A STUDY OF GESTALT PROBLEMS IN COMPLETED AND INTERRUPTED TASKS

PART III

By A. R. PACHAURI

I. Individual differences in the U–C effect

The important problem that confronts us is that of throwing some light on the question of 'individual differences' in the U–C effect as referred to at the end of Part I of this paper (1). We have already drawn attention to the fact that this question has so far received no proper consideration. In all the investigations on the U–C effect hitherto, the number of subjects and especially the psychological range covered by the experiments has been rather small; it seemed desirable therefore to extend in both directions and obtain a broader basis of fact.

Experimental work on the psychology of individual differences of the U–C effect can take two courses: (1) an attempt might be made to obtain correlations between U–C tests themselves for a fairly big group of subjects, and (2) an attempt might be made to establish a possible contact between the U–C effect and any other psychological factor or factors that are likely to be connected with it.

The first course does not lend itself to satisfactory investigation since the repetition of U–C tests with the same group of subjects results in a considerable deterioration of the U–C effect as we have observed already (2). Consequently stable correlations cannot in general be established between the U–C tests. If two U–C tests follow each other closely, the effect is marred in the second test.

The second course affords ample experimental opportunities for a

comparative study. Firstly, the U–C effect appears to have an 'inertial' character; and already two broad psychological factors, also of an inertial kind, have been isolated. These are (1) the factor '*P*', that of so-called general inertia yet appearing to cover ideo-motor activities only (3), and (2) that of ideational inertia or fluency. Secondly, the connexion, if any, between the U–C effect and '*W*'—which has been explained as "persistence of motive"—obviously requires examination. Thirdly, although the U–C score is so arranged as to cancel or equal memory abilities, any score such as U/C is always open to correlative influence between U/C and either U or C, so that control of the U–C effect could well be made in terms of independent memory tests. These factors, then, together with Spearman's general intelligence factor '*G*', could well be used for the said purpose of a comparative study.

The main object of our research is to determine what connexions, if any, these factors have with the U–C effect; whether the effect under discussion is explained already by some of the above factors, or whether an essentially new factor is indicated for the U–C effect.

II. DESCRIPTION OF THE TESTS

To pursue the second course introduced above, we conducted a preliminary experiment with a group of 80 boys and girls, consisting of an equal number of each (age 13–14 years). There were three groups; each was given three periods of testing, the same conditions of experimentation being employed for the three groups.

The tests applied are given in Table I below. The table shows (i) the main factors tested, and (ii) the tests used for the measurement of these factors respectively.

Table I

The main factors tested	Tests applied
U–C effect	(1) Miscellaneous U–C test A
	(2) Miscellaneous U–C test B
	(3) Opposites test
	(4) Synonyms test (same letter)
	(5) Synonyms test (different letter)
'*P*'	(6) 'SSS'
	(7) 'ZZZ'
	(8) '999'
Fluency ('*F*') (4)	(9) Free association
	(10) Ink blots
	(11) Controlled association (the data for this was obtained from Miscellaneous U–C test A)
'*G*'	(12) Pairs
	(13) Analogies
'Memory'	(14) Kelley's Memory test
'*W*' estimates	(15) Estimates by two responsible teachers for each group

Table II shows the order in which these tests were applied; (I) gives the period; (II) the test; and (III) the time required for application.

Table II

I	II		III
Period	Test no.	Tests in order of application	Time allotted for application in min.
First	12	Pairs	10
	1	Miscellaneous U–C test A	30
	13	Analogies	10
	9	Free association	5
Second	3	Opposites	15
	10	Ink blots	8
	4	Synonyms (same letter)	15
	6	'S'	15
	2	Miscellaneous U–C test B	30
Third	5	Synonyms (different letter)	15
	14	'Memory'	45
	7	'Z'	15
	8	'9'	15

Detailed descriptions of the various tests are given in the following section.

