Comment *by V. J. Polidora* The University of Wisconsin

In his studies of shuttle avoidance learning to an air-blast US, Ray (1966a, b) reported very rapid and nonincremental learning by rats. It can be argued, however, that Ray's use of a 5/6 criterion of "learning" is excessively lenient, making his conclusions possibly misleading with respect to the issue of nonincremental learning. Ray tested for nonincremental learning by comparing the number of avoidance responses in the first and second halves of the block of intermediate trials (the "oscillation sequence") between the first avoidance and the last escape before reaching the 5/6 criterion. Ray reported both significant (1966b) and nonsignificant (1966a) t-values for this comparison, and he cited *both* as evidence of nonincremental or all-or-none learning. He also reported (1966b, p. 434), ". . .there were many fewer avoidance responses in the second half than in the first half of the oscillation sequence."

In our study of avoidance learning with electric shock and air-blast US (Polidora & Boyer, 1967), squirrel monkeys learned more rapidly to avoid air-blast than continuous or discontinuous shock US. Testing for stationarity with a 5/6 criterion also revealed insignificant t-values, indicating nonincremental learning in all groups of monkeys. But testing with a run-of-10 (cf., Theios & Dunaway, 1964) or even a run-of-6 criterion, obviously more convincing evidence of "learning" having occurred, the t-values for all groups were significant ($p < .02$), indicating nonstationarity or gradual learning. Obviously one important issue is the selection of an adequately stringent criterion of "learning" in testing for stationarity. I do not believe Ray has yet provided sufficiently convincing evidence that rats learn nonincrementally to avoid air-blast.

References

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Reply to Polidora: Continued evidence of non-incremental acquisition *by A. Joseph Ray, Jr.* Carleton University, Ottawa, Ontario

Polidora implies that nonsignificant and significant t tests may not both sustain a nonincremental interpretation of shuttle-avoidance acquisition. It must be made clear that any statistical test is weak evidence for all-or-none learning, for *only* those Ss which oscillate between success and failure, and thus are not strictly nonincremental learners, can be evaluated by this technique. However, 15 rats of 29 that learned in the first experiment (Ray, 1966a) shifted abruptly (that is, with no oscillation) from escape responding to avoidance responding. In the second study (1966b), with many rats as young as 60 days (shuttle-avoidance learning improves with age), 14 of 45 that learned did not oscillate. This is good evidence of nonincremental learning if performance is similar when a more stringent criterion is used.

Did those which oscillated reach criterion incrementally? If they did, the paired t test would show that the proportion of avoidance responses to total number of trials in the *second* half of the oscillation sequence was significantly greater than the proportion of avoidance responses in the *first* half of the oscillation sequence. There are, however, two additional alternatives: (1) that the avoidance responses are equally distributed in either half of the oscillation sequence (stationarity) in which case the value of t would be close to zero, and (2) that there are significantly more avoidance responses in the first half of the oscillation sequence than in the second half, in which case t would be positive and significant.

The first experiment supported alternative (1): Avoidance responses were equally distributed on either side of the midpoint of the oscillation sequence, and t was close to zero. In the second experiment, which had fewer non-oscillating learners, the first half of the oscillation sequence had significantly more avoidance responses than the second half, resulting in a positive, significant t value. Neither finding sustains the incremental point of view.

Another datum of importance in this context is the Pearson correlation coefficient between Trials to Criterion and Total Errors to Criterion. The coefficient, 0.970, is extremely high, and indicates that the two dependent variables are nearly equal for each S. The only behavioral fact which would account for such a situation is elimination of the oscillation sequence, for, as should be clear, what makes Trials to Criterion greater than Total Errors to Criterion is the interspersion of successes, before criterion—the oscillation sequence. When there is no oscillation, learning is all-or-none, and a correlation coefficient between Trials to Criterion and Total Errors will be 1.00.

Selection of a performance criterion ought to take into consideration the number of trials necessary for most Ss to acquire the response. On the basis of pilot