THE INFLUENCE OF SUCCESS AND FAILURE ON THE RESUMPTION OF AN INTERRUPTED TASK [1]

BY HELEN HOWARD NOWLIS

Yale University

I. Introduction

The problem of discovering the factors which determine the resumption of an interrupted task has developed considerable importance in recent years because of its systematic relation to the concept of substitute activity. This latter concept refers to the commonly observed fact that when one kind of activity or reward is prevented from occurring some other activity or reward can in some respects have the same effects on the organism's future behavior as the first would have had if it had occurred. For example, under normal circumstances a child may fret or cry if a toy with which he is playing is taken away from him. Return of the toy will usually stop the crying. If a different toy is given him, however, there is some probability that his crying will stop as quickly as if the first toy had been returned and he will cease his efforts to secure the first one.

From a systematic standpoint this implies that the second response reduces the strength of motivation to the first; *i.e.*, playing with the second or substitute toy has reduced the strength of the child's desire (as measured by efforts) to play with the first. Any attempt to discover the conditions under which the second response has this effect requires a method of measurement of the strength of motivation to carry out the first activity or task.

It was to secure such measurements that Ovsiankina (7) elaborated the interrupted-task technique devised by Zeigarnik (11). A subject is given a task to do, the motivation for which is intrinsic to the task itself or derives from the subject's desire for the experimenter's approval. At some point in the progress of the task, but before it is completed, the activity is interrupted. After an interval of relative freedom or of occupation with another task, the subject is given an opportunity to resume the first task.

The measure of strength of motivation to continue the first (interrupted) activity is based on the presence or absence of resumption of

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that activity. It is assumed that at the time of interruption there was still a measurable amount of motivation to continue the task and that if this amount suffers no reduction there will be a resumption when opportunity is offered. These assumptions are supported by the work of Lissner (5), Mahler (6), and Ovsiankina (7). In general it has been shown that the interruption is followed by resumption whenever no intervening activity which might operate as a substitute occurs.

The measurement of any reduction in the strength of motivation to continue the first activity can be derived from a comparison of the frequency of resumption without intervening activity with frequency following any activity the substitutive qualities of which it is desired to test. It is clear that with the interrupted-task technique the strength of motivation to the original activity is operationally defined in terms of the frequency of resumption of that task, and that the measure of reduction of the strength of the motivation involves a comparison of the frequency of resumption following sheer interruption with frequency following the activity which is supposed to have reduced the strength. *A smaller frequency of resumption with the latter condition indicates that the intervening activity has served as a substitute activity.*

Analysis of the interrupted task situation shows that there are essentially four facts which seem to be of importance. The individual accepts a given task and, if he is not interrupted, will usually carry the task through to its conclusion. Once the conclusion is reached, he will cease working on that task. If, however, he is interrupted at some point in the series of acts leading to the completion of the task, he may object to being interrupted, even refuse, and if later given an opportunity will often resume and complete the activity. The interpolation of another activity following the interruption of the original one may result in a marked reduction in the resumption of the interrupted activity.

From the point of view of reaction psychology [2] the first fact to be accounted for is that the individual will continue to make a series of responses until he reaches a certain point and beyond this point will cease to make the responses. The continuation of action is dependent on the existence of *instigators*, which are defined as *the specified antecedent conditions of which any predicted response is the consequence.* There may be as many instigators to a response as there are antecedents which can be specified, and, unless there is evidence to the contrary, it is assumed that they represent the total amount (or strength) of instigation to that response.

[2] For a statement of this point of view see Dollard, Doob, Miller, Mowrer and Sears (1). The position adopted in the present discussion, together with certain concepts and their definitions, are those which have been applied to a variety of problems by these authors.

A second concept arises from the fact that, beyond a certain point, the individual will cease to make the responses which he has been making. The final response in a sequence beyond which the individual will cease to carry on the sequence of activities is a *goal response:* a goal response is *that response which reduces the strength of the instigation which produced it.*

In the present experiment, completion of a task in accord with the experimenter's instructions represents a goal response. In addition to *instigation-to-completion* there is other instigation involved in the interrupted-task situation. Almost everything that occurs even semi-officially in American college life is competitive. The mere mention of the word *test*, especially if it is related to psychology, makes the subject feel sure that, as on similar occasions in the past, his performance will be rated with reference to that of his fellow students. He wants his performance to compare well with that of the others. It is reasonable to suppose, therefore, that in addition to instigation to which the reaction to completion is a goal response there may be *instigation to which the reaction to success is a goal response.* Completion in itself may be considered a sort of success, but whether or not it functions as success for the subject depends on a number of factors of which an important one is its relation to his momentary level of aspiration.

What is perhaps the reverse of instigation to the goal response of reaction to success may also be operative in the interrupted task situation, at least as it occurs in the present investigation. A subject knows from past experience that a test situation offers at least two possibilities, that of showing how well he can do and that of showing how poorly he can do. He knows that two courses are open to him. He can attempt the solution of a problem with the chance of attaining success or he can avoid the problem and thus avoid the chance of doing poorly. Since resumption is his own choice and there is no external pressure in either direction he is free to choose resumption and possible success or non-resumption and certain avoidance of failure. A third source of instigation, therefore, may be postulated, *instigation to which the reaction to avoidance of failure constitutes a goal response.*

That there may be a marked reduction in the resumption of the interrupted activity when a second activity follows the interruption, leads to the definition of *substitute response* as *a response which reduces the instigation to a goal response which is specified as having been prevented from occurring.* A substitute response has *substitute value* to the extent to which it reduces the instigation to the original response.

A number of previous investigators have shown several factors to be important in determining the size of this value.

1. The nature of the original activity: resumption is more frequent with a task which has a definite goal than with one which lacks an objective goal and is more or less continuous (Ovsiankina, 7; Zeigarnik, 11).

2. The point at which interruption occurs in the progress of the original activity: interruption at points immediately after the instructions have been given and just before the completion of the task produces the highest frequency of resumption (Katz, 3; Ovsiankina, 7; Zeigarnik, 11).

