Effects of information about environmental probability on psychological probability

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Different amounts of information about empirical or environmental probabilities on psychological or judged probabilities were studied by instructing 204 Ss to estimate how often each letter of the alphabet occurred in a 1000 letter newspaper clipping. Ss were given (A) no information about the empirical distribution of letters, (B) the mean, or (C) the mean and the range. Although different amounts of information about the empirical letter frequencies did not influence judged frequencies, the correlations between these two variables ranged from $r = .89$ to $r = .92$. The extreme stability of Ss' judgments is indicated by the higher correlations among the judgments of the groups than between judged and empirical frequencies.

The objectivist and the personalist represent two extreme positions regarding the interpretation of probability. Although the objective position is currently the most popular, a number of investigators (e.g., Davidson, Suppes, & Siegel, 1957; Edwards, 1953; Preston & Baratta, 1948) have attempted to measure subjective or psychological probability, i.e., personal belief in a particular proposition. Moreover, Komorita (1959), in an extension of these studies, has attempted to define factors which might influence an individual's estimate of the likelihood of events.

With the exception of a study by Attneave (1955), however, little work has been directed toward determining the correspondence between environmental (true) and psychological probabilities. Attneave investigated this problem by asking Ss to estimate the frequency with which each letter of the alphabet occurred in a newspaper clipping containing 1000 letters. The results indicated that judged frequency correlated substantially with true frequency although Ss tended to overestimate low probabilities and underestimate high probabilities, the point of indifference (where psychological probability is equivalent to mathematical probability) being approximately equal to the arithmetic mean. Attneave speculated that this particular indifference point may have resulted from mentioning the value of the arithmetic mean in the instructions. The present study was designed to determine the effects of different amounts of information about true letter frequency on their judged frequency (psychological probability).

Subjects

The Ss consisted of 204 students enrolled in introductory psychology classes at Augusta College. Groups A, B, and C contained 73, 64, and 67 Ss, respectively.

Procedure for Obtaining Judgments

Each S was given a mimeographed sheet on which the alphabet was printed with a blank space by each

letter. All three groups were given the following basic instructions, which were taken from Attneave (1953, p. 82).

This is a test to find out how observant you are. All of you read newspapers, magazines, and books, from time to time. Now, in ordinary reading matter of this sort, some of the letters of the alphabet are used much more often than others. We want to find out how well you have noticed which letters of the alphabet are used most often, and which ones are very seldom used.

Suppose you took a newspaper clipping with a total of a thousand letters in it. This clipping I'm holding up has just about a thousand letters in it. Suppose you counted all the As in this clipping. Then all the Bs, then all the Cs, and so on down through the alphabet. How often do you think each letter would turn up? This is what you are to fill in on the blanks I have given you: how often, on the average, you think each letter would appear in a sample of reading matter about this long, with a total of a thousand letters in it.

The estimates you put down actually ought to add up to a thousand, but don't worry about trying to make them add up—the important thing is to get the proportions of letters to each other as nearly right as you can. You will have only 10 min. in which to make these estimates, so work as quickly as you can. Are there any questions before we start?

Group A received only the basic instructions. Group B received the following additional instructions about the mean of the letter frequency count (LFC).

"However, if the 26 letters were used equally often, each one would appear about 38 times. Therefore, if you think a particular letter is used more often than average your guess should be above 38, whereas if you think it is used less often than average your guess should be below 38."

Group C was additionally informed about the range of the LFC.

"In this newspaper clipping the most frequent letter appears 127 times while the least frequent letter appears 1 time."

Letter Frequency Count

The frequencies of the letters were obtained by count from local newspapers. A total of 10,000 letters were counted in 100-letter groups selected at random.

Results and Discussion

Table 1 shows the intercorrelation matrix for (1) the letter frequency count (LFC), (2) Group A, which

received no information about the LFC, (3) Group B, which was given the LFC mean, (4) Group C, which was given the LFC mean and range. (All reported correlations are based on an N of 26, rather than number of Ss. For a discussion of this relatively unusual use of Pearson's r , see Attneave, 1953.)

No significant differences were found among the correlations of the three groups with the LFC. In order to compare the stability of relative frequencies of letters in English-text, the LFC obtained in the present study was compared to the LFC obtained by Attneave. The correlation between these two LFCs was $r = .99$.

As shown in Table 1, the correlations among Groups A, B, and C are all higher than the correlations of the three judgments groups with the LFC. The average z for correlations between the LFC and the judgment groups was 1.51. The average z for the correlations among the judgment groups was 2.48; the corresponding standard score for the difference between correlations was 3.34, $p < .001$ (Guilford, 1966). This finding shows that the correlations among Ss' judgments are significantly higher than the correlations between the judged and empirical LFC. The overall results thus provide strong evidence that Ss' estimates are both highly stable and relatively immune to change from additional information about the LFC.

In the present study, Group B received the same instructions as did Attneave's Ss who estimated relative frequencies of letters. Attneave reported a correlation of $r = .79$ between LFC and judged frequency. The corresponding correlation in the present study was $r = .91$. The difference between these r s is non-significant.

Preston & Baratta (1948), Attneave (1953), and Komorita (1959) all found that Ss tend to overestimate low probabilities and underestimate high probabilities. Figure 1 corroborates these findings for Group A (essentially the same results were obtained for Groups B and C) and indicates that additional information about the LFC not only failed to increase the correlation between psychological and environmental probabilities but also failed to change the systematic error involved.

Attneave found the point of indifference to be quite close to the arithmetic mean. He speculated that explicit mention of the mean in his instructions to

Table 1. Interrelation Matrix for Groups A, B, C and Letter Frequency Count

	LFC	A	B	C
LFC	x	.89	.91	.92
A		x	.98	.99
B			x	.99
C				x

Fig. 1. Mean judged frequency plotted against English letter frequency for Group A.

Ss may have been of some importance in this connection. However, the results of the present study showed no evidence for this hypothesis. In fact, the point of indifference is quite close to the arithmetic mean for all three groups.

In general, the data indicate that giving Ss varying amounts of information about the relative frequencies of letters had no detectable effect on judgments. This finding requires some explanation since it would normally be expected that additional information about environmental probabilities would result in more accurate likelihood estimates. One explanation may be that Ss were really not given any additional information. It is possible that experience with English prose may have already provided Ss with a reasonably accurate and highly stable estimate of the statistical parameters involved.

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