WHOLE VERSUS PART METHODS IN LEARNING NONSENSICAL SYLLABLES*

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Whole method procedure demands the continuous repetition of an entire body of material until the desired stage of mastery is attained. Part procedure demands an initial mastery of definite sections of the material and the final connection of these different sections in proper serial order. It has seemed established that the whole method proves the more efficient in the field of learning verbatim. A recent paper† has shown, however, that certain modified forms of the part method prove far superior to the whole method when a motor problem is being learned. In so far as the maze problem may be considered typical of the motor field, one is led to face one of several propositions: (1) There is no correlation to be drawn between learning upon the motor and ideational levels. This proposition is substantiated by no experimental evidence. (2) The results obtained for motor learning are inapplicable to the ideational realm, since the motor problem studied allowed the subjects to distribute their learning over many days, whereas the accepted results for learning verbatim have in general been secured under massed conditions of learning effort. The validity of this proposition is sound until the relationship between distributed and massed conditions of learning is thoroughly established. (3) The field of learning verbatim is not sufficiently tested. This statement has validity only in so far as it suggests that certain modified forms of the part method have not been employed in this field and that final generalization as to the superiority of the whole method must be deferred until these modified part methods have had opportunity to show that they fail to duplicate the efficiency shown in motor learning. This paper directs attention, therefore, primarily to learning nonsensical syllables by numerous whole and part learning methods and secondarily to comparing the results with those for learning motor problems under like massed conditions.

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†PECHSTEIN, L. A., *Alleged Elements of Waste in Learning a Motor Problem by the Part Method*, Jr. Ed. Psychol., 1917, 8, 303.

The experimentation employed two series of nonsensical syllables. The A-Series consisted of thirty-two syllables in consecutive arrangement. The B-Series consisted of the same syllables but arranged in sixteen pairs, as 1-2, 3-4, 5-6, etc. The series were mounted on a mechanically driven drum and were exposed singly or in pairs through an adjustable aperture. The A-Series required an exposure of two seconds per syllable, the B-Series four seconds for each pair. The A-Series was considered learned when the subject could successfully anticipate and write each syllable when shown the immediately preceding one. The B-Series was considered learned when the subject could write the second syllable of each pair when the first syllables were shown as stimuli. These stimulus words were arranged in different order from their position in the original paired learning series. Each subject was given a learning trial and a test for measuring the amount learned immediately after each such trial, two seconds being allowed to anticipate each subsequent syllable in Series A or to recall the paired associate in Series B. The amount learned was calculated for each trial and the difference between a perfect score and this amount learned per trial was called the learning error.* Students in introductory psychology were used for subjects, no student having had earlier experience with the learning material. Each student learned one series by an assigned method. Six students constituted a learning group for a single method and series and the results obtained were averaged.

A description of the methods employed reveals significant differences. Of the whole methods, the learner may be allowed full opportunity to retrace the material earlier traversed in the trial and hereby to work over certain difficult sections before reaching the end of the series. This method is apparently a natural one for some organisms and is designated the Whole Method—'Returns Allowed,' Type A. The learning series is kept upon the drum, whose rotation is controlled as desired by the learner. The method renders it possible to keep a record of the number of times the material is completely worked through and to test the amount learned after each such trial. Because of the unlimited possibilities of returning, a question immediately arises regarding the satisfactory criterion of learning. The student soon learned not to complete

*A syllable was considered learned when it was spelled correctly and recalled in its proper place. No credit was given if the syllable was out of place. A single letter was credited if properly placed.

a learning trial until he felt reasonably sure of having mastered much of the material. Consequently, the number of trials for learning and the number of errors would seem so small as to argue that the method is quite efficient. On the contrary, the excessive amount of time consumed by each trial argues for the inefficiency of the method. The time measurement seems the only just one for comparative purposes. Type B differs from Type A in that the student is allowed to completely learn the material in private before being tested, with retracing as desired. Time is the only measurement of the learning. Contrasting with these whole methods which allow full opportunities for returning, the method entitled 'Returns Prevented' requires the subject to study each syllable a constant period of time and to pass directly to the next one of the series.

The part methods are four in number. The "pure part" method requires that the material be divided into four equal parts, each part learned as a unit, and then the connecting of the units in proper serial order. For the A-Series, this makes each unit to consist of eight syllables; for the B-Series, of four pairs of syllables. The "progressive part" method requires that the first two sections be learned as separate units and then connected as soon as the second is mastered; the third unit is then learned separately and immediately added to the earlier material; the fourth unit, learned and then added to the complex unity already established, completes the learning act. The "direct repetitive" method provides that the first section be learned as a unit and that the learner review this section at each trial as an introduction to the new second division. When the first two units are finally thus mastered, they constitute the introductory review as section III is being learned, and the three in turn for section IV. The "reversed repetitive" method permits as the initial learning the last unit of the series, whereupon the subject is introduced to the new next-to-the last section, reviewing the previously learned one as the final part of each learning trial. When these two units are mastered, the subject is introduced to the next earlier unit and reviews all the previously learned sections as the final part of each learning trial. These two methods are, therefore, review methods and differ only as regards whether the review introduces or follows the unlearned unit. The "progressive part" and the two "repetitive" methods agree with the "pure part" method in satisfying the requirement that the material be

learned in parts; they differ from the "pure part" method in that they significantly modify the time and manner of connecting the several separately learned parts.*

These methods lend themselves most admirably for employment in learning a maze earlier reported.† This maze is divided into four distinct parts or units, each possessing the same number and type of cul de sacs, the same linear distance in the true pathway, entrances and exits into a common place, etc. By the removal of sliding panels, the maze can be learned as a whole or separately learned parts easily connected. The number of trials, the errors (*i. e.*, entering the blind alleys), and the total learning time can easily be measured. Consequently, learning this maze is highly comparable to learning such material as the nonsensical series A, when the sections are equated for length, and where the material may be learned as a whole, in parts or in any desired combination of parts. It is slightly less comparable to the B-series, for this series requires the learner to state the proper associates in an order differing from that of the original learning and hence renders impossible the fixing of such definite unit habits as are allowed and required by both the A-Series and the maze.

