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TASK INTERRUPTION

Stellingen

I

Het is noodzakelijk, dat een korte cursus literatuuronderzoek in de onderscheiden kandidaatsopleidingen wordt opgenomen. Bij de voorbereiding en uitvoering van deze cursussen zouden de universiteitsbibliotheken moeten worden betrokken.

II

Het de proefpersoon successievelijk aanbieden van een (groot) aantal gelijke of gelijksoortige beoordelingschalen heeft voordelen boven de gebruikelijke wijze van het aanbieden van de gehele lijst tegelijk.

III

In veel psychologische onderzoekingen worden de uitkomsten van twee-steekproeven toetsen onjuist geïnterpreteerd.

IV

De begrippen die Van Heek hanteert ter verklaring van de mentaliteit van de Nederlandse Rooms-Katholieken, worden in hun samenhang niet geheel juist geïnterpreteerd.

F. van Heek: *Het geboortenniveau der Nederlandse Rooms-Katholieken*. Leiden 1954.

V

Het verdient aanbeveling schriftelijke tentamens in duplo te laten maken; één exemplaar dient op een voegzame en veilige plaats te worden bewaard.

VI

De gebruikswaarde van de Nederlandse proefschriften zou in aanzienlijke mate worden verhoogd, indien de eis tot het bijvoegen van stellingen zou worden vervangen door die tot het toevoegen van een namen- en zakenregister.

Academisch Statuut, art. 222 lid 1.

TASK INTERRUPTION

ACADEMISCH PROEFSCHRIFT

TER VERKRIJGING VAN DE GRAAD VAN DOCTOR
IN DE SOCIALE WETENSCHAPPEN
AAN DE UNIVERSITEIT VAN AMSTERDAM
OP GEZAG VAN DE RECTOR MAGNIFICUS MR. J. VAN DER HOEVEN,
HOGLERAAR IN DE FACULTEIT DER RECHTSGELEERDHEID,
IN HET OPENBAAR TE VERDEDIGEN IN DE AULA DER UNIVERSITEIT
(TIJDELIJK IN DE LUTHERSE KERK, INGANG SINGEL 411, HOEK SPUI)
OP VRIJDAG 3 MEI 1968
DES NAMIDDAGS TE 4 UUR DOOR

ANNIE VAN BERGEN



NORTH-HOLLAND PUBLISHING COMPANY - AMSTERDAM - 1968

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PROMOTOR: PROFESSOR DR. J. KOEKEBAKKER

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Cathy van Stalen-Kroon kindly undertook and completed the task of correcting the English.



Introduction

“There is a story related to Zeigarnik’s experiment. Lewin and his friends were in a restaurant in Berlin, in the sort of prolonged conversation which always surrounded Lewin. It was a long time since they had ordered and the waiter hovered in the distance. Lewin called him over, asked what he owed, was told instantly and paid, but the conversation went on. Presently Lewin had an insight. He called the waiter back and asked him how much he had been paid. The waiter no longer knew”. (Boring 1957, p. 734).

The studies by Zeigarnik and Ovsiankina

1.1 *Zeigarnik's study*

The first experimental study published in the series “Untersuchungen zur Handlungs- und Affektpsychologie” (1926–1937) by Lewin and his students was that of Zeigarnik (1927)¹. Its purpose was to investigate the effect of tension systems – or, more specifically, of quasi-needs – on memory.

In short, the quintessence of the theory reads as follows. When a person intends to perform a task, a quasi-need is established which presses in the direction of fulfilment of the intention. Dynamically, this implies the erection of a tension system which tends to discharge. Completion of the task means release of the tension system, or discharge of the quasi-need. If, however, the activities which are used for execution of the intention are blocked, the quasi-need remains unsatisfied, i.e., the system remains under tension (Zeigarnik 1927, p. 29). It was hypothesized that this unreleased tension has an effect on memory.

In laboratory experiments, the intention to perform a task may go back to the subject's acceptance of the experimental instruction (Lewin 1926*b*, p. 371–372; 1951*b*, p. 140). The effect of an intention that has been brought about in this way, may also be regarded as a quasi-need.

The specific question posed in Zeigarnik's experiment reads: “What is the relation between the retention of activities that have been interrupted before completion and the retention of completed activities?” (Zeigarnik 1927, p. 3; 1938, p. 300).

1.1.1 *Main experiment (experiment I)*²

The main experiment was performed with 32 students of the University of

¹ The study has been published in English in abridged form (1938, p. 300–314). Zeigarnik's derivations have been formalized by Lewin (1940).

² Wherever possible, the present author re-analyzed the quantitative data by making use of recall difference scores. The results of these statistical re-evaluations are given in footnotes. The rationale of the statistical procedure is explained in chapter 4.

Berlin as subjects. The relationship between Zeigarnik, as the experimenter, and her subjects was one of unconstrained good fellowship.

After the experimental instruction: "I shall give you a series of tasks which you are to complete as rapidly and correctly as possible", 22 tasks were presented, one at a time. Half the tasks were interrupted before completion. At the moment when the subject was most engrossed in his work on a task that was to be interrupted, the experimenter presented the material of the next task, saying: "Now do this, please".

Immediately following the last task, the experimenter asked what tasks the subject had worked on during the experiment. The time given for recall was unlimited. However, only those items that had been mentioned prior to a hesitation period in the recall were analyzed. It was assumed that the unresolved tension systems would be reflected only in spontaneous recall. Searching for more items would correspond to another task set by the experimenter (a quasi-need for its own sake), i.e., to recall all of the tasks. For the reduction of this specific tension system, recall of completed items would do as well as recall of uncompleted ones.

The tasks which remained uncompleted for half the subjects were completed tasks to the other half, and vice versa. In this way two interruption series, *a* and *b*, were used. In the following list of the tasks, numbered in the order of presentation, an *a* is added to those tasks that remained uncompleted in the *a* series:

1. monogram; 2*a*. pentagram; 3. thread winding; 4*a*. beads; 5*a*. poem; 6. spiral; 7. paper-folding; 8*a*. crosses in ellipse; 9*a*. matches; 10. box; 11. triangles; 12*a*. counting backwards; 13. drawing a vase; 14*a*. flag at angles; 15*a*. honeycomb pattern; 16. multiplication; 17. mending a chair from a match-box; 18*a*. straightening wire; 19*a*. pattern of a carpet; 20. crotchet; 21*a*. riddle; 22. printing.

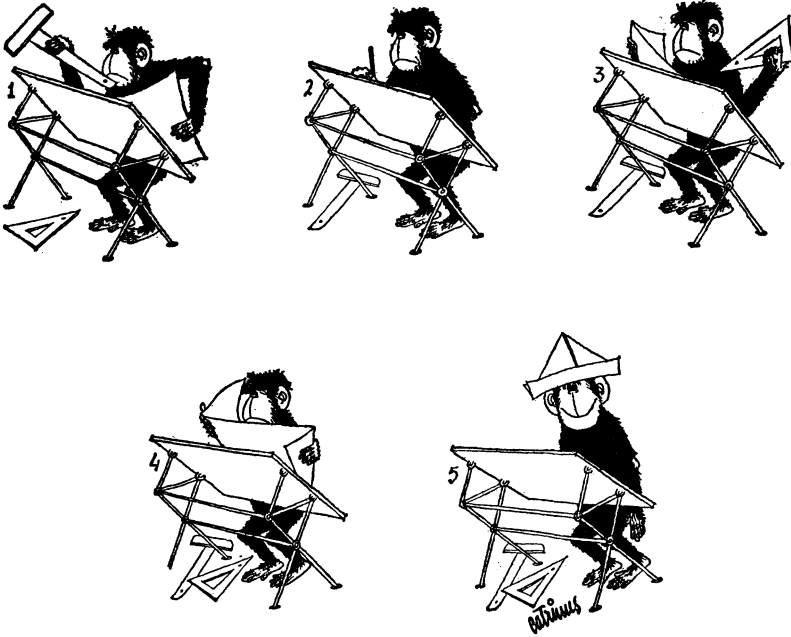
A large majority of the 32 subjects¹ recalled more uncompleted than completed tasks². The median recall difference score was +3. If the tasks are taken as the unit of measurement the same result is obtained; most of the 22 tasks were recalled better in the uncompleted than in the completed condition³. There was no significant correlation between the recall of tasks in the uncompleted and completed condition⁴.