The U–C tests

The U–C tests were of two kinds, Miscellaneous A and B respectively, and the Synonyms and Opposites tests 3, 4 and 5:

Miscellaneous tests. A full description of the complete tests A and B has been given previously. They have already been used in the course of the work described in Part II of this paper (2), pp. 448–53). Miscellaneous U–C test consists of miscellaneous tasks, all of a verbal nature, each requiring a minute or so, for completion or interruption. The tests were applied as described in Part II (2), p. 451). The test B is a second form of the test A: it consists of the same kind of tasks, and was applied in the same way as test A.

For comparative purposes, we used Lewin's variable, namely the ratio of U to C for tests A and B combined and test A alone which was applied first. The latter alone was used in our later investigations, since the two tests (A and B) correlated with each other very poorly ($r=0{\cdot}092$), a result which we may ascribe to the influence of repetition. This is also confirmed by a low correlation between the U scores of the two tests ($r=0{\cdot}095$). We have already observed in Table III, Part II (2), p. 456), that the value of U/C for test B is only 1·5. It is apparent that the U–C effect is almost destroyed for reliable individual differences on second testing. We propose to call this isolated variable for test A, var. 1.

In using two forms of the Miscellaneous test, we hoped to study the effect of repetition of U–C tests; for reasons mentioned above, the U–C test first applied (Miscellaneous U–C test A) can be used as the crucial test for correlation with the variables.

The Synonyms and Opposites tests. We have dealt with these tests in detail in Part II, Exp. IV, under the heading of "Difficulty of tasks" (2), p. 453), and we

have also observed that the U–C effect does not ensue under such circumstances. Yet we applied these tests again to give them further trial, by making the time limit for each item shorter than before (8 sec. as compared with 15 sec.), in order to minimize the chances of memorizing an 'easy' item in the surplus time after solving it. The present device did not improve the main effect as indicated by the results shown in Table II, Part II (2), p. 455), the value of U/C for the three tests, in order of application being 1·2, 1·2 and 1·0 respectively.

'*P*' *tests*

Three '*P*' tests were applied, (*a*) the 'SSS' test, (*b*) the 'ZZZ' test, and (*c*) the '999' test.

The tests were applied with a special technique suggested by Dr Stephenson. Each test had its own especially prepared printed sheet. In each case, a sample letter was given, and the subjects were required to write letters of this shape and size in the lines provided. The aim is to secure some approach to standardization of the work done in '*P*' tests. The subjects are not to make exact copies of the given letters, but have to write as quickly as possible, every letter being as nearly as possible the same as the given letter in size and shape. Taking the 'SSS' test as a sample, the test had the following parts:

(*a*) 30 sec. writing 'SSS'
(*b*) ,, ,, 'SSS'
(*c*) ,, ,, 'ƨƨƨ'
(*d*) ,, ,, 'SƨSƨ'

Two sample letters are allowed as a preface to each part; a rest pause of 10 sec. approximately, intersperses each part.

The instructions take the following form, a sample being in front of the class, on a black-board: "You have to write ordinary S's as big as those given, and with the same amount of spacing. The letters should all be clearly and well written; all like those printed. You are not to spend too much time on each letter. You have to write as many of the letters as you can in 30 sec. Although you write as many as you can, each must be well written. That is, you have to write as *quickly*, but also as *well* as you can. When I say 'Go!' you have to start writing but not before I say so. As I say 'Stop!' you must stop at once. It is very important to do just what I tell you to do, and to start and stop when I say so."

The instructions for writing reversed 'S' and 'S', in its alternate form, were given in the same fashion.

The mean of the first two activities (writing ordinary 'S' for periods of 10 sec. each) was denoted by X, and the mean of the reversed and alternate forms of writing 'S' was denoted by Y. The '*P*' score for the individual was obtained from the formula, $'P' = X/Y$.