3. The nature of the interruption: 'accidental' interruptions produce more frequent resumption than do those which are clearly intentional on the part of the experimenter (Lissner, 5).

4. The intensity of the primary action tendency: resumption is less frequent when the original task has been performed to satiation (Sliosberg, 10).

5. Four characteristics of the period following the interruption: (*a*) the degree of similarity between the interrupted and the second activity (Lissner, 5); (*b*) the degree of difficulty of the second activity relative to the first (Lissner, 5); (*c*) the degree of contact between the tension systems involved in the two tasks (Lissner, 5); and (*d*) the degree of reality of the second activity (Sliosberg, 10; Mahler, 6).

In addition to the above characteristics of the period following the interruption, there is some indication that, within wide limits, the mere amount of time elapsing between the interruption and the opportunity to resume is important.

Accepting, for the present, the findings of these earlier studies by the Lewin group as a point of departure, but divorcing them as far as possible from their relation to Lewin's theory of substitute activity (4), the present investigation proposes to hold all of these factors constant [3] and introduce success and failure on both the original and the second activity as additional factors which may influence resumption of the interrupted activity. Two main problems have been investigated: (1) the effect on the subsequent resumption of an interrupted activity of superimposing success or failure on the interruption of that activity, and (2) the effect on the resumption of an interrupted activity of success and failure superimposed on the completion of a second activity.

The reactions to success and to avoidance of failure are two of the three goal responses mentioned above as being involved in the interrupted-task experimental procedure. From a systematic standpoint, therefore, the present problem has been essentially that of determining the effect on resumption of the occurrence or non-occurrence

[3] With the possible exception of *dynamic contact*. For a discussion of this point, see Section IV.

of these three goal responses both at the point of interruption of the first activity and superimposed on the completion of the second.

From the work of the Lewin group there are several suggestions that feelings of success or failure on the part of the subject may influence resumption.

In discussing the results of her experiment on interrupted activity, Ovsiankina (7) suggests that for 'ambitious' subjects the experimental situation represents an occasion for testing their ability and if the task promises success there will be resumption, while there will be avoidance if it promises failure. Zeigarnik (11) has shown that the tension systems corresponding to an interrupted activity may be destroyed by sufficiently strong variations of tension in the whole person and in this connection mentions affective variations produced naturally or artificially, suggesting that strong feelings of failure may be among these. Lissner (5) has shown that difficulty of the second activity is likewise an important determiner of substitute value. The relation of the concept of 'difficulty' to those of 'success' and 'failure,' as it applies to the interpretation of the results of the present study, will be considered in detail in Section IV.

II. Method

The method of the present investigation is, with certain exceptions, essentially that of the interrupted task as developed by Ovsiankina (7) and elaborated by Lissner (5). In general, all those properties of the tasks which have been found by the Lewin group to affect the resumption of an interrupted activity were held constant by using the same tasks for each subject. Intensity of need was presumably held constant by using equivalent groups of twenty subjects in each experimental group. Tasks were chosen in which individual differences in ability would not produce too great variation in performance and which would, nevertheless, allow success and failure in the tasks to have some reality. The procedure for each subject was kept as rigid as seemed consistent with the best operation of the experimental variables. At no point, however, were adequate conditions for success and failure sacrificed intentionally for strict rigidity of experimental procedure. Variations in the response of individuals to praise and reproach determined the amount and, to some extent, the kind of both.

1. *The Tasks Used*

In selecting the tasks to be used it seemed wise to choose as the original or interrupted task one which met the following requirements: (*a*) it should have a well-defined goal and the responses made during the progress of the activity should have a definite relation to that goal;[4] (*b*) it should be capable of being interrupted at some specific point; (*c*) it should be interesting enough to the subject so that he will not welcome the interruption; and (*d*) it should allow success or failure without completion. The second activity should have a substitute value near 50 percent under neutral conditions [*i.e.*, neither success nor failure stimulation] so as to allow fluctuations in both directions under experimental conditions of success and failure. Neither activity should be highly preferred over the other.

Because it is almost impossible to predict *a priori* what activities or tasks will best fulfil these requirements, a series of six different tasks, which included cancelation, simple addition, card sorting, dart throwing, a ball-in-wheel puzzle and a jig-saw puzzle, were presented in various com-

[4] Both Zeigarnik (11) and Ovsiankina (7) have shown that the greatest resumption is obtained with tasks which have a well-defined goal, in their words 'Endhandlungen' as contrasted with 'fortlaufende Handlungen.'

binations, to a small group of subjects. The combination of the ball-in-wheel puzzle followed by the jig-saw puzzle was the most satisfactory from the standpoint of the criteria mentioned above.

The ball-in-wheel puzzle chosen as the original or interrupted activity consisted of a glass-covered box in which there were a wheel with eight cogs in it and eight small balls, four black and four white. The cogwheel, which turned freely on its shaft, was surrounded by a fixed cardboard ring in which there was one small opening through which the balls might pass. The subject was required to put the balls in the cogs of the wheel, alternately a black and a white. The average time required by the 180 subjects in the main experimental groups to put in six of the eight balls was five minutes.

The second task was a jig-saw puzzle cut from one piece of 3-ply wood, 12 inches by 9.5 inches, and stained with a dark stain. There were 15 pieces, ten of which had at least one right angle. The grain showed through the stain and was the best cue for putting the puzzle together. The average time required for completion by the nine experimental groups was ten minutes.

2. *Subjects*

The subjects for the main part of the experiment were one hundred and eighty undergraduate men. One half of this number were registered in elementary psychology courses and served in this experiment as a part of a course requirement. The other ninety were obtained through the University Student Employment Office and were paid fifty cents for their services.

Each of the nine experimental groups was composed equally of paid and unpaid subjects. In no respect were there any apparent differences in the performance of the two groups of subjects. They were equally coöperative and seemed equally well motivated once they were in the experimental situation. In several instances the paid subjects would even start to leave before they had been paid.