*The time and manner of the complex act of connection are exceedingly important. Positional relationships of space and time are established during the learning of each unit and these are markedly reconstructed during the acts of connection. For an analysis of these relationships and their significance in whole-part learning, see PECHSTEIN, L. A., *Whole vs. Part Method in Motor Learning. A Comparative Study*, Psychol. Rev. Mon. Supp., Vol. xxiii, No. 2, p. 42.

†Ibid. pp. 4-5; 70. Also, Jr. Ed. Psychol., 1917, 8, p. 304.

TABLE I
*Whole and Part Methods in Learning**

Method	Trials			Errors			Time		
	Maze	A-Series	B-Series	Maze	A-Series	B-Series	Maze	A-Series	B-Series
Whole Returns Allowed Type A Type B	30	18	6	260	830	127	1250"	3461"	994"
								4552	2040
Returns Prevented	25	14	12	204	573	220	1208	1772	736
Part									
Pure Part	10	13	11	107	409	211	538	1654	712
Progressive	14	9	11	96	148	126	536	1152	672
Direct Repetitive	24	12	15	120	237	155	716	1576	936
Reversed Repetitive	20	10	20	126	139	212	764	1297	1312

*Group averages to show the number of trials, errors and length of time required to learn certain problems by different "whole" and "part" methods. The first problem is the typical pencil maze. The A-Series is a list of thirty-two nonsensical syllables, the B-Series being the same syllables arranged in pairs. The criterion for having the maze learned is its perfect traversal, for the A-Series, successful anticipation of each successive syllable, for the B-Series, successful statement of the paired associate. The several "part" methods differ only as regards the manner of connecting the several parts. Of the "whole" methods Type A allows unrestricted trials upon the material and a measurement of the learning after each such trial; Type B allows the subject to completely learn the material in private before being tested, the sole learning measurement being in terms of time.

A comparative study of the data secured (See Table I) reveals three important conclusions. (1) So far as the whole and part methods are concerned, all the part methods prove superior to the whole methods, both for maze learning and for the highly comparable A-Series of nonsensical syllables, this superiority being demonstrated throughout by all the three criteria of learning, namely—trials, errors and time. Also, only the wasteful repetitive methods are inferior to the whole method when the B-Series is concerned, and this inferiority is only shown in the unavoidable requirements of trials and time, not in regard to errors. It suggests that less reviewing would have secured all the advantages of these repetitive methods and produced results uniformly superior to those of the whole methods. (2) One of the part methods, namely, the “progressive part,” wherein each new section is learned as a unit and added at once to the earlier learned materials, is consistently most efficient throughout all the various learning tests. In maze learning, it is superior to its nearest competitor both in time and errors; in both the A-Series and B-Series, it is overwhelmingly superior in all three respects,—trials, errors and time. (3) Motor learning and learning verbatim obey, in the main, the same laws of learning, as witnessed by the facts that, in both cases, the part methods are more efficient than the whole; that the same part method is consistently the best in each field; that marked positive correlation invariably maintains between the results secured in the two fields by the entire list of methods, irrespective of whether the correlation relates to the trials, errors or learning time.

The conclusions suggest two points of explanatory value. It seems that any part method has certain inherent advantages, although these values may be lost sight of if the complex act of unit connection is not properly controlled. The advantages can be mentioned only in passing. The first of these is the matter of transfer. It is possible to show that the learners master successive units with increasing ease. The second advantage refers to the relation between learning effort and the length of the material. Neither for motor learning nor for this verbal material does the learning effort vary directly with the length of material. Diminishing returns are invariably secured as the material is lengthened. Any part method secures complete utilization of the items of transfer and avoids the diminishing returns due to the excessive length of the motor problem. Any whole method fails in both respects.

The second point of explanatory value refers to two principles operative in all learning. The first of these is that of *elimination*. It connotes the detection of the critical points in the problem, the careful study of all the details, the formation of proper associations, the rejection of others, etc. Consciousness is here at white-heat. The longer and more difficult the problem, the greater the task upon the learner to see the many details of the problem and to learn to eliminate the possible faulty reactions. Confusion, hesitation, emotional conditions all operate to delay the learning. If the problem is short, as is always the case with part methods, the principle of elimination can operate more effectively. The second principle is that of *mechanization*. The final stage of learning is no longer explorative and eliminative but rather, mechanizing and rendering habitual the entire activity. Whole method learning presents so many critical details that the principle of mechanization is not only delayed in being given an opportunity to operate but is repeatedly nullified by the reinjection of the highly conscious eliminative principle. Part methods utilize these principles to greater value. The explorative or eliminative principle is operative when the details of the short and easy parts are being mastered. The mechanizing principle then becomes operative, both logically and chronologically. It secures the mechanization of each unit and then the connection of the several units, being concerned only with rapidly welding the several unit habits. Hence any part method secures complete utilization of the principles of elimination and mechanization. Any whole method fails in both respects.

In conclusion, it may be said that the demonstrated advantages of these part methods when operating in the fields of motor learning and in learning nonsensical series verbatim, lead the writer to question the superiority of the whole method in the remaining field of meaningful material until the results of certain modified forms of part learning have been obtained herein and found inferior. This work is well under way.