The three '*P*' tests, scored as above, correlate by a mean amount 0·22, which compares well with the results obtained by previous workers (Wynn Jones (3), Pinard (5), Stephenson (6), Sivaprakasam (7)) with normal subjects as experiment. Without entering in detail into problems about the validation of the '*P*' score, both as a factor of measurement and as one with inertial quality as its explanation, we propose using the composite '*P*' score given by the sum of the '*P*' scores (on a standard basis) for the three tests, as the invariable representing '*P*' factor.

The Fluency tests

Three tests were used as a measurement of 'fluency': (i) Free or uncontrolled association; (ii) Controlled association, (iii) Ink blots.

(i) *Free association.* The test is described in Whipple's Manual ((8), p. 410), and has been used by Pyle (9), Wynn Jones (3), Hargreaves (10), Sivaprakasam (7) and others as an '*F*' test. The subjects are supplied with pencil and paper, and the following instructions are given: "I want you to write different words as fast as you can. You may give any words you like but they must not run into sentences or clauses. Again, you must avoid writing the names of objects in the room, and the same word should not be repeated. I shall tell you when to stop."

In scoring this test, no account is taken of quality of response, the number of words written in 3 min. being the crude score.

(ii) *Controlled association.* This test too, is described in Whipple's Manual ((8), p. 437), and is of wide use as a test of '*F*'. In the present case, three of the C items in the Miscellaneous U–C test A were used, as follows:

No. 3. Name any countries that you know.

No. 11. Write down words consisting of three letters only.

No. 15. Name any things that are green or might be green.

The time allotted for each of these three items was uniform for each group of subjects. After the lapse of the allotted time, the tasks terminated, in each case with the remark, "That will do", from the experimenter.

(iii) *Ink blots.* The test is well known ((8), pp. 620–6) and was originally used by Wynn Jones (3) as a measure of ideational '*P*'.

To make the test applicable as a group test, we prepared small booklets each containing five ink blots. The ink blots were numbered, and 1 min. was allowed for each. The instructions were: "Every one of you has a set of 5 odd-shaped ink blots. I shall ask you to take them in order from 1 to 5, one at a time, and to write down on the numbered blank the things you can see in each blot. Try each blot in different positions. These blots are not real pictures of anything, but I want to see if you can imagine pictures of things in them, just as you sometimes try to see figures in the fire or clouds. Do not try to turn over before the word is given, and do not look back again."

The three '*F*' tests provide scores which correlate by a mean amount 0·39. Their correlation with '*P*' is negligible (see Table V). We propose, again without attempting any further validation of these '*F*' tests as a measure of an '*F*' factor, to use the composite '*F*' score as a variable for correlational work.

'G' tests

Two non-verbal tests were used as a measure of '*G*' factor. Recent work (11) shows that these non-verbal tests supply a measure of pure '*G*' factor. The test no. 12, "Paired abstraction", has already been described by Brown and Stephenson (12) and the Analogies test, no. 13, by Burt (13). In both cases we used the tests supplied us by Dr Stephenson.

The two '*G*' tests yield scores which correlate by a mean amount of 0·24. The '*G*' scores require no factor validation, and we again use the pooled score as our measure of '*G*' factor.

Memory test

The test was essentially the same as that applied by Kelley ((14), p. 154). It consisted in exposing a card for a few seconds containing separate short words which the subjects of experiment had to memorise; one such card is that shown below:

Sample card no. 5

D O
B E
N O
U S

To measure the immediate memory, the subjects were then required to turn to an answer sheet where, in a particular column, were to be found the words they had just seen on card no. 5. Any words remembered had to be cancelled in the answer sheet from the column mentioned by the experimenter. Altogether the answer sheet contained 42 rows of 8 words each; there were also 42 exposure cards. The cards were exposed in irregular order (nos. 5, 15, 41, 13, ... etc. in order of application). Each card was exposed for 9 sec., so simplifying the test applied by Kelley who used varying times for exposure as well as cancellation.

'W' estimates

We collected careful estimates as to the character qualities of persistence of the three groups of children that composed the population (15).