In addition to the above one hundred and eighty, there were thirty subjects who served in control groups. Since there seemed to be no differences between the two groups, and the paid subjects were more readily available, the control groups consisted of paid subjects only.

So far as could be determined none of the subjects knew or suspected the purpose of the experiment. They were told at the time of making their appointments that they were to serve in an experiment on perception and would do a number of puzzles. At the end of the session the subject was asked what ability or function he felt the experiment might adequately test. The answers almost invariably were perception, learning or mechanical ability. In only three instances was there any approach to the true purpose of the experiment and the data for these subjects were discarded. At no time were the subjects told the real purpose.

3. *Procedure*

The subjects were divided into nine experimental groups of twenty subjects each. These groups represented all nine possible combinations of success, neutral and failure conditions on both the first and the second tasks. For convenience they are represented in Table I.

TABLE I

THE NINE EXPERIMENTAL GROUPS

Task I	Task II		
	Success	Neutral	Failure
Success	*A* Success I–Success II	*B* Success I–Neutral II	*C* Success I–Failure II
Neutral	*D* Neutral I–Success II	*E* Neutral I–Neutral II	*F* Neutral I–Failure II
Failure	*G* Failure I–Success II	*H* Failure I–Neutral II	*I* Failure I–Failure II

With each of the nine groups Task I was always interrupted and Task II was always completed. Success and failure were produced by statements of the experimenter at the point of interruption of Task I and at the conclusion of Task II.

Groups A, B and C (Success I) [5] were interrupted on the first task but were made to feel that they had done very well; Groups D, E and F (Neutral I) were merely interrupted on the first task by being requested to help the experimenter check a list of numbers for a minute; Groups G, H and I (Failure I) were interrupted and made to feel that they had done very poorly in terms of their speed. For Task II, Groups A, D and G (Success II) completed the second task and were highly praised; to Groups B, E and H (Neutral II) no comment was made when the subject completed the second task; Groups C, F and I (Failure II) completed the second task but were told that they had been unusually slow.[6]

In all cases the subject was seated at a desk on which had been placed the cogwheel and the jig-saw puzzles. The cogwheel was placed in front of him with the following instructions:

> "The first thing is this. There are four black balls and four white ones. You are to put the balls in the cogs of the wheel, alternately a black and a white. Do you understand? Ready, go."

The experimenter sat in a chair near the desk and busied herself with a sheaf of papers. It was not difficult to follow very unobtrusively the progress of the subject, for after each ball was in a cog of the wheel it was necessary to tap the puzzle to make the wheel turn so that another cog was opposite the hole in the cardboard ring. In most instances the 'ah's' and 'there's' of the subject also signified the correct placement of a ball. When six balls were correctly placed the subject was interrupted with a Success, Neutral or Failure interruption.

Following the interruption, the jig-saw puzzle was pushed forward on the desk by the experimenter with the following remarks:

> "The jig-saw puzzle makes a rectangle. It is all cut out of one piece of wood so that the grain matches, and the long piece is one dimension."

At this point the experimenter retired to a desk at the opposite end of the room, facing the one at which the subject was working. She again busied herself with books, papers and writing and apparently ignored the subject completely. When the jig-saw was completed, it was necessary for the subject to call the attention of the experimenter to the fact. At this time the experimenter either praised, reproved, or said casually, "Just a second, please," and continued writing hurriedly for a period of two minutes.[7] During this period the subject was free to resume the interrupted activity if he chose. A detailed record was made of his behavior, including the point at which he resumed. If he did resume he was allowed to work until he had completed the task or put it aside voluntarily. If he did not resume spontaneously he was asked, at the end of the two-minute period, to choose one of the two tasks to do again.

At the conclusion of the experiment the subject was asked the following questions:

1. What ability or function do you think this experiment might adequately test?
2. Which type of puzzle do you prefer doing?
3. Which puzzle do you think is easier?
4. Did you have a theory or a working hypothesis when you were doing the cogwheel puzzle?

4. *Success, Neutral and Failure Conditions*

The problem of making the subject feel that he really had succeeded or failed on either of the tasks was a difficult one. Because it seemed advisable to keep the average time spent on the tasks as constant as possible for each group, all those subjects who actually did well could not be put in the Success groups and those who did poorly in the Failure groups.[8] With a few exceptions,

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[5] The Roman numerals I and II following Success, Failure or Neutral refer to Task I and Task II. Thus Success I means Success stimulation accompanying the interruption of Task I. Success I-Success II refers to Group A, Success I-Neutral II refers to Group B, etc.

[6] The Success, Neutral and Failure conditions are discussed more fully in Section 4 below.

[7] It has been shown by Ovsiankina (7) that spontaneous resumption, if it occurs at all, will usually occur within 4 to 20 seconds. The 2-minute interval was decided on as having sufficient margin to allow for any resumptions. There is some indication from the present data that the 20-second interval specified by Ovsiankina is not sufficient.

[8] Ovsiankina reports some evidence to the effect that, within 4 to 20 minutes, the mere time elapsing after interruption does not greatly influence resumption.

the subjects were allocated to the nine groups in whatever order they appeared at the laboratory. However, if a subject scheduled for Success on the first task was obviously doing very poorly and seemed to feel that he was not doing well he was shifted to a Neutral or Failure group.

In general, the procedure for producing feelings of success and failure was that used by Sears (8). Comments and attitudes of the experimenter were used to supplement the reporting of false time scores. For the Neutral condition no reference was made to the time score and evaluative comments were avoided.

For Success and Failure on the first task the experimenter interrupted the subject just after the sixth ball had been put in place and either praised or reproached. In the case of Neutral on the first task the experimenter said, without looking up, "Say, would you do something for me?" and, handing the subject a sheet of numbers, "Just read these totals to me while I check them." The average time for reading these numbers was 50 seconds, approximately the time consumed by the Success and Failure procedures. For Success and Failure on the second task the appropriate comments were made when the task was completed. When the second task was Neutral the experimenter did not even look up from her work but said, "Just a minute," and continued writing rapidly for the two-minute period.

