"If" is Easier Than "Or" in the GRE

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In logic, a conditional, such as: "If the trend continues then a decline will occur" is equivalent to a disjunction: "Either the trend stops, i.e., doesn't continue, or a decline will occur". Both assertions are compatible with the following three possibilities, where "¬" denotes negation:

Trend Decline
¬ Trend Decline
¬ Trend ¬ Decline

The equivalence may break down as a result of the specific content or context of assertions (Johnson-Laird and Byrne, 2002). But, where the two assertions are equivalent, the conditional has the mental models:

Trend Decline
. . .

in which the first model represents the possibility in which the antecedent is true, and the second wholly implicit model represents the possibilities in which the consequent is false. The disjunction has the mental models:

¬ Trend
Decline
¬ Trend Decline

It follows that reasoning should be easier with the conditional than with the disjunction.

We conducted three experiments to test this prediction using "logical reasoning" problems from the Graduate Record Examination (the GRE, devised by Educational Testing Services, Princeton. In Experiment 1, 20 participants carried out either a conditional version or a disjunctive version of 8 GRE problems, e.g.: the conditional version:

Because the number of surgeons is growing faster than the number of operations and because noninvasive medical therapies are increasingly replacing surgery, the average annual number of operations per surgeon has fallen by one-fourth in recent years. It can be concluded that, if these trends continue, a dangerous decline in the level of surgical skill will occur.

The argument is based on which of the following assumptions?

(A) Surgeons now spend a large percentage of their time performing noninvasive medical procedures.

(B) A surgeon's skill cannot be properly maintained unless the surgeon performs operations with a certain minimum frequency.

Option (B) is the correct answer. The disjunctive version included instead the following final assertion:

It can be concluded that, either these trends stop, or a dangerous decline in the level of surgical skill will occur.

The participants had to select the correct response from the pair of assertions, which were the correct conclusion and the most frequently chosen foil (according to ETS). The accuracy of responses did not differ, but the participants were reliably faster to solve the conditional problems (mean 1.76 min.) than the disjunctive problems (mean 2.06 min.).

Experiment 2 was a replication but in which the two response options were conditionals (for the conditional problems) and disjunctions (for the disjunctive problems). The participants were reliably more accurate and faster with the conditional problems (73% correct, 0.8 min.) than with the disjunctive problems (61% correct, 1.17 minutes). The use of a sentence containing a given connective in both the text and the two response options evidently amplified the difference between conditionals and disjunctions.

Experiment 3 used conditional and disjunctive texts with conditional and disjunctive response options in all four combinations. The results showed that the nature of the response options was decisive. The 40 participants were faster and more accurate with problems that had conditional responses than with problems that had disjunctive response options.

We conclude that the model theory's predictions about the different representations of conditionals and disjunctions extend to realistic problems based on the GRE. Theories based on formal rules of inference (e.g., Braine and O'Brien, 1998; Rips, 1994) make no predictions about this difference.

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