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WHEN NEGATION IS EASIER THAN AFFIRMATION

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An experiment is reported which establishes that affirmative sentences are not always easier to grasp than negative sentences. The subjects had to make inferences from pairs of premises such as: "Either John is intelligent or he is rich. John is not rich". The task was reliably easier when the second premise was explicitly negative (as in the example) than when it was an affirmative ("John is poor"). It was most difficult when the negative occurred in the disjunctive premise and was denied by an affirmative (e.g. "John is intelligent or he is not rich. John is rich"). It is argued that it is simpler to establish that two statements are mutually inconsistent when one is the explicit negation of the other, but that the natural function of the negative is to deny.

Introduction

Negative sentences are generally harder to understand and to evaluate than affirmative sentences. This was originally demonstrated experimentally by Wason (1959) and has subsequently been confirmed by numerous investigators. Yet, in daily life, negatives hardly ever seem to be difficult. This paradox is perhaps best resolved in terms of Wason's thesis (1965) that negatives are normally used to deny plausible misconceptions. For example, the misconception, or preconception as we prefer to call it, in the case of, "John doesn't like Mary", would be that John does like Mary. It is accordingly feasible that the comprehension of such a negative in its everyday context is facilitated by the prior grasp of its preconception. Precisely this advantage is lost by the experimental presentation of the sentence in contextual isolation. There is some evidence to support this conjecture. Both Wason (1965) and Johnson-Laird (1967) were able to reduce the difficulty of negatives by ensuring that they made plausible denials. But are there any circumstances in which a negative would actually be easier than an affirmative?

Consider the logical problem of what can be inferred from the following premises:—(1) Either John is intelligent or he is rich. (2) John is not rich. It is a simple matter to appreciate that the second premise is a categorical denial of one of the alternatives in the disjunctive premise, and hence that the other alternative must be true, i.e. John is intelligent. But suppose that the negative premise is replaced by an affirmative one with the same function:—(1) Either John is intelligent or he is rich. (2) John is poor. It now seems that an extra step is required since it is necessary to appreciate that *poor* implies *not rich*. Hence, this problem is likely to be more difficult than the first one, because it contains an implicit rather than an explicit denial.

The problem is likely to be still harder if the negative is moved into the disjunctive premise:—(1) Either John is intelligent or he is not rich. (2) John is rich. It is still easy to see that there is a conflict between the categorical premise and one alternative of the disjunctive premise, but it seems very much harder to grasp what this implies. In fact, of course, one alternative is again false so the other must be true, i.e. John is intelligent.

The present study investigated all three sorts of problem: the first in which a negative is used appropriately to make a denial, the second in which an affirmative is used to make a denial, and the third in which the negative is inappropriately denied. It was predicted that the "appropriate negative" problem would be easier than the "affirmative" problem which, in turn, would be easier than the "inappropriate negative" problem.

Method

Design and materials

The subjects acted as their own controls and attempted to solve two examples of each of the three sorts of problem. The order of presentation was counterbalanced so that each of the six possible different orders for three problems, followed by its mirror image, occurred with an equal number of subjects.

In constructing the problems three boys' names and three girls' names were used, and three pairs of traits: intelligent or rich (poor), generous or beautiful (ugly), athletic or short (tall). The terms in parentheses were used, where necessary, to deny their antonyms in the first three problems encountered by subjects, they were denied by their antonyms, where necessary, in the second three problems encountered by subjects. The order of the resulting six different lexical contents was held constant over the subjects.

Subjects

Twenty-four undergraduates at University College, London were individually tested. They had no previous experience with tasks of this sort or with formal logic.

Procedure

The subjects were told that their task involved reasoning but it was not an intelligence test. They would be given a series of problems, each consisting of two premises, and they would have to determine what followed from them in virtue of logic alone. They were to make their responses as quickly as was compatible with drawing the correct conclusion.

The experimenter read aloud each problem, and timed the subjects by stopwatch from the moment that he finished reading until they uttered a response. The response was neither commented upon nor corrected. There was a single practice problem of a different logical variety to familiarize subjects with the general procedure.

Results

The mean response times for the three sorts of problem on their first and second presentations are given in Table I. The evident trend in favour of the prediction was highly reliable. Nine subjects conformed precisely to the required rank order, seven subjects partially conformed to it except that for them the "affirmative" problem was the most time consuming, and four subjects partially conformed to it except that for them the "affirmative" problem was the least time consuming. Only the results of the four remaining subjects were sufficiently far from the prediction to count against it (in terms of Kendall's P). Hence, the trend was

highly significant ($P = 0{\cdot}001$, sign test, one tail). It will be noted that the appropriate negative was less time-consuming than the affirmative for 17 out of the 24 subjects ($P < 0{\cdot}04$, sign test, one tail).