¹ No breakdowns can be made with respect to either interruption series or sex, as the necessary information is not available.

² Wilcoxon matched-pairs signed-ranks test: $T_+ = 429$; $T_- = 6$; $T_v = 423$; $n = 29$; $P < .01$.

³ $T_+ = 199$; $T_- = 11$; $T_v = 188$; $n = 20$; $P = .0001$.

⁴ $\tau = + .11$.



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The relative priority of uncompleted tasks was also reflected in the order of recall. The subjects tended to recall an uncompleted task in the first and second place, while the last items recalled were predominantly completed tasks.

This result – the better recall of uncompleted tasks – was ascribed to the tensions that had not been discharged because of interruption, i.e., to the continuation of quasi-needs.

1.1.2 *Systematic variations*

Before accepting the interpretation of the continuation of quasi-needs and their effect on recall, however, several possible criticisms should be met. Zeigarnik therefore designed variations in the experimental conditions, the most important of which will be dealt with.

First of all, the main experiment was replicated with 14 subjects and another selection of 20 tasks (experiment Ia). The result was the same: a

predominant recall of uncompleted items¹, with a median recall difference score of +3. This result was also obtained in two mass experiments, with 47 students and with 45 children (13 and 14 years old) respectively².

It was felt that the uncompleted tasks might have been recalled better because of a possible shock effect of the interruption. Therefore, in experiment III interruption took place for all the tasks, half of which, however, the subject was allowed to complete. Again the uncompleted items were in the majority in recall; this tends to eliminate the interpretation of the affective emphasis of the interruption³. The median recall difference score was +2⁴.

Another interpretation has been advanced: that recall of the uncompleted tasks might be superior because the subject believes that these tasks are to be resumed later, which induces him to remember them. Therefore, in experiment IV, the interruption was accompanied by the remark, "This task will be resumed later", and in experiment IVa the subject was told after each interruption, "You are not to work on this task any more". However, both experiments yielded the same results⁵. Thus the interpretation of intentional remembering of the uncompleted items was discarded.

1.1.3 *Different groups of subjects*

Experiments I and Ia were replicated with 30 children (5 to 10 years old). Zeigarnik observed that the children wished to resume the unfinished tasks more strongly than the adults and sometimes even asked for resumption two or three days later. She said that the needs of children tend to press on rather unconstrainedly (1927, p. 81–82).

The large majority of the 30 children, most of whom lived in Prienai, Lithuania (1927, p. 4 and p. 82), recalled more uncompleted than completed items⁶. Especially the unintelligent, somewhat backward children, were said to recall predominantly unfinished tasks (1927, p. 82–83).

¹ $T_+ = 87$; $T_- = 4$; $T_v = 83$; $n = 13$; $P = .002$.

² Binomial test: $P < .000005$ (both experiments). In the latter experiment Zeigarnik made an error in recording the number of subjects.

³ $T_+ = 63.5$; $T_- = 2.5$; $T_v = 61$; $n = 11$; $P < .005$.

⁴ Subject B1 has been excluded from the computations as the data presented do not fit (Zeigarnik 1927, table 9, p. 24).

⁵ Experiment IV: $T_+ = 61.5$; $T_- = 4.5$; $T_v = 57$; $n = 11$; $P < .01$; median recall difference score: $+3 > \text{Mdn} > +2$. Experiment IVa: $T_+ = 76.5$; $T_- = 1.5$; $T_v = 75$; $n = 12$; $P < .001$; median recall difference score +2.

⁶ $T_+ = 387$; $T_- = 19$; $T_v = 368$; $n = 28$; $P < .01$; median recall difference score +2.

Zeigarnik, who computed the mean of her ratio scores (an incorrect procedure, see section 4.1), obtained a somewhat higher average score for the children than for the adults. She interpreted this difference rather extensively. However, the median recall difference score of the 30 children is not higher than that of the 32 adults of the main experiment, it is lower – although the difference is negligible¹.

Zeigarnik, furthermore, contrasted the scores of five “infantile” adults, which were extremely high (median + 4) with those of six “mature” adults, whose median recall difference score was 0 (1927, p. 83–84). The data were probably selected from the other experiments².

A median score of 0 was also, however, obtained in an experiment with a group of ten grammar school boys. The boys felt somewhat trapped when they had to perform the tasks while paying a visit to the Psychological Laboratory (1927, p. 63). Of both the boys and the mature adults it was said that they did not become sufficiently engrossed in the activities, which precluded the establishment of separate tension systems (for the separate tasks) with firm boundaries.

Furthermore, the data of nine ambitious subjects were presented (Mdn recall difference score + 3). Zeigarnik (1927, p. 59), calculating the mean of her ratio scores, mentioned that these subjects gave a much higher mean score than those of the main experiment³ (whose Mdn recall difference score is also + 3). She wanted to use the data of the ambitious subjects to demonstrate the importance of the communication of the quasi-needs with the individual's real needs. In this instance it was said to have brought about an increased tendency to completion.

¹ Wilcoxon two-sample test: $z = .29$; $P = .77$.

² Zeigarnik presented the recall scores of some sub-group(s) several times, without, however, stating the criteria on which the subjects of these *post hoc* breakdowns were selected. A comparison between breakdowns like these may therefore not always be quite correct, as it is not known whether the data are independent in all these instances. Moreover, it is not improbable that at times special cases have been presented and others omitted in order to accentuate a certain finding. As ideas about the requirements of verification and falsification were less sophisticated in the 'twenties than nowadays, one may hardly criticize Zeigarnik for this *hineininterpretieren*; neither would it be fair to criticize Zeigarnik for not having used any test of significance – like e.g. Martuscelli (1959, p. 57) did – considering the customary procedure of data analysis in those days. Nevertheless, it is a great pity that the statistical re-analysis of the data has to remain rather questionable because of the problem of data independence.

³ The difference cannot be tested because some of the ambitious subjects performed (and are therefore included in the data of) the main experiment.

1.1.4 *Different attitudes toward the tasks, and recall*

A very peculiar finding was that the whole effect of superior recall of uncompleted tasks was due to those tasks towards which the subjects felt indifferent. The interesting tasks were recalled equally well under both conditions¹. It thus appears that if a subject feels indifferent towards some task – as contrasted to indifference towards the experiment as a whole – tension systems are still established.

The crucial factor in selective recall was not the objective completion or incompleteness, but the subjective feeling of having finished the task or of being still unsatisfied. Sometimes, moreover, a feeling of completion was approached if the interruption occurred when a well-structured part of the task had just been finished.

The predominance of uncompleted tasks in recall was much less for continuous activities² than for tasks with a clearly defined end. Furthermore, when tasks were interrupted in the middle or near the end, they were recalled much better than when interruption took place near the beginning of the task³.

The relative priority of uncompleted items was larger for those subjects who told the experimenter casually what tasks they had performed than for those subjects who experienced recall as a test of memory⁴. To the latter, recall was a new task that had to be finished, i.e., all tasks had to be mentioned. This interpretation is substantiated by the greater total recall (RU + RC) of the memory-test group as compared to that of the casual group⁵.

1.1.5 *The effect of fatigue and of delayed recall*

Subjects who were tired at the time of the experiment recalled significantly less uncompleted than completed tasks⁶.