A subjective estimate of the response of the subject to interruption and to Success and Failure stimulation was made on a four-point scale. Approximately 80 percent of the subjects in each group made some observable response to these conditions.

5. *Control Groups*

Since it became increasingly evident as the experiment progressed that the time spent on the second task would range from four to twenty minutes and that the average time would be from three to five minutes longer for the Failure than for the Success groups, three additional groups of ten subjects each were used to determine the effect of varying amounts of time elapsing between interruption and the opportunity to resume. In all of these groups the interruption of the first task was Neutral and the second activity was one which had no possible relation to the interrupted activity. The only variable was the amount of time consumed by the second activity.

The subjects of the first group (Neutral-1 minute) were given the cogwheel puzzle with the usual instructions and were interrupted after placement of the sixth ball in the same way in which the Neutral I groups in the main experiment were interrupted. They were asked, as a favor to the experimenter, to read the same list of totals while she checked them. When the figures had been read the experimenter said, "Thanks," and continued working with the figures for two minutes while the subject was free to resume the cogwheel.

The second group (Neutral-5 minute) were given the cogwheel as usual and when six balls were in the experimenter said, "Say, would you do something for me? I promised one of the professors that I would put an assignment on the board in Room 104 for his seminar and I forgot it completely. Would you be willing to go downstairs and write this assignment on the board? I think you can read it all right." The experimenter then gave the subject a piece of paper on which was written a long German reference and read it over with him to be sure he understood it. The subject had to go from the third floor to the first floor, write the reference on the blackboard and return to the experimental room. This routing occupied an average of five minutes for the ten subjects. When he returned to the experimental room the experimenter was busily occupied and greeted his arrival with only a casual "Thanks." She continued working for the usual two-minute period and noted carefully the behavior of the subject. If, at the end of the two minutes, he had not resumed he was asked whether he would prefer to work on the cogwheel or do a jig-saw puzzle.

The procedure for the third group (Neutral—15 minute) was essentially the same except that the subject was given a paper with four long references on it. The average time for this group was fifteen minutes.

The average interpolated time for the twenty subjects of the combined Neutral-5 minute and Neutral-15 minute groups closely approximated that required for the interpolated (second) activity of the Neutral I-Neutral II group of the main experiment (10 minutes). The frequency of resumption in this control group provided a basal resumption score which, when compared with the frequency of resumption in the Neutral I-Neutral II group, would permit an estimate of the basic substitute value of the jig-saw puzzle.

III. Results

In Table II is presented the total number of subjects in each group who resumed Task I. Three types of resumption could be distinguished and separate figures are given for each type. These are (1) *resumption with completion*, in which the subject spontaneously resumed the interrupted task within the two-minute free period and continued working until he had completed it; (2) *resumption without completion*,[9] in which the subject spontaneously resumed the interrupted task within the two-minute limit but put the cogwheel aside without having completed it; and (3) *choice resumption*, in which the subject did not resume during the two-minute period but, when asked to choose one of the tasks at the end of that period, chose the interrupted task.[10]

TABLE II

Resumption of the Interrupted Task Under the Nine Experimental Conditions

Group *	Resumption with Completion		Resumption without Completion		Choice Resumption		Total	
	N *	%	N	%	N	%	N	%
Success I–Success II.....	7	35	1	05	4	20	12	60
Success I–Neutral II.....	8	40	1	05	5	25	14	70
Success I–Failure II.....	3	15	8	40	3	15	14	70
Neutral I–Success II.....	15	75	1	05	3	15	19	95
Neutral I–Neutral II.....	5	25	3	15	7	35	15	75
Neutral I–Failure II.....	8	40	0	00	3	15	11	55
Failure I–Success II.....	9	45	4	20	4	20	17	85
Failure I–Neutral II.....	4	20	4	20	3	15	11	55
Failure I–Failure II.....	3	15	6	30	5	25	14	70
Combined Success I.....	18	30	10	17	12	20	40	67
Combined Neutral I.....	20	47	4	07	13	22	45	76
Combined Failure I.....	16	27	14	23	12	20	42	70
Combined Success II.....	31	52	6	10	11	18	48	80
Combined Neutral II.....	17	28	8	13	15	25	40	66
Combined Failure II.....	14	23	14	23	11	18	39	64

* N for each single group is 20, for each combined group, 60.

Examination of Table II indicates that, for the total resumption scores, the only difference between Success, Neutral and Failure conditions in either task which has a *P*-value [11] of less than .04 is that

[9] *Cf.* Ovsiankina (7) *tendency to resume* and Lissner (5) *playful resumption* and *resumption without completion.*

[10] This is almost equivalent to Mahler's (6) *resumption after instruction* except that, in this case, all those subjects who had not resumed to completion were required to make a choice between doing Task I or Task II.

[11] *P* is the chances in 100 that the differences between two sets of data can be attributed to chance. Throughout this discussion *P* is derived from the Critical Ratio of the difference between two percents.

between Success and Failure on Task II, Task I being Neutral. Similar comparisons for the combined groups [12] (Table II) show no differences which would occur by chance in less than four cases in 100.

However, if one considers only resumption with completion, as there may be some justification for doing,[13] differences in the effect of Success and Failure in both the first and the second tasks become more apparent. The following analyses will be based on the figures for *resumption with completion.*

1. *The Effect of Success and Failure Stimulation in the First Task on Its Resumption*

The results for Success and Failure stimulation in the first task are, in general, inconclusive (Table III). A comparison of the Success I–Neutral II group with the Failure I–Neutral II group indicates that there is a tendency in the direction of increased resumption with Success stimulation on the first task. The difference between the two groups is 20 percent (P = .08). The difference between the combined Success I group and the combined Failure I group is only 3 percent in the direction of decreased resumption under Failure conditions (P = .36). The combined Success I and the combined Failure I groups both differ in the direction of decreased resumption from the combined Neutral I group with differences of 17 percent and 20 percent, respectively (P = .03 and .01).

