g., that of Adams (1975, 1998). Whether or not P(if p then q) should be P(q|p) has implications in philosophical logic