¹ Unfortunately, this finding cannot be statistically evaluated, because the source (which subjects and which tasks?) and the composition (was any subject counted more than once?) of the frequencies of table 17 (1927, p. 45) are unknown.

² *fortlaufende Handlungen*.

³ See, with reference to table 21 (1927, p. 57), the penultimate footnote.

⁴ Wilcoxon two-sample test: $W = 36$; $m = 8$; $n = 10$; $P = .055$.

⁵ $W = 33$; $n = 8$; $m = 10$; $P < .04$.

⁶ Wilcoxon matched-pairs signed-ranks test: $T_+ = 4$; $T_- = 51$; $T_v = 47$; $n = 10$; $P = .014$; median recall difference score -1 .

The question arose whether this reversal in recall was due to fatigue during work on the tasks or to fatigue at the moment of recall. Zeigarnik therefore compared a group of 8 subjects who were fit when performing the tasks but tired at the moment of recall, with a group of 7 subjects who were tired when working on the tasks but fit when asked for recall. A period of 13 to 15 hours was interpolated between the work on the tasks and recall for both groups, in order to be able to study the subjects under these different physical and psychical conditions. It was found that predominant recall of completed tasks was largely the result of the inferior establishment of tension systems during fatigue¹.

The other subjects, who had been tired only at the moment of recall, are comparable to another group of 11 subjects of whom recall was first required the next day. For this group, a difference between recall of finished and unfinished items could not be detected². Zeigarnik's interpretation of this finding was that tensions tend to weaken with time. An experiment with immediate and delayed recall resulted in higher recall difference scores for immediate recall³, and thus substantiated the interpretation.

1.1.6 Repetition of the experiment

After a period of 3 to 6 months, the experiment was repeated with the same subjects ($n = 14$) and a different selection of tasks. It was found that the value of the recall scores was almost identical the first and the second time⁴. This result seems to indicate that the subjects in a Zeigarnik experiment are not necessarily naive.

1.1.7 Emphasis on intervening variables

It has been seen that superior recall of the uncompleted tasks not only depends on incompleteness as such. One must also know whether the subject is an ambitious person, whether he is tired, whether he feels satisfied with his task completion, etc. etc. In her publication, Zeigarnik discussed other similarly intervening variables.

She also treated the role of the experimenter; she felt it should not be a

¹ $W = 17; m = 7; n = 8; P < .03$.

² $T_+ = 34.5; T_- = 20.5; T_v = 14; n = 11; P > .49$.

³ $T_+ = 92; T_- = 13; n = 17; P = .01$.

⁴ $\tau = +.88$.

standard role, but should be adjusted to each individual subject. In this way Zeigarnik tried to create equivalent, though not identical, stimulus situations for all subjects.

A strong emphasis on the intervening variables makes for nuances in the interpretation of the results. However, the risk of *hineininterpretieren* is not illusory, as some of the critical remarks made in this chapter have established.

1.2 *Ovsiankina's study*

A related experimental study in the same series (*Untersuchungen zur Handlungs- und Affektpsychologie*) was that of Ovsiankina (1928). The purpose of her investigation was to ascertain if and under which conditions subjects resume interrupted activities (cf. section 2.2).

The theorizing is equivalent to Zeigarnik's, for both studies had been inspired by Lewin. Zeigarnik studied the effect of quasi-needs on memory: an indirect measure of undischarged tension systems. Ovsiankina studied the effect of quasi-needs on the resumption of interrupted tasks: a direct indication of the continuation of quasi-needs.

Ovsiankina's main experiment was performed with 28 subjects, most of them students of the University of Berlin. More than half the tasks – which are comparable to the ones used by Zeigarnik – were interrupted by the experimenter. The number of tasks presented varied from 8 to 12, while 6 to 8 of these tasks were interrupted¹. The interruption took place in several different ways, the most important of which were: deliberate interruption (presentation of the material for the next task), and "accidental" interruption (e.g., dropping a box of paperclips and asking the subject for help). After the accidental disturbance was over, or after completion of the interrupting task, the experimenter busied herself writing notes. The subject was thus left alone for some time.

The whole experimental situation was rather disorderly. This was mainly due to the accidental interruptions, and the fact that the subjects were still "allowed" to resume and finish the tasks after the experimenter had first interrupted them also probably played its part in bringing about confusion.

¹ This means that for 28 subjects, the smallest possible number of interruptions would be 168. However, Ovsiankina mentioned only a total of 141 interruptions (1928, p. 324–325).

Sometimes this feeling was expressed by the subjects who, e.g., exclaimed: You are a restless experimenter, aren't you! (1928, p. 319).

Most of the subjects showed some kind of irritation at being interrupted, or even protested against it.

The result of the main experiment was the most striking as regards the 47 accidentally interrupted tasks: all of them were resumed. 79% of the 94 deliberately interrupted tasks were resumed within 20 seconds after completion of the interrupting task. These high frequencies seem to give a directly affirmative answer to the question whether quasi-needs press on after interruption or not.

One feels, however, that the results of the first interrupted task might be of importance. As from the first resumption, the subject must know that the experimenter permits – or at least “overlooks” – the completion of the interrupted tasks¹. Unfortunately, Ovsiankina did not give these data.

With regard to the moment of interruption, Ovsiankina's results differ from those of Zeigarnik. Whereas recall was better when interruption occurred in the middle or near the end of the task (Zeigarnik 1927, p. 57), resumption was most frequent when the tasks were interrupted in the beginning and least frequent when the interruption occurred between the middle and the end (Ovsiankina 1928, p. 328–330).

Of Ovsiankina's many other experimental variants (with 124 subjects in all) and analyses, only one more finding will be discussed. Many subjects experienced the interrupted task as the principal task, as more or less the crux of the experiment. These subjects often finished the interpolated task hurriedly, in order to be able to resume the main task as soon as possible. If the interpolated activity in its turn was interrupted, they frequently even welcomed the interruption. Only rarely was an interrupted interpolated task taken up again later (1928, p. 317–320). If this finding indicated that it is not (or hardly) possible to establish another tension system for a new task after an interruption², it would mean that Zeigarnik's experimental design is

¹ Ovsiankina herself recognized the problem of the dependency of the data in table 1 (1928, p. 326). She tried to compensate for this by excluding from the data the three subjects to whom most of the non-resumptions were confined and by eliminating the task showing the lowest resumption. After this – obviously incorrect – manipulation, the percentage of resumptions was increased to 88 (table 2, 1928, p. 326).

² Ovsiankina's exact formulation reads: in a situation of an unsatisfied need, no firm tension system for the new [interrupted] activity can be set up after completion of the first activity. (“... dass in der Situation eines unbefriedigten Bedürfnisses nach Vollendung der ersten Handlung sich für die neue Handlung kein starkes Spannungssystem heraus-

worthless. However, a check on the data of Zeigarnik's main experiment shows that recall is not significantly less for tasks preceded by an interrupted activity than for tasks preceded by a completed activity.

It thus appears that the two classical studies on task interruption led to partly ambiguous results.

bilden konnte". 1928, p. 319). I reformulated this interpretation in the main text because, according to Lewinian (and thus Ovsiankina's) theory, the establishment of tension systems occurs at the moment of the intention to perform a task, and not only after the activity has been interrupted, at the moment of a possible resumption (cf. second footnote of section 6.2).

Theoretical background of the interruption studies

Following the two classical studies by Zeigarnik and Ovsiankina, many different schools of psychology and related disciplines took up the problem of interruption.