For each group, two teachers independently assigned marks to the individuals entrusted to them, for four persistence qualities, namely, perseverance, reliability, trustworthiness and amenability. The highest mark a subject could get for any quality was +3, and the lowest −3. The marks thus allotted to each individual were added up, and then the 81 subjects ranked according to the total. It may, however, be mentioned that the teachers making the estimates knew nothing of the results of the experimental tests, which at the time were not even worked out; and the experimenter did not receive the result of the estimates until he had completely finished his own task of marking and correlating his tests.

III. THE INTERCORRELATIONS

In the first place we could find no evidence for sexual differences in the U-C effect; the mean U/C for the girls was 1·84 and for the boys was 2·0. We therefore put all together for correlation purposes.

We have already concluded that repetition of a U–C test mars the U–C effect, reducing the ratio, for instance, from 1·9 to 1·5. But the reduction is apparently still worse for individual differences, since the correlation between U/C for the Miscellaneous tests A and B is only 0·09.

Nevertheless, we must remember that, apart from any special significance for recall of particular items in test B, the individuals who score highest for test B have done so in spite of a fore-knowledge of the required recall. They are likely, therefore, to be the most interesting individuals for the purpose of a study of individual differences. We

found that the respective U and C scores and U/C, for tests A and B, gave much the same correlations respectively with the various variables we have to consider (see Table V); hence it was considered feasible to use in the main correlation table composite U and C scores for the two Miscellaneous tests A and B, instead of only the scores for A, or for A and B separately. The variables 1, 2 and 3 in Table III below, then, are for composite scores for tests A and B.

Although we have seen that the Synonyms and Opposites tests, involving very short-time tasks, failed to give a very significant U–C effect, we include them, for comparative purposes, in the main table of correlations. The variables 4 and 5 below are for the composite scores derived from the three Synonyms and Opposites U–C tests (nos. 3, 4 and 5 of Table I).

We have therefore the variables shown in Table III for one main correlation table for this verbal group test experiment.

Table III

(1) U for Tests A and B (Miscellaneous)
(2) C " " "
(3) U/C " " "
(4) U for the tests 3, 4 and 5 (Synonyms and Opposites)
(5) C " " "
(6) U/C " " "
(7) 'Memory—test no. 14
(8) '*G*' sum of tests no. 12 and 13
(9) '*F*' sum of tests no. 9, 10 and 11
(10) '*P*' sum of tests no. 6, 7 and 8
(11) '*W*' estimates—test no. 15

The correlations for these variables are shown in Table IV, and the subsidiary Table V shows the corresponding correlations for U, C and U/C of the separate A and B (Miscellaneous U–C tests). The probable error for zero correlation for this population is 0·07, so that all correlations of about 0·20 are over three times probable error value, and may be tentatively accepted as significant.

Table IV

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	—	·41	·52	·198	−·013	·058	·223	·262	·232	·058	·087
(2)	—	—	−·17	·093	·168	·03	·241	·223	·134	−·182	·269
(3)	—	—	—	·12	−·004	·134	·008	·123	·194	·204	·035
(4)	—	—	—	—	·302	·18	·095	·110	·284	·017	·09
(5)	—	—	—	—	—	−·21	·111	·09	·395	−·230	·05
(6)	—	—	—	—	—	—	·07	·16	·144	·083	·065
(7)	—	—	—	—	—	—	—	·353	·246	−·181	−·033
(8)	—	—	—	—	—	—	—	—	·394	·025	·092
(9)	—	—	—	—	—	—	—	—	—	−·081	·082
(10)	—	—	—	—	—	—	—	—	—	—	−·089
(11)	—	—	—	—	—	—	—	—	—	—	—

Table V

	'G'	'F'	'P'	'Memory'	'W'
U (Miscellaneous A)	−·09	·084	·22	·27	·14
C ,,	·04	·13	−·12	·23	·17
U/C ,,	·07	·124	·261	·069	·068
U (Miscellaneous B)	·05	·18	·19	·423	·14
C ,,	·03	·172	−·05	·31	·07
U/C ,,	·041	·12	·14	·08	·10