TABLE III

COMPARISON OF RESUMPTION UNDER SUCCESS, NEUTRAL AND FAILURE STIMULATION IN TASK I

Group	Difference (%)	Critical Ratio	P
Success I–Neutral II—Failure I–Neutral II	20	1.41	.08
Success I–Neutral II—Neutral I–Neutral II	15	1.02	.15
Failure I–Neutral II—Neutral I–Neutral II	15	.38	.36
Combined Success I—Combined Failure I	03	.36	.36
Combined Success I—Combined Neutral I	17	1.95	.03
Combined Failure I—Combined Neutral I	20	2.32	.01

[12] The combined Success I group is obtained by adding the results for the three groups in which Success I appeared as a variable. The same procedure was followed in the other combined groups.

[13] A rank-order correlation between *total resumption* and *resumption with completion* is +.44. Since one of the goal responses postulated in Section I is that of reaction to completion, we are interested in the strength of the instigation to complete Task I after the completion of Task II. *Resumption with completion* would seem to be the critical measure for this. Resumption without completion in most instances was very brief, not exceeding one minute in any case, and indicates little about the strength of instigation to complete Task I after the completion of Task II.

2. *The Effect of Success and Failure Stimulation in the Second Task on the Resumption of the Interrupted Task*

The effects of Success and Failure stimulation following the completion of the second task are much more clearly differentiated (Table IV). A comparison of the Neutral I–Success II group with the

TABLE IV

COMPARISON OF RESUMPTION UNDER SUCCESS, NEUTRAL AND FAILURE STIMULATION IN TASK II

Group	Difference (%)	Critical Ratio	*P*
Neutral I–Sucess II—Neutral I–Failure II	35	2.39	.01
Neutral I–Success II—Neutral I–Neutral II	50	3.64	<.01
Neutral I–Failure II—Neutral I–Neutral II	15	1.02	.16
Combined Success II—Combined Failure II	29	3.04	<.01
Combined Success II—Combined Neutral II	24	2.75	<.01
Combined Failure II—Combined Neutral II	05	.63	.27

Neutral I–Failure II group shows that resumption under Success II conditions is greater by 35 percent than resumption under Failure II conditions ($P = .01$). A similar comparison of the Combined Success II groups with the Combined Failure II indicates a difference of 29 percent ($P = <.01$) in the same direction.

Although the Combined Success II group differs from the Combined Neutral group by 24 percent in the direction of increased resumption ($P = <.01$), the Combined Failure II group is strikingly like the Combined Neutral II group. The difference is only 5 percent ($P = .27$) with resumption slightly higher in the Combined Neutral II group.

3. *Analysis of Variance*

Since Success and Failure stimulation following the second task have been shown to be highly influential in determining the amount of resumption of the interrupted first task, it is possible that the second task is to some extent masking the effects of Success and Failure stimulation on the first task. It is possible, by using the Fisher analysis of variance, to determine the relative importance of varying degrees of success [14] in the two tasks in determining the total variance. The method is essentially a test of significance which allows for the simultaneous comparison of the variables involved. The total variation is divided into parts corresponding to the degrees of freedom allowed by each variable; the amounts of variation contributed by each variable to the total are compared.

[14] Success, Neutral and Failure may be considered three degrees of success with Success the maximum and Failure the minimum.

The analysis of the variance in the present data, following the method of Snedecor (9), is summarized in Table V. In order to

TABLE V

SUMMARY OF THE ANALYSIS OF VARIANCE FOR RESUMPTION WITH COMPLETION

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F*
Total	17	72.5		
Degree of Success on Task I	2	13.8	6.9	4.06
Degree of Success on Task II	2	27.5	13.8	8.12
Interactions	4	16.2	4.1	2.41
Replication†	9	15.0	1.7	

* F is the ratio between the mean square of one source of variation and the variation used as an estimate of error. It is an adaptation by Snedecor (9) of Fisher's z (2), which in turn is an extension of t appropriate to cases in which more than two variables are being compared. It is derived from the theory of errors and is less affected than t by obtained deviations from normality. The P-values of F are given in a table of F (Snedecor, p. 184).

† For the nine groups a rank-order correlation of the odd-even subjects is + .62.

increase the possible number of degrees of freedom and to have a known variable, other than the degree of success on the two tasks, as a basis for the comparison, each of the experimental groups was divided into two parts by taking the odd and even subjects from each of the original groups. This provides two measures for each of the nine main conditions instead of one and permits a statement of the influence of degree of success in terms of how much more the various degrees contribute to the total variance than the sampling error contributes.

In the analysis of variance (Table V), the F-values for degree of Success on Task I and on Task II are 4.06 ($P = < .05$) and 8.12 ($P = < .01$) respectively. The amount of variance contributed to the total by the degree of success (the combined Success, Neutral and Failure conditions) on either task is from five to eight times that contributed by replication. In view of the fairly low reliability of the odd and even groups the significance of variations in degree of success on either task is considerable.

One further fact gained from this analysis is relevant to the question of the possible blanketing of the effect of variations in degree of Success in Task I. Task I does contribute to the total variance but the contribution of Task II is approximately twice that of Task I. It is also indicated that there is an interaction between the conditions of Task I and those of Task II which might further account for the small differences obtained between the Success I and Failure I groups when direct comparisons of these groups are made.

The F-value for interaction falls so far short of a P-value of .05 that it is hardly worth pursuing further in an analysis of covariance.

On the basis of these results it would seem justifiable to conclude that the degree of success in the interrupted activity is somewhat influential in determining the resumption or non-resumption of that activity, but that the significantly greater influence of degree of success in the second task may overshadow it.

4. *The Influence of Success and Failure Stimulation on Subsequently Expressed Preferences for the Two Tasks*

At the conclusion of the experiment each subject was asked which of the two tasks he preferred. These preferences are summarized in Table VI.