In this chapter, the purpose of which is twofold, the principle differences between the various approaches will be discussed. Firstly, the influences on Lewin's thinking with regard to the problem of recall and resumption of interrupted tasks are traced. Secondly, the theoretical background of a number of studies in which the work on task interruption was continued, is discussed. A short review of the studies themselves ¹ will be presented in the next chapter. However, only part of the 160-odd studies reviewed were performed within a definite theoretical framework ². The contents of this chapter should therefore not be regarded as covering the whole field of research on task interruption.

2.1 *Würzburg school*

The first work to be discussed is Ach's (1905; 1910; 1935) ³, as Lewin's earliest experiments (1917; 1922*a, b*) were performed within the framework of the Würzburg school or, more specifically, within Achian tradition. Moreover, the first reaction to Zeigarnik's study came from a student of Ach's, *Schlote (1930), who not only made an exact replication of Zeigarnik's main experiment and of some of the variations, but also studied the interruption

¹ References made to studies reviewed in chapter 3 can be recognized by the asterisk attached to the author's name.

² *Butterfield (1963, p. 56) remarked that task interruption "has become one of those instances in the history of psychology when a technique rather than a concept is the focus of intense experimentation."

³ For an English translation of the last part of Ach (1905), with a commentary, see Rapaport (1951, p. 15-38). For a critical discussion see e.g. Humphrey (1951).

problem with the aid of an Achian experimental design¹. Only the few features of Ach's theorizing that are necessary for understanding these experiments are dealt with.

In Ach's psychology association and perseveration are accepted as mental mechanisms, and in addition a third was proposed: the determining tendency. Ach described what the determining tendency comprises within the context of the type of experiments he performed, reaction experiments. A specific experimental instruction gives rise to an aim-presentation². From part of the contents of this aim-presentation proceed influences which carry with them a determination in the sense of, or according to the meaning of, the aim-presentation. These influences are the determining tendencies³. Or, in other words, they are influences which – arising from the aim-presentation and directed towards the stimulus-presentation⁴ – determine that the course of events accords with the aim-presentation⁵. The establishment of a relation between the aim-presentation and the stimulus-presentation is called an intention⁶. Determining tendencies may proceed, not only from an accepted intention, but from a suggestion, a command, or a task⁷. They are the directive factor in the mental process, and make the formation of new associations possible (Ach 1905, p. 196; 1910, p. 4). They must be considered a hypothetical construct as the essential characteristics cannot be known sufficiently (Ach 1935, p. 195).

¹ Other interruption studies by students of Ach's are those of *Sandvoss (1933) and *Stoller (1935).

² Translations of *Zielvorstellung*: aim-presentation (Humphrey), and goal-presentation (Rapaport).

³ "Unter den determinierenden Tendenzen sind Wirkungen zu verstehen, welche von einem eigenartigen Vorstellungsinhalte der *Zielvorstellung* ausgehen und eine Determinierung im Sinne oder gemäss der Bedeutung dieser *Zielvorstellung* nach sich ziehen" (Ach 1905, p. 187).

⁴ Translations of *Bezugsvorstellung*: stimulus-presentation and object-presentation (Humphrey), and referent-presentation (Rapaport).

⁵ "Diese von der *Zielvorstellung* ausgehenden, auf die *Bezugsvorstellung* gerichteten eigenartigen Wirkungen, welche den Ablauf des Geschehens im Sinne der *Zielvorstellung* bestimmen, bezeichnen wir... als die von der *Zielvorstellung* ausgehenden determinierenden Tendenzen" (Ach 1905, p. 195).

⁶ Ach (1905, p. 224). Translations of *Absicht*: intention (Rapaport), and purpose (Humphrey).

⁷ "Dabei geht diese Wirkung der determinierenden Tendenzen nicht bloß von einer vorhandenen *Absicht* aus, sondern diese Tendenzen können auch durch *suggestive Beeinflussung*, durch *Kommando* oder durch *Aufgabestellung* gestiftet werden" (Ach 1905, p. 196).

Basic to *Schlote's (1930) experiments – in which the unfinished activities were never started but only intended – is the theory that the determining tendency which has issued from an intention is directed towards the realization of the mental procedure in accordance with the aim-presentation¹. If, therefore, an activity is only intended and not realized, the determining tendencies remain effective and try to form the course of mental events in accordance with the aim-presentation². *Schlote's (1930, p. 70) opinion – with which Ach (1935, p. 174) fully agrees – that there is not much difference between his and Zeigarnik's interpretations of the interruption experiments, will be discussed in section 2.2.

Critique has been directed to several aspects of Ach's theory. Humphrey, e.g., especially criticized the presentational aspects: he felt that thought and action cannot be explained by manipulation of presentations. Ach "is working in a closed world of presentations, and has neglected to show how to escape from it into the outside world of objective fact and objective action" (Humphrey 1951, p. 96). Lewin (1922*a, b*) directed his criticism mainly at the associational aspects of the system, and asserted that associations can never be a motor for psychological events. And a third type of critique comes from Vygotsky, amongst others, who attacked the "purely teleological interpretation, which amounts to asserting that the goal itself creates the appropriate activity via the determining tendency – i.e., that the problem carries its own solution" (Vygotsky 1962, p. 56).

2.2 Lewinian theory

To place Zeigarnik's study in a somewhat wider framework a few aspects of Lewinian theory – restricted to the Berlin period – will be discussed³.

Lewin, in beginning his psychological research, started with the subjects

¹ "Die von einer Vornahme, einem Entschlusse und dergleichen ausgehende determinierende Tendenz ist auf die Realisierung des psychischen Geschehens im Sinne der Zielvorstellung gerichtet" (*Schlote 1930, p. 63).

² "Wenn also eine Tätigkeit nur vorgenommen, aber nicht realisiert wird, so bleiben die von dieser Zielvorstellung ausgehenden determinierenden Tendenzen wirksam und suchen den Ablauf des psychischen Geschehens im Sinne dieser Zielvorstellung zu gestalten" (*Schlote 1930, p. 65).

³ Cf. Schwermer (1966) for a detailed study of Lewin's work during this period. For Lewin's later work reference may be made, e.g., to the extensive reviews by Deutch (1954) and Cartwright (1959).

of association and the determining tendency (1917; 1922a, b)¹. After years of experimentation within the limits of Achian thought, Lewin concluded that “an association does not represent a driving force”². He introduced the concept of activity readiness³ which was rather vaguely described as an influence that is not directly perceivable ... the existence of which essentially determines whether an activity and which special kind of activity will be started, provided the presence of a certain stimulus⁴. Any influence of the goal of the activity was eliminated⁵: An activity readiness is ... not determined by the external goal; before everything else it is determined by the way of performance of the activity, being in a state of readiness, itself⁶. Only when the goal has been reached can an influence be exerted, because there are cases in which the attainment of the goal is accompanied by the cessation of the activity readiness (1922b, p. 92). None of these descriptions, however, characterizes the activity readiness as a driving force. Lewin (1922b, p. 138) only once mentioned the possibility that the activity readiness was founded in a drive; he never called it a necessity.

¹ With the exception of the curriculum vitae, Lewin (1917) is a reprint of Lewin's (1916) doctor's thesis. Lewin, who had written his thesis under Stumpf, later on did not remember ever having discussed the study with Stumpf previous to the final presentation. Even Stumpf's initial acceptance of the topic of the study was given by the mouth of an assistant (Lewin 1937a, p. 193–194). Cf. section 2.3, first footnote.

² “Eine Assoziation (Gewohnheit) stellt keine bewegende Kraft dar...” (1922b, p. 138).

³ *Tätigkeitsbereitschaft*. *Fuchs (1954) used this aspect of Lewin's theory as the starting point for his work.

⁴ “... einen nicht unmittelbar wahrnehmbaren Wirkungsfaktor ... von dessen Vorliegen es im wesentlichen abhängt, ob überhaupt eine Tätigkeit und welche spezielle Tätigkeitsart bei Gegebenheit eines bestimmten Reizes eintritt” (1922b, p. 90).

