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Equal Rest-Work Ratios Under Massed and Distributed Conditions of Practice¹

B. L. KINTZ²

Abstract. Groups of subjects practiced operating the Multi-point Two-Hand Coordinator under various rest-work ratios. It was found that the groups which had equal ratios of rest-work, regardless of the absolute amount of time spent on either, performed at equal levels. Since many studies in the literature report different intervals of rest and work, making numerical comparisons between studies difficult, it is suggested on the basis of these results that equal rest-work ratios might be a useful comparison variable. Evidence was presented to support a hypothesis that groups practicing under massed conditions develop SIR (permanent work decrement), but distributed practice groups do not.

The two variables which have been used by most of the investigators who have studied the effects of massing (M) and distribution (D) of practice are: 1) some performance measure as the dependent variable, and 2) trials as the independent or manipulated variable. The trials variable has almost always involved some measure of time, which follows from the fact that the topic under study was amount of time spent practicing, along with the amount of time spent resting. The problem arises from the fact that almost every experimenter has chosen different periods of time to be designated as a trial. Some ambiguity arises from the use of the term "trial" since a trial for a M practice group involves much practice and little rest, whereas a trial for a D group involves a considerable amount of rest (e.g., consider a continuous practice group which gets no rest at all, and a distributed group which has five min. of practice and 15 min. of rest during every "trial"). Perhaps the term *practice time* would be less ambiguous. At any rate it seems that some unitary concept of the time or trials variable might be helpful for theoreticians who try to discover systematic relationships between the dependent and independent variables in motor performance situations.

The present study was designed to give information pertinent to the previously discussed problem, namely, that some unitary concept of the time or trials variable is needed, and that it is possible to experimentally locate a useful measure. The hypothe-

¹ This paper is based on a thesis submitted to the faculty of the Department of Psychology of the State University of Iowa in partial fulfillment of the requirements for the M. A. degree.

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sis upon which this research is based is that equal rest-work ratios might yield equal levels of performance. The check of this hypothesis involves the major portion of the study.

Given two sets of equal rest-work ratios, say R-10, W-30, and R-20, W-60 (ratio 1:3) along with R-90, W-30, and R-180, W-60 (ratio 3:1), a comparison of the performances of the separate groups provides a test of the hypothesis. This is what the present investigation entailed, along with the addition of a continuous practice group which is designated R-0, W-60 (ratio 0). It will be noted that the use of the words rest-work in that order is different from the usual order as used by other investigators. The reason for putting rest before work, or in the numerator of the fraction, is to avoid the anomalous situation of having a fraction with zero in the denominator.

Although this is primarily an empirical investigation whose main concern is the discovery of a convenient independent variable, it should be noted that one important problem which has been prominent in the literature, is touched upon. Kimble (1949) suggested that since one component of inhibition is the habit-like component SIR; as this component grows it should exhibit certain characteristics of habits in general as originally conceived by Hull (1943). That is, the SIR or conditioned inhibition should remain relatively constant over long periods of time. Changes in performance which occur over short periods of time are presumed to occur with respect to the drive-like component IR. Reyna (1941) and Kimble & Shatel (1952) reported that they found evidence for a permanent habit-like component in inhibition. Schucker, Stevens & Ellis (1953) and Seibel (1955) reported that they failed to find evidence for a permanent inhibitory component. It is important to note that Schucker, et al., introduced the idea that the subjects might rehearse the task during the rest period, thus the so-called permanent decrement might be due to the fact that the D group gets more practice, i.e., rehearsal during rest is similar to time spent practicing. These authors suggest introducing some other task into the experimental situation, for the subjects to perform during the rest period, in order to keep rehearsal at a minimum. Also they suggest that since the D groups perform at a higher level than the M groups, they are in effect getting more practice in a specified time period. Schucker, et al., use a correction for this practice differential in their experiment using the alphabet printing task. When such a procedure is used, no evidence for a permanent decrement SIR is found.

Kimble (1949) presented the following formulation concerning the growth of SIR. IR grows as a function of practice. After a

certain level of IR is reached, the subject imposes the resting response which results in a reduction of IR and a consequent growth of SIR through the principle of drive reduction. It seems, however, that continuous practice of about 90 sec., on the pursuit rotor task, is needed before much SIR will develop. In other words the critical level of IR that induces the resting response, is not reached before about 90 sec. of continuous practice. In groups using either 30 sec. or 60 sec. practice periods, no SIR would be expected.

The specific hypotheses that were tested in this study may now be stated:

1. Equal rest-work ratios will yield equal performance.
2. The continuous practice group will exhibit SIR, but the 1:3 ratio groups will not.