An analysis of variance was also carried out on the untransformed response times. It confirmed the significant difference between the problems ($F2,46 = 32{\cdot}7$; $P < 0{\cdot}001$), but failed to reveal any significant effects involving the lexical material. The apparent learning effect from the first to the second presentations of the problems was not significant, presumably because the "inappropriate negative" problem took more time (but yielded fewer errors) on its second presentation.

TABLE I

The mean response time (sec) for the three types of problems on their first and second presentations

	Type of problem		
	Appropriate negative	Affirmative	Inappropriate negative
First presentation	4·8	6·7	8·0
Second presentation	4·2	5·5	8·8
Overall mean	4·5	6·1	8·4

A greater number of errors were made by the subjects than had been anticipated: nine errors with the appropriate negative, 12 errors with the affirmative, and 21 errors with the inappropriate negative. (Their overall mean latency was about 1·0 sec longer than that of the correct responses.) The trend is again in the predicted direction, and, since about a third of the responses were erroneous, it was considered that some statistical treatment of them was desirable. They were therefore scored according to the following conservative principles: when only one error was made by a subject, it was counted in favour of the prediction if it occurred with an inappropriate negative, against the prediction if it occurred with the appropriate negative, and neutral with respect to the prediction if it occurred with the affirmative. When more than one error was made by a subject, exactly the same scoring procedure was followed for each of them, and the overall total computed. It transpired that of the 17 subjects who committed errors, nine had positive scores in favour of the prediction, and the remaining seven subjects had neutral scores of zero. Hence, there was a reliable trend in favour of the prediction ($P = 0{\cdot}003$, sign test, one tail). The main error consisted in stating the negation of the correct conclusion.

Most of the remarks made by the subjects were symptomatic of the difficulty of the inappropriate negative. They complained that it was somehow ungrammatical or invalid to assert: "Either John is intelligent or he is not rich". They complained, more irrelevantly, that it was unclear whether the two alternatives were mutually exclusive.

Discussion

The pattern of results makes a striking contrast with the other findings on negative sentences reported in the literature. In interpretative tasks, such as matching statements to pictures, affirmatives are easier to understand than negatives (e.g. McMahon, 1963), whereas we found that in denying a statement negatives are easier than affirmatives. The reason for this contrast obviously lies in the difference between the two tasks. Pictures are likely to be encoded in a primarily affirmative fashion, and, in evaluating descriptions of them, it is natural that the aim should be to set up a one-to-one correspondence between the description and encoding. Indeed, this is a basic assumption of two independently formulated information-processing models of the task (Clark, 1971; Trabasso, Rollins and Shaughnessy, 1971). However, to grasp that one statement denies another the aim should be to establish *not* a one-to-one correspondence between them but a mutual inconsistency. This will be easiest when the two statements contradict one another, especially if one is the explicit negation of the other. It will be hardest when the two statements are merely contrary to one another, especially if they contain affirmative but autonymous predicates.

There are, of course, further complications. Within some pairs of antonyms one item can be used in a quite neutral sense (e.g. *tall*, when one asks how tall someone is), whereas the other item can be used only in a contrastive sense (e.g. *short*). This asymmetry has prompted Clark (1971) to argue that the contrastive items are implicit negatives: their meaning is defined essentially by negating their antonyms. Hence, it is plausible that they would make more natural denials of their antonyms than their antonyms would of them. A careful examination of our data failed to reveal any such difference or, indeed, any difference between the different sorts of antonyms. However, the experiment was not specifically designed to examine these factors, and it is intended to put them to a more stringent test in a further investigation.

The more crucial complication concerns the order of statements. It is difficult to see why this factor should affect the detection of a mutual inconsistency. Indeed, Greene (1969) found that it had no effect upon a task in which subjects had merely to judge whether two statements, one affirmative and the other negative, were synonymous or not. Yet our findings show that it is easy to grasp that a negative denies an affirmative, but exceedingly difficult to grasp that an affirmative denies a negative. The simplest explanation would seem to be that the subjects attempt to keep track of the attributes which apply to the given individual. Hence, with an inference from the premises—(1) Either John is intelligent or not rich; (2) John is rich—there may be a tendency to argue that the second premise negates an alternative in the first premise. Hence, John is *not* not rich; it follows that he is rich. But this, of course, is precisely the premise from which the argument started. The whole of this "double negative" inference may then start again, and continue in an almost hypnotic fashion until the subject breaks the circle by concluding that a negative follows from the premises. In the easier inferences, however, it is a simple matter to keep track of the attributes which apply to the given individual because the double negative does not occur, and thus the vicious circle does not arise.

It would be easy to suppose that the greater difficulty of negative sentences over their correlated affirmatives was one of the constants of psycholinguistics. We now know that this is not so. Perhaps it should not surprise us that the proper function of affirmatives is to make assertions, and of negatives to make denials.

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