⁵ Perhaps it is this early extreme negation of anything that might directly be associated with the *aimi*- (presentation) that largely determined the confusion concerning the location of the forces in the life space in Lewin's later work. The problem arises especially when apart from inner-personal tensions, valenced objects come into play after 1926 (see, amongst others, Allport 1955, p. 155–163; Krech 1949; Hofstätter 1956, p. 44–45; Graefe 1961). In this context it is interesting to note that in the diagrams of the papers by Ovsiankina (1928), Dembo (1931), and Lewin (1931a, b), the origin of the vectors, which represent the forces, was located in the person: $\textcircled{P} \longrightarrow$. From 1933 onwards, however, Lewin gave it some indefinite place in the life space (this is found even in the reprint of 1931a in Lewin 1935): $\longrightarrow \textcircled{P}$ (cf. Lewin 1933b, p. 324). Locomotions were then represented thus: $\textcircled{P} \text{---} \rightarrow$. Lewin (1938, p. 83) considered the point of application of a force to be represented by the point of the arrow.

⁶ “Eine Tätigkeitsbereitschaft ist... nicht durch das äussere Ziel, sondern vor allem durch die in Bereitschaft gesetzte Art der Ausführung der Tätigkeit selbst bestimmt” (1922b, p. 92).

A similar indefinite dealing with the drive aspect is also apparent in the treatment of quasi-needs, a concept introduced in 1926. On the one hand, Lewin said that tension systems, *as a rule*, derive from needs. There are, namely, also tension systems that issue from an intention:¹ the quasi-needs². On the other hand, Lewin said time and again that "... in order that a process occur, energy capable of doing work must be set free"³. However, with respect to the quasi-needs – or better with respect to the intentions – the supplier of the energy remains in the dark⁴. In general, Lewin left open the question as to the source and content of the postulated energy⁵ and – influenced by Cassirer (1910, p. 249–270) – regarded it as a general logical fundamental concept of all dynamics⁶.

Lewin did not give a proper definition of the concept of quasi-need. Of the several vague descriptions by him and his students, the one given by Zeigarnik probably suffices best: The very moment a subject – because of the instruction – intends to perform a task, a quasi-need is established which, from itself, presses towards completion of the task⁷. The addition "from itself" should be read as "even if no predetermined occasion invites the action" or "without stimulus-presentation"⁸.

The latter aspect of the description made it possible for Ovsiankina to present her study as a crucial experiment using the competing Achian and

¹ In 1938 (p. 99) Lewin gave a hint as to the origin of this assumption: "The hypothesis... linking intention with tension (quasi-need) has been made in opposition to a previous theory which coordinates the effect of an intention to an association (or to a *Determinierende Tendenz* in the sense of Ach 1910) between the image of the occasion and the image of the intended action".

² 1926a, p. 311, p. 317; 1926b, p. 356; 1935, p. 44, p. 51; 1951b, p. 125. Quasi-needs derive their name from their close relation (fully unspecified!) to real needs (1926b, p. 349; 1951b, p. 117). References are given to the original German publications (Lewin 1926a, b) and to the English translations (Lewin 1935, p. 43–65; 1951a, b) as well. Lewin (1951b) has been reprinted in Shipley (1961, p. 1234–1287).

³ 1926a, p. 313; 1935, p. 45–46.

⁴ Cf. Gibson (1941, p. 801). It must have been Lewin's confusing presentation that led Hilgard (1956, p. 262) to identify intentions with quasi-needs.

⁵ According to London (1944, p. 267, 272) the concept was postulated as "an easy way out" for otherwise unaccountable behavior. Cf. Estes (1954, p. 320).

⁶ 1926a, p. 313, p. 318; 1935, p. 46, 52; cf. 1934, p. 259. Cf. Koch's (1941, p. 147–150) critical comments on Lewin's references to a "logic of dynamics".

⁷ "Im Augenblick, wo die Vp. sich vornimmt, auf Grund der Instruktion die Aufgabe auszuführen, entsteht ein Quasibedürfnis, das von sich aus zur Erledigung der Sache drängt" (Zeigarnik 1927, p. 29).

⁸ 1926b, p. 348; 1951b, p. 114.

Lewinian theories. To Ach, the relation between the aim-presentation and the stimulus-presentation is a necessary condition for the performance of the intended activity. Therefore, after the activity has been interrupted, resumption will only occur if the same or a similar stimulus-presentation again appears. As this is out of the question, Ovsiankina formulated the hypothesis for the Achian theory as: no resumption at all. The Lewinian quasi-needs which press from themselves towards completion of the task, may be said to press towards resumption as well, should the task be interrupted¹.

Nevertheless, *Schlote (1930) believed there was not much difference between his and Zeigarnik's interpretations of the interruption experiments. In Schlote's experimental design, the interrupted (unfinished) activities were never started but only intended. As the stimulus-presentation therefore remained the same, it was possible for Schlote to shortcircuit the complexities of Ach's system (see section 2.1). Under these circumstances there is – on the surface – indeed more similarity than difference between the two systems². It may even be said that it was Lewin who more or less shortcircuited the difficulties of the presentational psychology from which he so much wanted to alienate himself³.

The Lewin-Ach controversy, and especially Ovsiankina's share in it, may wrongly give the impression that the studies performed by Lewin's students (*Psychologische Forschung* 1927–1937), were designed for the express purpose of testing hypotheses derived from a well-established theory. Although a theoretical orientation was basic to and apparent in all of the experimental work, Lewin did at times allow the empirical data to determine all further progress. Theory and experiment rather developed simultaneously⁴.

In 1926 the goal of the activity was no longer as much taboo in Lewin's theorizing as it had been in 1922. He introduced the concept of valence as a complementary concept to that of (quasi-)need, but only considered it of secondary importance. Zeigarnik, with regard to tasks with a definite endpoint, seemed to be willing to attach a positive force to the goal, by saying that subjects are attracted by goals that function as positive valences (1927, p. 57–58). Lewin, however, emphasized that innerpsychic tension systems were pivotal in Zeigarnik's study (Lewin 1929*b*, p. 214–215), and stressed

¹ Ovsiankina (1928, p. 304–305). Lewin (1926*b*, p. 340; 1951*b*, p. 102).

² Cf. Heider (1959, p. 11).

³ G. Humphrey, personal communication, January 14, 1961.

⁴ Lewin (1926*a*, p. 297–298; 1951*a*, p. 79–80; 1940, p. 6). Cartwright (1959, p. 38).

tension reduction (a negative factor) as *the* basis for motivated action, despite his recognition of positive valences¹.

The chief characteristic of Lewin's tension system theory, necessary for the understanding of the interruption studies, is the principle of homeostasis: systems under tension tend towards a state of equilibrium, at the lowest possible level of tension, with neighboring regions. Or, as Lewin used to say: systems under tension tend to discharge. A task, as long as it is unfinished, may be thought of as a system under tension; completion of the task means tension release. If, however, the activities which lead towards tension discharge are blocked, the system remains under tension. This may have an effect on various phenomena like resumption, memory, and substitute activities.

2.3 *Classical Gestalt psychology*

Lewin's thinking was very much influenced by "classical" Gestalt psychology: so much that he himself is often called a Gestalt psychologist².

In Lewin's 1922*b* paper, Köhler and Koffka are only mentioned incidentally, but in 1926 – both explicitly and implicitly – far more frequently (Wertheimer is then also mentioned). "The quest after the elements of which the psyche is composed ... may be considered now ... a matter of the past in the fields of perception and intellectual processes. Yet in will- and affect-psychology it has played a paramount role until most recently"³.