METHOD

Subjects

One hundred male students from the introductory psychology course at the State University of Iowa served as Ss in this study. They served in the experiment as part of the requirements of that course.

Apparatus

The Multipoint Two-Hand Coordinator was used. This apparatus has been fully described elsewhere by Lewis (1957). The Multipoint requires the S to trace an irregular pattern of brass dots set in a bakelite disk, with a button. The button is moved by turning two lathe-like handles. The number of dots contacted during a trial period is recorded by a counter.

Experimental Conditions

Five groups of Ss were used. Group 1 practiced under R-0, W-60 or continuous conditions. Group 2 practiced under R-10, W-30; Group 3 under R-20, W-60; Group 4 under R-90, W-30; and Group 5 under R-180, W-60 sec. During the rest periods the various groups were given tasks to perform in an attempt to keep rehearsal at a minimum.

Procedure. Group 1 was given 12 min. of continuous practice, three min. rest, then three more min. practice. During the rest period the Ss were required to read a poem about which they were asked three multiple choice questions at the end of the session. The purpose of the extra three min. of practice was to get an indication of reminiscence, and through it, a measure of SIR.

Group 2 was given 24 30-sec. trials, three min. of rest, then three more min. of practice. During the 10 sec. rest periods these Ss were required to turn around slowly and prepare for

the next trial. It took about five sec. to turn around and all groups were given five sec. to prepare for the next trial, i.e., to face the apparatus, grasp the handles, etc. During the three min. rest, these Ss read the poem about which they were questioned at the end of the session.

Group 3 was given 12 60-sec. trials, three min. of rest, then three more min. of practice. During the 20 sec. rest periods these Ss were required to sit in a chair a few steps from the apparatus, then get back up and walk back to the apparatus and prepare for the next trial. It took about 15 sec. for the walking and sitting, which left five sec. to get ready for the next trial. The poem was read during the three min. of rest, and questions were administered at the end of the session.

Group 4 was given 24 30-sec. trials. During the 90 sec. rest periods the Ss read the poem, and at the end of the session they were given the three questions. The Ss were instructed to memorize as much of the poem as possible.

Group 5 was given 12 60-sec. trials. During the 180 sec. rest periods the Ss read the poem, and at the end of the session they were given the three questions. The Ss were instructed to memorize as much of the poem as possible.

RESULTS

The performance curves for the five groups are presented in Fig. 1. It is immediately apparent in these curves that the groups which practiced under the greatest degree of distribution performed at the highest levels. In order to compare the performance curve of each group with that of each other group, ten separate trend analyses of the type reported by Lewis (1960) were run. The two main comparisons carried out for all possible pairs of groups, are those for experimental conditions (R), and those for interaction of condition by trials (T x R).

The first item of interest is that every group differs significantly from the 0-60 or continuous practice group (all *F*s are highly significant; $p < .001$). Both the means and the slopes of the curves of every other group differ to a greater-than-chance degree from the 0-60 group.

The second item of interest is that the equal ratio groups do not differ significantly from each other. Comparisons of the means and the slopes of the equal ratio groups show that the differences are not significant ($p > .10$).

These results show that, as is usually the case when the M-D problem is investigated using motor tasks, D practice results in performance that is superior to the performance with M practice. They also show that groups practicing under the same ratio

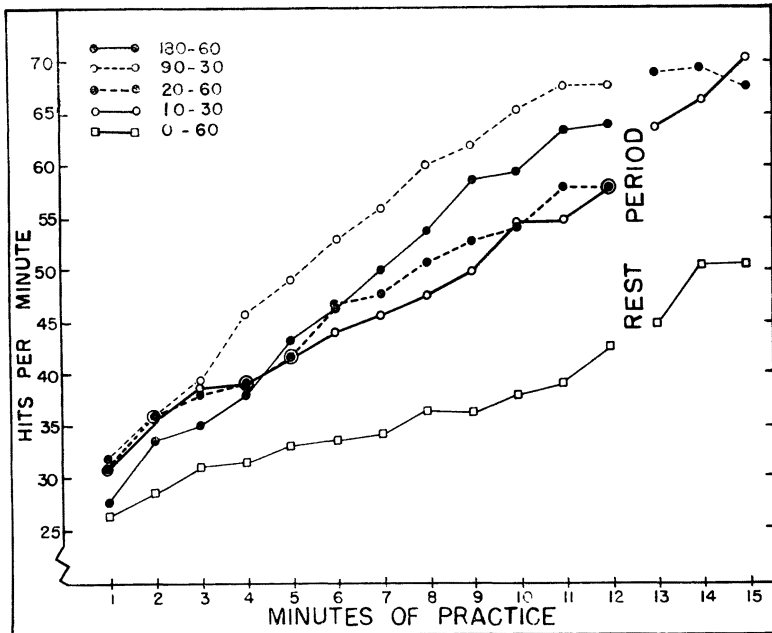


Figure 1. Number of hits per minute as a function of practice.

of rest to work do not perform at significantly different levels. The hypothesis that equal ratio groups perform equally well cannot be rejected, so it is tentatively accepted.