IV. CONSIDERATION OF RESULTS

(a) *The U–C tests amongst themselves*

The correlations between U and C for the two sets of tests, Miscellaneous, and Synonyms and Opposites respectively, are $r_{1,2}=0{\cdot}415$ and $r_{4,5}=0{\cdot}302$. Both U and C for the Miscellaneous tests correlate equally with 'Memory' (0·223 and 0·241 respectively); whilst the U and C scores for the Synonyms and Opposites correlate only 0·095 and 0·111 with the 'Memory' score. In both cases, however, the Lewin score U/C reduces the correlations with 'Memory' to 0·008 and 0·07 respectively. We may, therefore, use the variables 3 and 6 as representative of U–C effect, independent of 'Memory' as such.

The 'cross' correlations for the two sets of U–C tests must now receive attention. The correlations are $r_{1,4}$ and $r_{2,5}$ for the correlation between Miscellaneous U scores and Synonyms and Opposites U score and between Miscellaneous C score and Synonyms and Opposites C score respectively. The values are 0·198 and 0·168 respectively; they are small, but 'Memory' does not explain the values, since the partial correlations $r_{1,4}$ and $r_{2,5}$ are not much less (0·18 and 0·15 respectively) than the first correlations. The two types of tests, then, appear to work in the same direction, slight though the correlations are.

(b) *Correlation of U–C tests with 'P'*

The C scores for the Miscellaneous, and Synonyms and Opposites tests respectively correlate negatively and apparently just significantly with '*P*', the values being −0·182, and −0·230 respectively for $r_{2,10}$ and $r_{5,10}$ respectively.

On the other hand, U scores for the same two types of tests correlate +0·058 and +0·017 respectively with '*P*'. Now U and C correlate positively, and if there should be any significant psychological effect represented in these scores, then we wish to obtain the *negative* correlation of C with '*P*', whilst that of U with '*P*' (though only suggestive) is *positive*.

We therefore made a slightly more exhaustive examination of these correlations with '*P*'. For the Miscellaneous test A alone, we find that $r_{U,'P'}=0{\cdot}22$ and $r_{C,'P'}=-0{\cdot}12$ (Table V).

It is known that, amongst school children, those estimated as *low* for '*W*' (*i.e.* of poor persistence and character qualities) have extremes of '*P*'. We selected the nineteen cases of lowest '*W*' in the group and found that $r_{U,'P'}$ and $r_{C,'P'}$ were now 0·505 and −0·381 respectively. These are now significant values, the one *positive* as before and the other *negative*. Again, U and C for these nineteen cases correlated 0·18.

If, apart from the influence of 'Memory', the persistence properties of U correlated with '*P*'; it might well correlate significantly under conditions of experiment slightly better than those used above. Then it would be expected that C would correlate negatively with '*P*'; for the very individuals giving most U, give least C, in virtue of any significant persistent effect of U.

We notice that all the other variables, '*G*', '*W*', '*F*', as well as 'Memory', correlate positively with the U and C scores, only $r_{C,'P'}$ correlations are negative.

Further, '*P*' and 'Memory' correlate negatively (−0·181); so that the above suggestions of correlation between '*P*' and U are not attributable to 'Memory'. It is perhaps difficult to understand why 'Memory' should correlate negatively with '*P*', especially in view of the law of Memory given by Spearman ((16), p. 291); but further work is required before much can be said on this question.

In these correlations with '*P*', then, we see some reason at least for further experimentation.