In 1921 one may already encounter some ideas in Koffka that bear a close resemblance to some of Lewin's later discussions on the interrupted tasks. "If the course of action be interrupted in any one of our examples [melody and drama], we have not merely stopped an external succession of independent processes; we have disrupted a unitary course of events which, though incomplete at the moment of interruption, yet bore within itself, and evolved as it went along, its own law of progression. ... The beginning of a melody pushes forward in the direction of its continuation and completion"⁴. In

¹ Hilgard (1956, p. 428). Cf. *Henle & Aull (1953). "'Systems under tension' are the whole story" (Allport 1947, p. 5).

² Boring & Boring (1948, p. 133) mentioned Köhler as Lewin's only teacher "... in the formative period up to the time of the Ph. D." However, in Lewin's (1916) thesis Köhler's name is not mentioned. Cf. section 2.2, second footnote.

³ Lewin (1926*a*, p. 301–302; 1951*a*, p. 85; also 1929*a*, p. 544).

⁴ The quotation is from Koffka (1928, p. 105). This is the English translation of the 2nd

discussing instinct, although stating that the explanation does not only apply to instinct but to behavior as such (1921, p. 69), Koffka furthermore says: "... that the characteristics of 'closure' ... belong not merely to the phenomena themselves, but likewise to the behaviour taken as a whole, including all reactions made to the environment"¹.

Thus the transposition of the principle of closure from the field of perception to that of behavior had already been instigated by Koffka even before Wertheimer's (1923) paper on the Gestalt laws of perception was published, and Lewin only needed to apply the principle to motivation, i.e., to the working of quasi-needs. It is interesting to note that the very characteristic of the quasi-need ("which, *from itself*, presses towards completion of the task")² that Lewin used so frequently in order to alienate himself from Ach (see section 2.2) is the pre-eminent characteristic of the law of *Prägnanz*. However, the resemblance is rather a superficial one. Lewin's tension systems are established within the person, while the Gestalt forces originate in the phenomenal field (Koffka 1928, p. 105).

Koffka's (1935) theory of memory, in which the principle of closure is also utilized, appeared several years after Zeigarnik's publication. Lewin does not seem to have been influenced by Wulf's (1922) preliminary study³.

Basic to Koffka's theory of memory is the belief that every excitation leaves a trace. The "trace column forms a coherent and organized field, i.e., it is permeated by forces which hold it together, segregate it from the rest, and determine its own articulation. ... If the unit is 'open' or 'incomplete' then that part of the field which corresponds to the gap will be a seat of very particular forces, forces which will make the arousal of processes of closure easier than the arousal of any others. ... Our trace column, before the sequence has come to its natural end, is just such an open or incomplete spatial organization, and therefore it will facilitate such excitations as continue it properly and eventually lead towards closure" (Koffka 1935, p. 449).

In case of incompleteness, the particular forces leading to closure thus keep the trace more highly organized. Recall depends to an important degree on the extent to which a trace is organized. In this way Koffka interpreted

revised German edition of 1925. The same ideas were, however, already expressed in the first German edition of 1921 (p. 72), though not literally.

¹ Koffka (1928, p. 109; 1921, p. 73).

² Zeigarnik (1927, p. 29). The *italics* are the present author's.

³ Wulf (1922, p. 372) stated, e.g., that traces may be transformed according to the law of *Prägnanz*. The trace concept was also used by Köhler (1923) in his theory of successive comparison.

Zeigarnik's result of better recall of uncompleted tasks: "The very tensions which remain in the incomplete task-systems may keep them at a greater degree of organization" (Koffka 1935, p. 340).

However, if the forces leading to closure are absent, the traces of incomplete processes have a much lower "survival value" than traces of well-organized, or complete, processes. To some extent the former may be compared with chaotic patterns which "have neither a well-defined boundary, to keep them unified and segregated, nor interior stability" (Koffka 1935, p. 507).

In this way Koffka interpreted the results of Zeigarnik's fatigue experiments, in which completed tasks were recalled better than uncompleted ones: "thus uncompleted tasks, which usually, owing to the stress towards completion, were more frequently recalled than completed ones, were, because of their less perfect organization, inferior to the better organized completed ones when that special stress was lacking"¹ (Koffka 1935, p. 508).

In reviews of Koffka's theory of memory, it is sometimes only mentioned that the trace organization for an uncompleted task is less stable than that for a completed task (with regard to the survival value) without, however, adding that as long as forces towards closure are at work, the trace of the uncompleted task is more highly organized. This is the reason that, e.g., McColl (1939, p. 141–142) needed a lengthy and confused exegesis in trying to explain Koffka's interpretation of Zeigarnik's results.

The Gestalt principle of psychophysical isomorphism was never adopted by Lewin², nor the trace concept to explain memory phenomena. This led Köhler (1940), in his plea to rely more upon biological theories in psychology, to express his doubts concerning the Lewinian (and for that matter any psychological) interpretation of the superiority of uncompleted tasks in recall. He asked, e.g., what would become of a tension when the subject turns to a subsequent task, and could not find a satisfactory answer without the acceptance of a biological correlate (Köhler 1940, p. 44–47). Köhler (1947) seems to have had such difficulties with the explanation of the Zeigarnik effect in Lewin's and Zeigarnik's own terms, that the trace concept crept into his exposition of what he called "the explanation given by the authors" [= Lewin and Zeigarnik]³ (Köhler, ed. 1959, p. 179; see also Köhler 1933, p. 210–211).

¹ Compare Zeigarnik's (1927, p. 69) pictorial presentation of the fatigue situation: solid forms, □, for finished tasks, and open systems, ∩, for unfinished tasks.

² Cf. Woodworth (1951, p. 152).

³ In the first edition of 1929 this passage only read "the most plausible explanation" (Köhler, ed. 1930, p. 255).

Most of the studies that – after Zeigarnik – were performed within the tradition of classical Gestalt psychology, aimed at the demonstration of organizing processes (*Harrower 1933), or of field forces (*Baltimore *et al.* 1953; Henle 1957) outside the field of visual perception. “A well-patterned task, one which has a definite ending with steps leading logically to it, should have a tendency to complete itself. If the activity of completing it is interrupted, the structure should ‘cry out’ for completion” (*Torrey 1949, p. 194), without quasi-needs being involved (*Harrower 1933, p. 83).

In short, according to Gestalt psychology, the process of tension release is as follows: “as long as the person has not yet reached the goal, there is a tension in the behavioral field; this tension is communicated to the executive system, which changes the relation between organism and objective environment in such a way that the goal is reached; via perception this objective state is communicated to the behavioral field; and thus the tension in this field is removed” (Heider 1960a, p. 150).

2.4 *Psychoanalytic influences*

Whether or not Lewin’s thinking was influenced by Freud’s ideas remains an unsolved problem¹. In his two 1926 papers Lewin mentioned Freud only once², and rather incidentally at that. At the general medical congress of psychotherapy at Baden-Baden in 1928, however, Lewin said that Zeigarnik’s principal result showed an affinity to one of the basic Freudian assumptions³. And in the summary of this same paper, included in the congress report, Lewin even spoke of the verification of one of Freud’s basic assumptions⁴.

Dembo, Heider, and Rickers-Ovsiankina “agree ... that Lewin’s ideas did not derive from Freud” (Shakow & Rapaport 1964, p. 128). Boring (1957, p. 723), however, was of the opinion that developing a Gestalt psychology

¹ Cf. Shakow & Rapaport (1964, p. 125–132).

² The only reference, if none were overlooked, was made in the section on “The forgetting of intentions” (compare a section under the same title by Freud, 1904): “Freud has called attention to these hidden resistances” (Lewin 1926b, p. 347; 1951b, p. 111).

³ “... dass unbeendete Handlungen besser behalten werden als beendete. Das Ergebnis liegt also in der Richtung einer Grundannahme der Freudschen Theorie” (Lewin 1929c, p. 14).