In the procedure section it was pointed out that the 1:3 and zero ratio groups were given a three min. rest after the 12 min. of practice. Then they were given three more min. of practice under the same conditions. A rough indication of reminiscence can be obtained by taking the difference between the mean of the last block of three trials before the rest period and the mean of the three trials given after the rest period.

The pre-rest and post-rest means of the 1:3 ratio and zero ratio groups were compared using *t*s for related measures. The 3:1 ratio mean was compared with the post-rest 1:3 ratio mean and the pre-rest 1:3 ratio mean was compared with the post-rest zero ratio mean using *t*s for unrelated measures. The results of these four *t* tests are presented in Table 1.

From Fig. 1 it can be seen that the 1:3 ratio groups achieved a post-rest level of performance that is higher than the final level for the 3:1 ratio groups. The difference is not significant as is shown in Table 1 ($p > .30$). The zero ratio group, however, failed even to reach the final level of performance of the 1:3 ratio groups. The difference between their means was significant ($p < .05$) as is shown in Table 1.

Table 1. Results of *t* tests on the Prerest and Postrest Performance.

prerest group	postrest group	difference between means	<i>df</i>	<i>t</i>
3:1	1:3	3.1	38	.97
1:3	0	8.3	38	2.11*
1:3	1:3	10.8	19	13.24**
0	0	8.8	19	2.23*

* Significant at .05 level.

** Significant at .01 level.

Since the differences between performance levels for the various prerest groups is attributed to I, and since IR is assumed to decay during rest, the amount by which the postrest group differs from some maximal or asymptotic level should be a measure of SIR. The evidence presented in Fig. 1 and Table 1 suggests that little or no SIR developed for the 1:3 ratio groups, whereas a considerable amount of SIR seems to be present in the zero ratio group. Thus it is suggested that these data furnish direct support for Kimble's hypothesis that when the work periods are shorter than 90 sec., no permanent work decrement develops, but when the work periods are longer (in this case 12 min.) SIR develops.

DISCUSSION

It should be pointed out that the equal ratios measure presented here will probably not hold over all ranges. It is likely that very small ratios will not yield equal performance if the work periods differ greatly in length. An example would be: R-1 sec., W-60 sec., to give a ratio of 1:60, and R-60 sec., W-60 min. to also give a ratio of 1:60. An example of the other end might be R-60 sec., W-1 sec. for a ratio of 60:1, and R-60 min., W-60 sec., also for a ratio of 60:1. It seems, intuitively, that the equal performance from equal ratios paradigm would break down at both ends.

Any generalizations from the results of one study must be made with extreme caution. However, it can be suggested that equal rest-work ratios, providing the difference between work periods is not too great, will result in essentially equal performance. This prediction can be made for only those predominantly motor tasks such as the one used in this study.

SUMMARY

The effects of equal rest-work ratios in a massed (M) vs. distributed (D) practice situation were explored. Results pertinent to a hypothesis put forth by Kimble (1949) were discussed.

Five groups of Ss were used in this study. R-0, W-60 (ratio 0); R-10, W-30 and R-20, W-60 (ratio 1:3); R-90, W-30 and R-180, W-60 (ratio 3:1). It was found that 1) the equal ratios groups did not differ significantly in performance, and 2) in accordance

with Kimble's hypothesis, the M group developed SIR (permanent work decrement), but the D groups did not.

ACKNOWLEDGMENT

The writer is indebted to Professor Don Lewis under whose direction the research was conducted.

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Explorations in the Measurement of Empathy As Analytical Predictive Ability

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Abstract. This was a preliminary effort to develop a scale for the measurement of empathy as analytical predictive ability. The approach embodied the use of 20 words in three contexts; the 60 rating elements comprised the scale. Extent of agreement between self ratings of a person to be judged (reader) and the estimates of those ratings by a group of persons (judges) was used as a measure of empathic ability. An attempt to take into account possible spurious influences on the empathy scores was not fruitful. The standard materials, including a filmed version of the reader's behavior, were used with several samples. Results showed generally better than chance empathy scores. There was some intimation that this type of scale is useful in identifying students for a school of nursing. Other between-group differences are suggested. The findings for a group of student teachers were not revealing.

The word empathy was first used in the field of fine arts and defined in terms of the identification and recognition of shared

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