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Some comments on Brée & Coppens' "The difficulty of an implication task"

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In a recent article in this Journal, Brée & Coppens (1976) tested Brée's (1973) model of performance on Wason's extensively studied "four-card task." The Brée model is of considerable interest in that it (a) differentiates comprehension of the proposition to be tested from the hypothesis-testing strategy itself (as do Smalley, 1974, and Moshman, 1977), and (b) is closely related to Piaget's theory of formal operations (Inhelder & Piaget, 1958) in its consideration of combinatorial analysis (elaboration of possibilities) and hypothetico-deductive reasoning (reasoning based on possibilities rather than facts). Unfortunately, the test of the model is marred both by incorrect predictions and questionable exclusion of subjects from the data analysis.

The predictions of the model are discussed on p. 581 of the Brée & Coppens (1976) article and schematized in Table I on that page. There seem to be three discrepancies between the table and the verbal discussion. First, with regard to the $\bar{q}$ card and the illative interpretation, it is stated that 'subjects using either strategy A or B would not select this card'. But Table I indicates that strategy B would indeed lead to the selection of the $\bar{q}$ card for subjects using the illative interpretation. The table, rather than the text, seems to be correct in that such subjects "select any object which could have a symbol (hidden or visible) requiring the presence of *any* other particular symbol," and there clearly could be a p on the other side, requiring the presence of a q.

Later on the same page, the authors state that "subjects interpreting the proposition as illative implication should never select a card with an odd digit ($\bar{q}$), no matter which strategy they use." But this conflicts with their explanation in the preceding paragraph of why this card will be chosen by subjects using strategy C, and with the indication in Table 1 that $\bar{q}$ will be chosen by strategy B subjects as well. Again, the table seems to be correct, not the text.

Finally, still discussing the effect of subjects' interpretation of the proposition on choice of $\bar{q}$, the authors state that "those interpreting it as a converse, should always select such a card." But according to Table 1, subjects using a converse interpretation will not choose $\bar{q}$ if they are using strategy A. There is perhaps an ambiguity in the theory here. It could be argued that since, according to the definition of the converse interpretation in Table 1, subjects see $p\bar{q}$ cases as disconfirming, a card with a $\bar{q}$ on it requires a $\bar{p}$ on the other side and should thus be selected regardless of strategy (as suggested in the text). On the other hand, if we take the converse interpretation simply to mean an interpretation in which p requires q and vice versa, then $\bar{q}$ does not inherently require $\bar{p}$ and should be selected only by subjects considering the implications of hidden symbols (strategies B and C). This latter reading of the theory, which leads to the predictions in Table 1 (but disagrees with those of the text), seems preferable in that it makes the *modus tollens* inference ($p \rightarrow q$; $\bar{q}$; therefore $\bar{p}$) a matter of strategy rather than of interpretation. Taken this way, the Brée model has interesting implications not only for four-card task performance but for deductive reasoning in general. For example, recognizing the validity of *modus tollens* may not be inherent in the comprehension of implication but require a formal operational deductive strategy in which possible conclusions are considered (combinatorial analysis) and their implications traced out (hypothetico-deductive reasoning), a strategy analogous to four-card task strategies B and C in the Brée model.

Moving to the Results section of the Brée & Coppens paper, it should first be noted that Table 2, in which the results are presented, is misleading. The figures for both groups combined (third section of the table) have apparently been summed across strategy as well as across groups, though the table does not clearly indicate this. Thus, under converse implication, the numbers 11, 2, and 4 all come from column A (not B), while under illative implication the number 6 is not really in column B but rather is a sum of 1 from column A, 2 from column B, and 3 from column C.

A more serious problem than the misleading table is the fact that the discussion of results only considers those 19 subjects "who evaluated the proposition as a converse or as an illative implication and selected a pattern of cards predicted by the strategy model." The authors note that the two subjects using an illative interpretation but choosing p and q do not conform to the model, but fail to note that the subject using the illative implication but choosing p and $\bar{p}$ (a pattern not predicted by the model for any combination of strategy and interpretation) is equally disconfirmatory. In addition, there are four subjects giving interpretations of the proposition not conforming to the two legislated in advance who are for this reason discarded from the analysis. These subjects do not inherently falsify the model; it would be useful to see what interpretation each of them does use and whether their choice patterns could result from the application of one of the three Brée strategies to their interpretations.

In conclusion, the Brée & Coppens article seems to suffer from inaccuracies in making predictions, a misleading presentation of results, and questionable exclusion of subjects from the data analysis. It should be emphasized, however, that this in no way discredits the Brée model, which remains a viable and interesting model of four-card task performance, and which may have broader implications for deductive reasoning as well.

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