(*c*) *Other correlations*

We find that the fluency scores correlate equally on the average and positively with the U and C scores. U/C correlates 0·194 with '*F*' which is as high as the value 0·204 between U/C and '*P*'. But fluency does not show the anomaly described above, for '*P*'; further, it is probable, that a general speeded activity factor (the 'S' of Studman's work (4)) spreads over U, C, fluency and 'Memory'. '*W*', we find, makes no significant correlation with any variable except Miscellaneous C score—a result so far inexplicable except on chance grounds. But the correlations for '*W*' are rarely linear and, as shown by the above-mentioned data in which the nineteen cases of lowest '*W*' were selected, the '*W*' estimates may allow of the segregation of individuals of extreme '*P*', for whom correlation with U–C tests might be more clearly observed.

V. CONCLUSIONS

Although suggestive results have been obtained, the above experiment has been of a preliminary nature only. We need not therefore draw theoretical conclusions until confirmatory and better results have been obtained. Our main result, however, concerns the correlations of U and C scores with '*P*' under conditions that would fit with a theory that '*P*' and the U score have much in common, if the latter is freed from the effect of 'Memory'.

But the correlations of U and C with fluency require further examination; we see that 'Memory' is a useful control, and that it correlates negatively with '*P*'. The positive correlation of 'Memory' with other variables, '*G*', '*F*', U, C, however, is consistent with its negative correlation with '*P*', since '*P*' is scored on in inverse scale to these other variations. In these correlations it is difficult to see the role of 'Memory', but possibly a general 'activity' factor covers all.

We suggest, then, a repetition of the experiment, an attempt being made to improve the U–C and other tests. This can be done particularly for the '*P*' tests, whilst it is doubtful whether any more satisfactory U–C test is easily obtainable. We might, however:

(i) secure a more reliable measure of '*P*' by increasing the number of tests applied for the measure of '*P*';

(ii) secure a more pronounced U measure, by taking into consideration only those tasks that are recalled before hesitation. This can be achieved by directing the subjects to draw a line across their recall sheets, when a long pause occurs at the time of recall. Only those tasks that are written above the line would be taken into consideration for scoring, to obtain the value of U/C for each individual prior to hesitation.

REFERENCES

(1) PACHAURI, A. R. (1935). "A study of Gestalt problems in completed and interrupted tasks. Part I." *Brit. J. Psychol.* XXV, 365.

(2) —— (1935). "A study of Gestalt problems in completed and interrupted tasks. Part II." *Ibid.* XXV, 447.

(3) WYNN JONES, LL. (1929). "Individual differences in mental inertia." *J. nat. Inst. industr. Psychol.* IV, 282.

(4) STUDMAN, L. G. Papers to be published shortly.

(5) PINARD, J. W. (1932). "Tests of perseveration." *Brit. J. Psychol.* XXIII, 5.

(6) STEPHENSON, W. (1932). "Studies in experimental psychiatry." *J. ment. Sci.* LXXVIII, 908.

(7) SIVAPRAKASAM (1930). M.Sc. Thesis, London University.

(8) WHIPPLE, G. M. (1910). *Manual of Mental and Physical Tests.* Baltimore: Warwick and York.
(9) PYLE, W. H. (1913). *Examination of School Children.* New York: Macmillan.
(10) HARGREAVES, H. L. (1927). "The 'faculty' of imagination." *Brit. J. Psychol. Monog. Suppl.* No. 10.
(11) CATTELL, R. B. and BRISTOL, H. (1933). "Intelligence tests for mental ages of 4–8 years." *Brit. J. educ. Psychol.* III, 142.
(12) BROWN, W. and STEPHENSON, W. (1933). "A test of the theory of two factors." *Brit. J. Psychol.* XXIII, 352.
(13) BURT, C. (1911). "Experimental tests of higher mental processes." *J. exper. Ped.* I, 93.
(14) KELLEY, T. L. (1928). *Crossroads in the Mind of Man.* Stanford University Press.
(15) WEBB, E. (1915). "Character and intelligence." *Brit. J. Psychol. Monog. Suppl.* No. 3.
(16) SPEARMAN, C. (1927). *The Abilities of Man.* London: Macmillan.

(*Manuscript received* 22 *July* 1935)