⁴ “... dass die unbeendeten Handlungen besser behalten werden als die beendeten. In dieser Hinsicht bestätigt sich also eine Grundannahme der Freudschen Theorien” (Lewin 1928, p. 527). In a later paper, in which psychoanalysis and *topological* psychology were compared, Lewin (1937b) did not express any indebtedness to Freud. Cf. Brown (1937).

of motivation in the 'twenties can only have meant "a scientific adaptation of the only thorough-going psychology of motivation extant – the Freudian system".

Boring's presupposition derives some plausibility from the similarity between, e.g., Freud's instincts ¹ and Lewin's tension systems ². With regard to the concept of instinct, Freud made mention of its motor element, its aim (satisfaction), its variety of objects (means) for achieving satisfaction, and its – not further specified – somatic source (Freud 1915*a*, p. 214–216). Characteristics of Lewin's description of tension systems (1926*a, b*) are: their motor element, their pressing towards satisfaction (discharge), their variety of substitute consummations, and their – not further specified – source of energy.

Even more relevant to the problem of interrupted activities is Freud's description of problems that are still unsolved at the moment of falling asleep:

"Unsolved problems, harassing cares, overwhelming impressions, continue the activity of our thought even during sleep, maintaining psychic processes in the system which we have termed the preconscious. The thought-impulses continued into sleep may be divided into the following groups: 1. Those which have not been completed during the day, owing to some accidental cause. 2. Those which have been left uncompleted because our mental powers have failed us, that is, unsolved problems. 3. Those which have been turned back and suppressed during the day. This is reinforced by a powerful fourth group: 4. Those which have been excited in our unconscious during the day by the workings of the preconscious; and finally we may add a fifth, consisting of: 5. The indifferent impressions of the day, which have therefore been left unsettled. We need not underrate the psychic intensities introduced into sleep by these residues of the day's waking life, especially those emanating from the group of the unsolved issues. It is certain that these excitations continue to strive for expression during the night..."³

Lewin's description of the effect of an intention after task interruption is not unlike the last sentence of Freud's quotation: "There exists rather an

¹ *Triebe*. Rapaport (1960) speaks of instinctual drives.

² Cf. Heider (1960*b*).

³ Freud (1900); ed. 1961: p. 451–452; Rapaport's (1951, p. 266) translation. Cf. Woodworth's (1932) recollections on his (unpublished) work on dreams, which he began at James' suggestion in the course of the 'nineties: "I thought I could see that we dreamed about matters that had been opened up but interrupted... during the day. Any desire or interest aroused during the day, but prevented from reaching its goal, was likely to recur in dreams and be brought to some sort of conclusion that was satisfactory in the dream, while activities that... had been carried through to completion, were conspicuous by their absence from the dream" (Woodworth 1932, p. 366).

internal pressure of a definite direction, an internal tension-state which presses to carry out the intention even if no predetermined occasion invites the action”¹.

Especially Freud’s points one and two are relevant to the interpretation of experimentally interrupted activities. Point one, the accidental interruption, is applicable to Zeigarnik’s experimental situation. Point 2, incompleteness resulting from failure, may be brought into relation with the psychoanalytic interruption studies from 1933 onward, especially those by *Rosenzweig.

2.4.1 *Rosenzweig’s repression theory*

Whereas Zeigarnik directed her attention to the *recall* of uncompleted and completed tasks, Rosenzweig was interested in the *forgetting* of these two types of tasks², especially in the forgetting of the uncompleted ones, i.e., in the repression of failed tasks³.

The main argument of Rosenzweig is as follows. Experiences that wound an individual’s self-respect (failures) are less apt to be remembered than experiences that are gratifying to the ego (successes). In interruption experiments that are introduced as a competition or as an intelligence test, the uncompleted tasks may be regarded as failures and the completed tasks as successes. If the subjects have reached a sufficient degree of intellectual maturity this leads – according to the Freudian theory of repression⁴ – to repression of the failed tasks (*Rosenzweig & Mason 1934, p. 258).

In close connection with the repression hypothesis, Rosenzweig postulated a need for vindication after failure with respect to the older children (Freudian reality principle), while the younger children were said to respond according to the pleasure principle (*Rosenzweig 1933b; 1945). This means that at the end of an interruption experiment, the older children tend to resume their failures while the younger children tend to repeat their successes.

The two aspects of Rosenzweig’s theorizing taken together infer, therefore, that an individual who tends to resume failures will, when resumption is denied

¹ Lewin (1926b, p. 348; 1951b, p. 114).

² It is noteworthy that Rosenzweig did not analyze the forgotten items, but the recall data. This cannot have been for reasons of comparison, as he used some modification of the RC – RU score, instead of Zeigarnik’s RU/RC.

³ In one instance Zeigarnik also spoke of repression. Referring to tasks which the subject could not solve she rather reluctantly – “one can hardly escape the conclusion” (1927, p. 77) – ascribed the low recall to repression.

⁴ *Rosenzweig & Mason (1934) referred to Freud (1915b).

him, tend to repress the failures and recall successes. This statement is clearly in contradiction with Lewin's theory, in which both recall and resumption are ascribed to the same quasi-need, i.e., a high resumption and a high recall of uncompleted tasks go together.

A few years later, Rosenzweig restricted his repression hypothesis to one special group of subjects, relative to their immediate reaction to frustration or failure. Subjects who, at the time of failure (interruption), are inclined to blame the external world (extrapunitive reaction) or themselves (intro-punitive reaction), tend to recall their failures. On the other hand, subjects who tend to gloss over their failures as if inevitable and try to rationalize them away (impunitive reaction) at the time of interruption, tend to recall their successes better than their failures. Only this last group displays repression¹ (see, e.g., Rosenzweig 1934; 1938*a, b*; 1944*a*).

Several criticisms were directed against Rosenzweig's opinion that his findings were "in keeping with the Freudian theory of repression"² (*Rosenzweig & Mason 1934, p. 258). By stating that a sufficient degree of intellectual maturity is required in order for repression to occur, he himself practically provoked the attack that his use of the concept had nothing in common with Freud's notion of repression. Rosenzweig later admitted that repression is "an immature mechanism of ego defense"³ (1952, p. 342), and detracted from the importance of his use of the concept by saying that the only bearing his 1934 study had on repression "... concerned the stage at which the ego of

¹ For non-verification of this hypothesis, see *Rosenzweig & Sarason (1942); *Lelkens (1964).

² E.g. Rapaport (1942, p. 96–98); Gould (1942, p. 286); *Sanford (1946); McElroy (1954). Freud himself was not very much impressed by Rosenzweig's findings either, according to the report made by Grinker (1958, p. 132): "I can remember full well when studying with him [Freud] in Vienna that he angrily threw to the floor a letter he had received from Sol Rosenzweig, who was then studying at Harvard. Rosenzweig wanted to utilize psychoanalytic concepts experimentally in order to test the theory of repression. Freud angrily threw this letter away, saying, 'Psychoanalysis needs no experimental proof'". Nevertheless, Freud answered Rosenzweig's letter on February 28, 1934: "I have examined your experimental studies for the verification of the psychoanalytic assertions with interest. I cannot put much value on these confirmations because the wealth of reliable observations on which these assertions rest make them independent of experimental verification. Still, it can do no harm." (Shakow & Rapaport 1964, p. 129). For a facsimile of Freud's letter (in German, written by hand), see McKinnon & Dukes (1962, p. 702). Cf. Rosenzweig (1937, p. 65).

³ This is a formulation comparable to that given by Freud in 1937. For the development of the concept of repression in Freud's thinking, see Brenner (1957).

the child might be sufficiently developed to be wounded by experiences of failure" (1952, p. 342). He set this stage at approaching puberty.¹

More important, perhaps, than these discussions, is Freud's remark that incompleteness of an activity owing to some accidental cause, as well as *incompletion owing to failure*, maintain psychic processes in the preconscious². This interpretation is more in line with the experimental occurrences than the repression hypothesis (expulsion into the unconscious).

