Sample size, likelihood, and confidence in a decision¹

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Ss made decisions in a two-choice task following 3, 9, and 19 items of information, and rated their confidence in their decisions. When the likelihood of the informative events was constant, confidence was inversely related to sample size. The results were the reverse of findings in studies of the sequential revision of confidence.

Confidence ratings following decisions are frequently employed to provide information on the decision-making process. However, there appear to be certain systematic discrepancies between confidence judgments and objectively determined probabilities. One such effect is a failure of Ss to reduce their stated confidence in a decision following information which disconfirms their decision (Brody, 1965; Pitz, 1965; Pitz, Downing, & Reinhold, 1967). Related to this effect is the finding that it takes more information for Ss to change a preliminary decision than to arrive at a decision, prior information being identical (Pruitt, 1961; Gibson & Nicol, 1964). There are two possible explanations for this phenomenon. On the one hand, Ss may believe that contradictory information is less important than confirming information, possibly because a small amount of contradictory information is to be expected in a probabilistic situation. On the other hand, the phenomenon may reflect a commitment process, Ss being unwilling to retract a decision once it has been made. There are data from other sources to support both interpretations. Binary choice experiments confirm that Ss possess expectations concerning the patterning of sequences of probabilistic events, while studies of decision-making in a social context indicate that commitment to a decision makes Ss resistant to change.

A simple comparison of the two hypotheses may be obtained by providing Ss with information of equal likelihood, but with different numbers of disconfirming events. In a two-choice decision task, suppose information consists of a sequence of independent, fallible predictors of the correct choice, where the probability of a correct prediction is constant. The likelihood of the information is then a function of the difference between the number of predictions of the two hypotheses. If D is this difference, and N is the total number of events presented, one may present sequences in which D is constant but N varies. The number of disconfirming events will then be a function of N . If Ss are less responsive to disconfirming events than to confirming events, confidence in a decision should

be greater for larger values of N , given a constant D . If Ss make a single decision following all N events, there is presumably no prior decision to which Ss are committed, and a commitment process should be unimportant.

Method

A Bingo basket² containing six balls, three painted red and three painted blue, was arranged so that its contents were hidden from Ss' sight. One ball was removed from the basket at random, the task being to predict the color of the ball. Information consisted of a sampling, with replacement, of balls which remained in the basket, so that it was clear to Ss that the selection of the correct hypotheses and the generation of information was entirely random. The color of the ball which was removed may be predicted from the color of one sampled ball with probability 0.6. Hence, if R is the number of red balls sampled, and B is the number of blue balls, an optimal decision should be based on the value of $D = R - B$. That is, Ss should have guessed "red ball" when $D < 0$, and "blue ball" when $D > 0$.

Fig. 1. Average confidence judgments as a function of the absolute difference between red and blue balls sampled, and sample size, N .

Fig. 2. Proportion of optimal responses made as a function of the absolute difference and of N.

Twenty-eight volunteers from an introductory psychology course served as Ss, obtaining credit towards a course requirement. Half the Ss kept written records of the samples, their decisions, and the outcomes, while the others kept no records. Since there were clearly no differences in the results of these two groups, their data were pooled for all analyses.

Samples of size $N=3$, 9, and 19 were used, and 10 decisions were made at each sample size. The order of presentation of the sample sizes was randomized independently for each S. Following their decisions, Ss gave ratings of their confidence that they were correct; complete uncertainty was indicated by 0, and complete certainty by 10.

Results

Average confidence judgments for each absolute value of D, with N as a parameter, are shown in Fig. 1. The hypothesis that confidence judgments would be higher as a function of N is clearly wrong; in general, the reverse was true. Because of the random nature of the information, some Ss were not represented at all points in Fig. 1. However, it was possible to find five orthogonal comparisons of average confidence for constant D but varying N for each S. Hence, for each S, the number of times that confidence was higher for smaller N varied from 0 through 5. The null hypothesis that these frequencies were binomially distributed with $p=0.5$ was rejected at the .01 level ($\chi^2=19.10$, $df=5$). There is some evidence that for constant likelihoods, confidence is inversely related to N.

The proportion of optimal responses as a function of D and N is shown in Fig. 2. It appears that, for con-

stant D, the proportion of optimal responses was higher for smaller N, but there were too few non-optimal responses given for this effect to be statistically significant.

Discussion

In the sequential revision of confidence judgments, confidence in a decision has been shown to be higher for larger values of N, with constant D, as a result of a failure to reduce confidence following disconfirming information (Pitz, 1965; Pitz, Downing, & Reinhold, 1967). In the present study, the reverse was true. It seems that the earlier findings were a result of the sequential revision process, and were probably due to Ss' having committed themselves to a statement of opinion. The explanation for the results in the present non-sequential task is not clear, but it is possible that Ss reacted in part to the ratio of R to N or B to N, as well as the difference between R and B. The present results are consistent with those of Peterson, Schneider, & Miller (1965), who found that in the revision of probabilities, Ss were more conservative (less extreme in their judgments) when sample size was larger.

The fact that the functions in Figs. 1 and 2 are similar is interesting, but, owing to the small number of cases upon which Fig. 2 is based, is difficult to interpret. Whereas the effect of N upon confidence in this study was the opposite of the effect in a sequential task, there is some evidence that the effect of N upon optimality of performance in a sequential task (Pitz & Reinhold, 1967) is similar to that shown in Fig. 2.

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Notes

1. This study was supported by a grant from the Psychiatric Training and Research Authority of the Illinois Department of Mental Health.
2. Examples of the equipment and its use may be seen at any church bazaar.