TABLE VI

PREFERENCES FOR AND JUDGMENTS OF DIFFICULTY OF THE TWO TASKS EXPRESSED AT THE CONCLUSION OF THE EXPERIMENTAL SESSION

Group	Prefer Task II		Task II easier	
	No.	%	No.	%
Success I–Success II	14	70	9	45
Success I–Neutral II	10	50	11	55
Success I–Failure II	7	35	4	20
Neutral I–Success II	13	65	14	70
Neutral I–Neutral II	10	50	15	75
Neutral I–Failure II	8	40	8	40
Failure I–Success II	14	70	15	75
Failure I–Neutral II	15	75	15	75
Failure I–Failure II	12	60	16	80

Regardless of whether the Success or Failure was on the interrupted or the completed task, the one which was accompanied by Success stimulation was preferred. A comparison of the percent of subjects in the Success I–Failure II group who preferred Task I with the percent of subjects in the Failure I–Success II group preferring Task I gives a difference of 35 percent ($P = < .01$) in the direction of preference for the task in which there was Success stimulation. It is interesting to note here that in the Success I–Neutral II group 50 percent of the subjects preferred Task II, while in the Success I–Success II group 70 percent of the subjects preferred Task II. This might indicate that Neutral II following Success is more like Failure in Task II than is Success II following Success I. A similar state of affairs seems to hold when the Failure I–Neutral II and the Failure I–Failure II groups are compared. The preferences for Task II are 75 percent and 60 percent, respectively. There seems, therefore, to be some indication that Neutral following Success is experienced by the subject as a mild failure, while Neutral following Failure is ex-

perienced by the subject as definite Success. A comparison of Success following Failure (70 percent preferring II) and Neutral following Failure (75 percent preferring II) further substantiated the latter conclusion.

In no group was a Failure task preferred over one in which there was either Success or Neutral stimulation.

An analysis of variance based on the number in each group preferring Task I [15] indicates that degree of Success on the second task is more influential than degree of Success on the first but the *P*-values corresponding to *F*-values of 21.5 and 3.15 for nine and two degrees of freedom are considerably greater than .05.

5. *The Influence of Success and Failure Stimulation on Subsequently Expressed Judgments of the Relative Difficulty of the Two Tasks*

The subjects were asked also, at the conclusion of the experimental session, which of the two tasks they considered the easier. The results of these judgments are also summarized in Table VI.

A similar trend to that found in the case of preference is shown, although in this instance the results are not quite so consistent. A comparison of the percent of the subjects in the Success I–Failure II group who judged Task I as the easier with the percent of the Failure I–Success II group judging Task I the easier gives a difference of 55 percent in the direction of more judging easier the task on which there was Success stimulation ($P = < .01$).

An analysis of variance for these data indicates that the degree of Success on the first task is more than twice as influential as degree of Success on the second and that both contribute more to the total variance than does a sampling error.[16] The *P*-values corresponding to *F*-values of 9.2 and 3.5 for nine and two degrees of freedom are less than .01 and considerably more than .05, respectively.

6. *The Effect of the Amount of Time Elapsing between the Interruption and the Opportunity for Resumption*

Although the average time spent on Task II was 10.56 minutes for the nine experimental groups, the range was from three to twenty-five minutes and the averages for the individual groups were from 9.3 to 14.1 minutes. Because the Failure groups were generally slower than the Success groups, some check on the influence of the length of time elapsing between interruption and resumption was necessary.

In Table VII are presented the number of resumptions in the three control groups, Neutral–1 minute, Neutral–5 minutes and

[15] For the nine groups a rank-order correlation of the odd-even subjects is +.43.
[16] For the nine groups a rank-order correlation of the odd-even subjects is +.69.

TABLE VII

RESUMPTION OF THE INTERRUPTED TASK IN GROUPS WITHOUT SUBSTITUTE ACTIVITY

Group	N	No. resuming	% resuming
Neutral– 1 minute	10	8	80
Neutral– 5 minutes	10	8	80
Neutral–15 minutes	10	6	60

Neutral–15 minutes. In these three groups the factor of elapsed time is not complicated by an activity which might be a substitute for the first task. There is no difference in resumption between the 1- and the 5-minute groups, and the difference of 20 percent ($P = .16$) between these and the 15-minute group, although indicating a tendency in the direction of reduced resumption, is not very significant in comparison with the differences obtained as the result of the main experimental variables. It must be noted, however, that the number of subjects in these groups is small and the conclusion must be correspondingly tentative.

Additional evidence in support of this conclusion is offered by a further analysis of the data of the nine main experimental groups. Each group may be divided into two parts on the basis of the time spent on Task II and the ten subjects who spent the longest time on Task II may be compared with the ten subjects who spent the shortest time. The results of this analysis are presented in Table VIII.

TABLE VIII

COMPARISON OF RESUMPTION FOR THE HALF OF EACH GROUP WHICH SPENT THE LONGER TIME ON TASK II AND THE HALF WHICH SPENT THE SHORTER TIME

Group	Longer half		Shorter half	
	Av. time	No. resuming	Av. time	No. resuming
Success I–Success II	10.2	4	5.3	3
Success I–Neutral II	12.0	1	4.6	7
Success I–Failure II	12.0	2	6.8	1
Neutral I–Success II	13.0	7	5.7	8
Neutral I–Neutral II	17.3	3	9.5	2
Neutral I–Failure II	15.8	4	10.6	4
Failure I–Success II	11.7	6	5.8	3
Failure I–Neutral II	17.5	3	6.6	1
Failure I–Failure II	14.7	2	8.5	1
Average	13.9		7.0	
Total		32		30

The totals for the two groups indicate that despite a seven-minute difference in the average time of the longer half and the shorter half of each group, there is a difference in total resumption of only 2 percent.

On the basis of this combined evidence it would seem safe to conclude that the discrepancy between the times spent on Task II in the main experimental groups was not an important variable.

