If, by Jonathan Evans and David Over. Oxford: Oxford University Press, 2004. Pp. vii + 190. H/b $54.50.

This is a book on the psychology of reasoning with conditionals. It draws on and sometimes criticizes philosophical accounts of conditionals, but is primarily about reasoning with conditional sentences. Two kinds of philosopher should read it. First of course are people working on conditionals. But also logic teachers: the book summarizes data on the difficulties normal intelligent people have in conforming to the standard patterns of inference for 'if', that everyone teaching elementary logic ought to know and take account of. It is not the authors' aim to disseminate this data, which is familiar to psychologists, as much as to argue for a view of what conditional constructions mean to speakers of English. The conclusion they tend to is Ramseyan: usually when we say 'if' we are making a conditional assertion, and the degree to which we believe the assertion is roughly proportional to the probability we give to the consequent conditional on the antecedent. They tend to this conclusion rather than asserting it because they acknowledge that the data is very confusing and the truth is probably rather complex.

The views defended in the book are based on a large amount of empirical data about the responses of experimental subjects on various reasoning tasks involving the conditional and related constructions. The authors use this data to adjudicate between various competing psychological theories, notably the mental models approach associated with Johnson-Laird, the mental logic approach associated with Brain and O'Brien, and their own approach. They give fairly comprehensive expositions of the rival views and give definitely merciless — sometimes somewhat nit-picking — criticisms of them. I shall not summarize the psychological theories the authors summarize and the data for and against them that they present. The exposition is very clear and the material very interesting. The authors' defence of their own views and their objections to rival views are impressive. I am not the person to evaluate them in detail, though, and I simply urge anyone interested in theories of reasoning to read the book. In the rest of this review I shall express some worries about the general line taken in the book. But these must not obscure my general admiration for it.

Among the book's aims is to choose between different accounts of what 'if' means in English. The crucial data here is subjects' non-mistaken judgements about inferences involving conditionals. 'Non-mistaken' is crucial: if we can explain why subjects deviate from the inferences that a theory would label as correct then their deviance is less telling as evidence against the theory. The authors describe a number of systematic sources of error, in particular the

interesting 'matching bias', which is a tendency to consider instances and counterexamples whose lexical content, if not their sense, overlaps with that of the conditional sentence being considered. They also discuss difficulties people have with negations of complex sentences, and various biases depending on the relevance of a counterexample to the assumed communicative purpose of a conditional. But in general they want to avoid explaining inference patterns in terms of mistakes. This gives them an ambivalent attitude to inferences such as *modus tollens* and contraposition, which are widely violated or ignored in people's actual reasoning but which are hard to exclude from one's list of correct inferences involving indicative conditionals. It is not easy to gather from the book which of these inferences they take to be correct. In fact, I am told by the authors that they take *modus tollens* to be valid and contraposition not to be. Given the authors' interest in linking conditionals to conditional probability, I wonder whether it is for them a troubling fact about contraposition that P(B|A) can be high (above 0.5), P(B) be low, but P(A) be high. And I wonder what their attitude is to natural-feeling derivations of contraposition from *modus tollens such as the following.* Suppose 'if p then q'. Then suppose further that 'not q' is true: it follows by *MT* that 'not p' is true, so when we suppose 'not q' we get 'not p'. So 'if not q then not p' is true. In fact inferences people are not comfortable with are very easily derived from inferences people are comfortable with. Philosophers can find ways of blocking the derivations, but they are themselves often ones that have the same intuitive appeal as those whose status the blocking is supposed to protect.

The authors sometimes speak of 'the' meaning of the English conditional, though they acknowledge the contrast between indicative and subjunctive conditionals. They feel that they have a pretty strong case that 'if' in English is almost never represented by the material conditional. Their case is based on the fact that frequently-used patterns of inference conflict with all the possible truth tables for the conditional. It is not unreasonable to conclude from this that 'if' is often not truth-functional. The authors are particularly receptive to the possibility that conditionals lack truth values when their antecedents are false. But there are many cases in which it is hard to deny that the material conditional is the right reading. The clearest are ifs that are linked to generalizations: if it's a cat then it has whiskers, if we meet in Paris we will be meeting in France. Or, more complicated but more telling, 'all my children's children are on the boat' can be true even if one of my children has no children: if it is a child of my child then it is on the boat, so if it is a child of Alice it is on the boat. You cannot hold on to a truth value gap and also hold on to 'all As are Bs' entailing 'if it is an A then it is a B'.

Reasoning with generalizations is at the heart of the Wason task, which is extensively discussed. In that task subjects are asked to say which possibilities need to be checked to discover the truth or falsity of a generalization 'all As are Bs'. Subjects tend to ignore the relevance of non-Bs that might be non-As. What they seem to be mistakenly ignoring is contraposition, but the authors

analyse the case entirely in terms of *modus tollens*.

These issues arise in part because of the assumption, shared by many philosophers, that the meaning of 'if' is linked to patterns of valid inference. Even without this assumption the project of separating core conditional reasoning competences from the many possible sources of performance error is a very hard one. There is a basic contrast here between on the one hand approaches like that of this book and the mental logic school, and on the other hand approaches like the mental models school. On the former, inference is basic and based on rules that should have some syntactic basis; on the latter, inference is a by-product of our searches for verifying instances and counter-examples among semantic representations. As the authors make clear, we do not have a version of the mental models approach that accounts for the data in an enlightening way, or which is even clearly formulated. All the same, the book as a whole gives me a strong sympathy for this latter approach, on which it is not at all surprising that patterns of inference are so varied and unsystematic.

The last two chapters of the book present evidence that subjects tend to assess the probability of a conditional in terms that approximate the conditional probability they give to the consequent given the antecedent. The authors take this as suggesting a 'suppositional' theory, according to which when evaluating a conditional we suppose the antecedent and see how strongly we are pushed towards the consequent. Views of this sort have been strongly defended, notably by Dorothy Edgington. They might turn out to be correct. It is possible to doubt that the evidence points so directly at them, though. A clue as to what might be going wrong is given by their treatment of 'negated conditionals'. The section in chapter three with this title discusses conditionals linking negated propositions. Reasoning tasks involving 'It is not the case that if p then q' are not discussed. In fact reasoning with real negations of conditionals is, I think, little studied. A basic reason for this is that people rarely use explicitly negated conditionals in their speech, so that to investigate them we would have to devise tasks which reveal to the subjects possibilities they had not appreciated. Here is an experiment that I would like to see tried. Take a coin and a die and say 'if the coin lands heads, the die will not land 6-up', and before tossing them ask 'is that true?' Then ask about the truth of 'if the coin lands heads, the die will land 6-up'. My prediction is that significantly many subjects will assert that both sentences are false. I also predict that after a training in which issues like this arise in various forms some intelligent subjects will react differently when asked 'how probable is it?' They will have gained the capacity to take 'it' to refer to the whole conditional rather than to antecedent, consequent, or consequent-given-antecedent. They will typically judge the probability of the conditional to be lower than the corresponding conditional probability (which is 5/6 in the 'heads then not 6-up' example, suggested by an example in William Lycan's *Real Conditionals*.). I predict that some intelligent subjects will also refuse to be influenced by this procedure.

And some of the most intelligent subjects of all will respond with 'depends on what you mean by *if*.'

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