7. *The Substitute Value of Task II*

The basic substitute value of Task II is obtained by comparing the combined Neutral–5 minute and Neutral–15 minute groups, in which the interpolated activity had no relevance to the original task, with the Neutral I–Neutral II group where Task II occurred without either Success or Failure stimulation. This comparison shows a difference in resumption of 45 percent.

Lissner (5) has adopted the procedure of expressing substitute value in terms of the ratio between frequency of resumption without substitute activity and frequency of resumption with substitute activity. Expressed in these terms the substitute value of Task II under Neutral conditions is 2.8.

When Success and Failure are introduced as variables the differences in percent of resumption range from 5 percent more resumption in the Neutral I–Success II group (substitute value = .93) to 55 percent in the direction of less resumption in the Failure I–Failure II and the Success I–Failure II groups (substitute value = 4.6).

IV. Discussion

Two alternatives present themselves in the interpretation of these results with reference to Lewin's field theory of psychological forces. One is that the conditions produced by Success, Neutral and Failure stimulation can be equated to certain of the factors which have already been shown to influence resumption, *e.g.*, dynamic contact, difficulty or similarity. In such case these kinds of stimulation would be special instances of conceptualized variables which are already an integral part of the field theory. The other alternative is that the effects of Success, Neutral and Failure stimulation be accepted simply as a further set of empirically determined factors which influence the substitute value of an interpolated task.

In discussing *dynamic contact* in relation to substitute value Lewin states:

> We find very little substitute value if the two activities are psychologically *separated* through special circumstances of the situation. Such isolation can sometimes be realized by having the Experimenter say at the time of interruption: "Now we shall do an entirely new task . . . " (7, p. 185).

The experimental evidence on which he bases this statement is from Lissner (5, p. 40). Close examination of Lissner's data reveals that, for the group with *dynamic contact* (Im Zussamenhang), of the 43 percent who resumed, none resumed to completion, 29 resumed in

the sense that they did something other than the original task with the materials of the original task, and 14 percent resumed *in thought*. In the group without *dynamic contact* (Ohne Zussamenhang) 70 percent of a total of 85 percent resumptions were resumptions with completion. In other words, a high degree of dynamic contact reduces resumptions to a greater extent than a low degree and therefore may be said to provide the interpolated task with a greater substitute value.

In the present investigation Success and Failure stimulation at the point of interruption might be interpreted as breaking the dynamic contact between the two tasks. But the results, in terms of either resumption with completion or total resumption, do not support this suggestion. Both Success and Failure decreased the number of resumptions with completion to approximately 40 percent of the number obtained with a Neutral interruption. The reverse of the Lissner results is true. Therefore, if the effect of dynamic contact between two tasks is to decrease the number of resumptions of the interrupted task following the second task, then in the present instance either Success and Failure stimulation at the point of interruption *increased* the dynamic contact between the two tasks or some factor other than dynamic contact is operative.

The present results appear only at first sight to be in agreement with Lissner's finding that a relatively *difficult* substitute task decreases the resumption of an original interrupted task more than does a relatively easy one. Comparison of Success I–Failure II with Failure I–Success II and of Neutral I–Success II and Neutral I–Failure II suggests that the effects on resumption of Success, Neutral and Failure stimulation are dependent on the degree of perceived difficulty produced by these conditions. Careful examination of the data, however, shows that but four of the nine groups are used in these comparisons and they represent average relationships without regard to variability.

In the first column of Table VI has been given the percent of subjects in each group who judged the second task to be easier. The larger the percent for any group, therefore, the greater was the number of subjects who found the second task easier than the first. Since according to the Lissner results resumption should occur more frequently with easy substitute activity than with difficult, the groups having a large percent of 'easier' judgments should have a large percent of resumptions. But this proves not to be the case. When the nine groups are ranked in terms of the number of subjects in each group who found the second task easier, the rank-order correlation with the same groups ranked in terms of obtained resumption scores is $-.08$.

It appears, then, that identifying Failure stimulation with difficulty and Success stimulation with relative non-difficulty gives no predictive power whatever.

The factor of similarity appears, likewise, to permit of little differentiation between the groups on a theoretical basis, since the second task was equally similar to the first under all nine conditions. Despite dissimilarity of those factors which Lissner considers important determiners of similarity between two tasks, in the present problem the difference between resumption after an irrelevant second activity and resumption after the jig-saw under neutral conditions is of the same order as that obtained by Lissner between resumption without substitute activity and resumption following a task which was similar in terms of the material used, the type of activity involved and the finished product.

There is similarity, however, in the nature of the instigation to the two tasks. It was pointed out earlier that both tasks involved goal responses of *reaction to completion*, *reaction to success*, and *reaction to avoidance of failure*. So far as instigation is concerned, therefore, similarity is present to some degree and may be the factor which provides the second task with a basic substitute value under Neutral I–Neutral II conditions.

Since the resumption scores for the nine experimental conditions are not predictable on the basis of an identification of Success, Neutral and Failure stimulation with the conceptualized variables of *dynamic contact*, *difficulty* or *similarity*, the only alternative from the standpoint of field theory seems to be to adopt the suggestion of Zeigarnik (14) that sufficiently strong variations in affective state of the subject may destroy the tension system corresponding to the interrupted task and thus reduce resumption. Such an explanation would account for the low resumption scores in the Failure II groups but would not account for the fact that resumption in the Success II groups is significantly greater than in the Neutral II groups. It is necessary, therefore, to look elsewhere than to field theory for a systematic explanation of the results.

Inasmuch as a substitute response is one which reduces the instigation to an original interrupted activity and the strength of instigation is operationally defined in terms of frequency of resumption, the jig-saw puzzle does act as a substitute for the cogwheel. Under Neutral I–Neutral II conditions resumption of the interrupted activity was 25 percent as compared with 70 percent when the second activity was completely irrelevant to the interrupted task (Control group of combined Neutral–5 minute and Neutral–15 minute groups).

When the factors of success and failure are superimposed on the usual interrupted task situation, however, there is a wide variation

among the nine groups in terms of amount of resumption. The obtained values vary from 75 percent resumption under a Neutral I–Success II condition to 15 percent resumption for Success I–Failure II and Failure I–Failure II. In general, success on the second task favors resumption and failure militates against it (Combined Success II, 52 percent, Combined Failure II, 23 percent). This fact, taken in conjunction with the theoretical analysis of the experimental situation,[17] suggests that the effect of the occurrence on a second task of goal responses common to a first is to reinforce or strengthen the instigation to the first.

From this point of view the present results may be interpreted in the following way. Instigation has been defined as the specified antecedent conditions of which a predicted response is the consequence, and three components, *a*, instigation to which the reaction to completion is a goal response, *b*, instigation to which the reaction to success is a goal response, and *c*, instigation to which the reaction to the avoidance of failure is a goal response, have been specified. It can be assumed that the total strength of instigation is the combined effect of all the instigation represented by the specified goal responses in a given situation; therefore, the goal responses *a*, *b*, and *c* in combination represent the instigation to both Task I and Task II.

If the occurrence of a goal response on Task II generalizes to reinforce the instigation to Task I and goal responses *a*, *b*, and *c* in combination represent the instigation to Task I, the reinforcing value of the occurrence of these goal responses on Task II should be directly proportional to the number of goal responses which occur. It would, therefore, be predicted that under Success II conditions, where all three goal responses occur, reinforcement would be greater than under either Neutral II or Failure II conditions where only two (*a* and *c*) and one (*a*) goal responses, respectively, occur. This hypothesis is supported by the resumption scores for the combined groups (Success II, 52 percent; Neutral II, 28 percent; Failure II, 23 percent).

To account for the results of the nine experimental groups individually is more difficult. Since, by definition, a goal response is that reaction which immediately reduces the strength of instigation to a degree at which it no longer tends to produce the predicted response, the occurrence of any of the three goal responses will *reduce* the instigation to Task I and the amount of reduction will be directly proportional to the number of goal responses occurring. But the strength of instigation to Task I is not measured until after the completion of Task II and it is assumed that the instigation to a task reduced by the occurrence of a goal response to that task recovers

[17] *Cf.* Introduction.

partially when a second activity intervenes between the task and the point at which the instigation is measured. Therefore, the instigation to Task I reduced by the occurrence of any of the specified goal responses will partially *recover* by the time the strength of instigation to Task I is measured. Also, since the occurrence of a goal response reinforces the instigation to perform a task, the occurrence of any of the three goal responses on Task I will *reinforce* the instigation to Task I. As above, the occurrence of any of the three goal responses on Task II will generalize to reinforce the instigation to Task I. The strength of instigation to Task I at the time when it is measured will thus be a function of the occurrence on Task I or Task II, or by the interaction between Tasks I and II, of one, two, three, or none of goal responses *a*, *b*, and *c*.

Ideally, it should be possible to test this hypothesis, at least tentatively, by deducing the expected rank of each of the nine experimental groups and correlating the expected ranks with those actually obtained. If the relative importance of the three instigational components and a constant for the amount of recovery of instigation reduced by the occurrence of the goal responses were determined this could be done.[18]

It is difficult to consider the relation of this discussion to data obtained by other investigators for, in most instances reported in the literature, a variety of tasks was used in a single experimental session, the experiments were done in another culture, and knowledge concerning the manner in which subjects were obtained and the instructions given to them with regard to the general conditions of the experiment is not available. It is thus impossible to assume with any certainty the operation of the instigation components on which the present discussion has been based. It should be possible, in cases where the background of the subjects and the social factors arising from the experimental situation can be specified, to name the instigation components and consider the present hypothesis.

V. Summary

The interrupted-task technique was used for the study of the influence of success and failure on substitute activity; those characteristics of a task which have been shown by previous investigators to influence the resumption of an interrupted task were held constant. Verbally produced success and failure were introduced both

[18] Such a correlation, using a simple equal-weighting of the three components and one-half the value of a goal response for the recovery constant, was tried in the original dissertation (on file in Sterling Library, Yale University). A rank difference coefficient of +.76 was obtained. When this was corrected after the model of the formula for the coefficient of attenuation the value was +.98. Definitions, postulates, and detailed deductions are presented in the dissertation.

at the point of interruption of the first task and following the completion of a second task, and their effect on the subsequent completion of the interrupted task was determined. The findings, as obtained from 210 male undergraduates, may be summarized as follows:

1. Success and Failure stimulation on an interrupted task (Task I) do not produce significantly different amounts of resumption of that task following a second task. Both Success and Failure stimulation definitely reduce resumption in comparison with a Neutral interruption, the effect of Failure being slightly more pronounced than that of Success.

2. Success stimulation following the completion of a second task (Task II) increases resumption of the original activity to a significantly greater degree than does Failure stimulation or a Neutral condition. Failure stimulation and a Neutral condition on a second task are not significantly different in their effects on resumption of an original interrupted task.

3. Success, Neutral and Failure conditions on either the interrupted or the second task contribute significantly more to the total variance than does the sampling error. The comparatively greater effect of Success, Neutral and Failure conditions on the second task indicates that the results of similar variations on the interrupted task may be somewhat overshadowed.

4. Regardless of whether the interrupted or the completed task is considered, Success stimulation produces significantly more judgments of preference for a task than does Failure stimulation.

5. Regardless of whether the interrupted or the completed task is considered, Success stimulation produces significantly more judgments of 'easier' for a task than does Failure stimulation.

6. Within the limits of one and fifteen minutes, the time elapsing between the interruption of a first task and the subsequent opportunity for its resumption is not an important factor in determining resumption.

7. Variations in the substitute value of the same task, ranging from 4.6 to .93, were obtained when Success, Neutral or Failure conditions on the two tasks was the only variable.

These results are interpreted from the point of view of reaction psychology.

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