In spite of theoretical difficulties and shortcomings with regard to data-analysis and -interpretation,³ Rosenzweig exerted an important influence on subsequent interruption studies. His three main experiments (1933*b*; 1943; and with Mason 1934) were performed at the Harvard Psychological Clinic, where further work was done within the framework of Murray's (1938) conception of personality. It is probably the combined influence of these two men that gave rise to further experimentation on the relation between personality variables such as ego strength, and selective recall.

2.5 *Personality variables*

Many studies have concentrated on the differential effect of personality variables on selective recall. Rosenzweig's distinction of three types of immediate reaction to frustration has already been discussed in the previous section. The main variable studied is ego strength⁴, in general in the dichotomy of ego strength and ego weakness. The description given by Murray (in an unpublished paper) reads: "Ego-Strength manifests itself chiefly as a successful n Achievement, giving proof of the power to persist" (*Alper 1948, p. 114). Thus the connection is indicated between the concept of ego

¹ *Miller, Swanson & Beardslee (1960) tackled the problem of repression and selective recall somewhat differently. They considered it in relation to child-rearing practices and "...anticipated that relatively benign antecedent conditions ... would be associated with repression" (recall of successes > recall of failures) (p. 249). On the other hand, a person who as a child had suffered great hardships, might be more prone to resort to denial. This means that failures, because they are not experienced as failures, need not be repressed (recall of successes < recall of failures). Of the two mechanisms of defense, repression was considered the more mature, as denial requires a break with reality.

² See previously quoted exposition on interrupted activities, at the beginning of this section (Freud 1900).

³ See chapter 3, sections on Rosenzweig. Cf. *Butterfield (1963, p. 70).

⁴ See, e.g., *Alper (1948; 1957); *Eriksen (1952*a, b*; 1954); *Lazarus & Longo (1953); *Jourard (1954); *Zolik (1955); *Lowe (1961).

strength and the concept of achievement motivation, as used by McClelland, Atkinson, *cum suis*.

In the ego strength studies it is hypothesized that, under task orientation, subjects with strong egos tend to react in a goal oriented manner and thus recall relatively more uncompleted tasks (failures) than completed ones (successes); while under ego orientation (or under stress) they tend to dwell on their successes and to neglect the failures. The hypotheses with regard to subjects with weak egos are different. Under task orientation, such subjects, being insecure, tend to display defensive forgetting with regard to their failures and to recall successes, while under stress they tend to break down and recall failures without remembering their successes¹. Adherents of this school do not think it advisable to study selective recall without taking personality variables into consideration.

In studies on achievement motivation², the goal of personal accomplishment is focal. To subjects high in *n* Achievement, whose aim is to experience feelings of success and personal accomplishment, persistence of the interrupted activities in recall is instrumental to the attainment of their goal. To subjects lower in *n* Achievement, whose primary aim is to avoid feelings of failure, non-recall of past failures is instrumental to the avoidance of renewed feelings of failure (*Atkinson 1953, p. 387).

Environmental conditions or experimental instructions may engage achievement motivation to a greater or lesser degree.³ To high *n* Achievers,

¹ To Iverson & Reuder (1956), on the other hand, recall of failures when self-esteem is threatened is an indication of ego strength rather than of ego weakness, as – for them – it represents a more adequate type of response than recall of successes. *Miller, Swanson & Beardslee (1960), again, question the assumption that the recall of failures under stress is relatively realistic. It might, perhaps, be ascribed to the mechanism of denial. Because denial alters the meaning of a failure, it may not interfere with its recall (Miller & Swanson 1960, p. 253).

² See, e.g., *Atkinson (1953); McClelland *et al.* (1953); *Atkinson & Raphelson (1956); Moulton (1958); *Martin & Davidson (1964); *Weiner (1965*b*; 1966*a*).

³ Weiner (1965*a*) criticized Atkinson's model for achievement-oriented behavior (the model presented in 1957 in particular) for being completely stimulus-bound. It "therefore cannot incorporate ... investigations by Zeigarnik ... and Ovsiankina ... That is, the model cannot account for the maintenance of goal-seeking, purposive behavior in the absence of the instigating external stimulus" (Weiner 1965*a*, p. 429). Following up this criticism he mentioned, however, that the extension of the conceptual scheme of achievement motivation by Atkinson & Cartwright (1964, p. 585) includes the assumption "that a goal-directed tendency, once aroused, persists until satisfied or dissipated". Atkinson (1964, p. 298–314) elaborated this, stressing the idea of an already active organism for which the stimulus situation only functions to enhance, selectively, the strength of some (not all) already activated tendencies.

test instructions that make the question of personal competence salient, engage achievement motivation to a greater degree than instructions designed to belittle the importance of the tasks. The latter instructions create the very conditions under which persons high in achievement motivation lose interest.

The additional motivations that are sometimes suggested in an effort to explain the results of the low *n* Achievers (like the motivation to comply with the experimenter)¹ led McClelland *et al.* (1953) to conceive of the idea of computing two separate *n* Achievement scores: one for hope of success and one for fear of failure².

The lack of agreement in the results of the studies on achievement motivation and ego strength led *Alper (1957) to suggest that there might be an inverse relationship between *n* Achievement and ego strength³. The low *n* Achiever, whose achievement needs are not constantly under tension, is equated to the Strong Ego, who recalls predominantly uncompleted tasks as long as the objective situation does not involve stress or is unrelated to achievement. According to *Alper (1957), it is the high rather than the low *n* Achievers that feel the relatively greater anxiety about failure⁴. It might therefore not be utterly improbable that the high *n* Achiever would show the weak ego recall pattern.

Emphasizing the influence of active avoidance behavior in case of anxiety-producing stimuli, Inglis (1960) came to conclusions similar to *Alper's (1957). A curvilinear relationship between anxiety and avoidance was postulated. Small amounts of anxiety have no influence upon avoidance behavior, whereas large amounts have a disruptive effect. Recall of a majority of completed tasks was equated to avoidance of anxiety-mediators, whereas recall of a majority of uncompleted tasks was regarded as failure to avoid anxiety-mediators. A personality continuum from neurotic extraverts (least susceptible to stress), via the stable varieties, to neurotic introverts

¹ Atkinson later detracted from the importance of this interpretation of the results of low *n* Achievers (i.e. compliance) by stating that it was "... more important as a reminder that the assumption of *all other things equal* may sometimes be incorrect than as an adequate explanation of the result" (Atkinson 1964, p. 235).

² Cooper & Howell (1961) suggested that hope of success and fear of failure should not be regarded as opposite positions on a uni-dimensional continuum, but as two different continua. Cf. Rand (1960, p. 101).

³ This suggestion was made in spite of the fact that *Alper herself had adopted Murray's description of ego strength in 1948 (see quotation given at the beginning of this section).

⁴ Cf. Costello's (1967) two need achievement factors: the need to do well at a task, and the need to be a success. The latter was found to be correlated to anxiety and neuroticism.

(most susceptible to stress), was assumed. In situations without stress, the neurotic extraverts do not initiate the avoidance of mediators involved in the recall of either completed or uncompleted tasks. For the neurotic introverts, however, the same situation is one of considerable stress, so that they suppress the recall of anxiety-producing mediators, i.e., the uncompleted tasks. In the situation objectively involving high stress, the neurotic extraverts avoid the recall of uncompleted tasks, whereas the neurotic introverts have passed an anxiety-level which is such that their avoidance behavior breaks down and uncompleted tasks preponderate in their recall.

Inglis (1960) suggested that Alper's dichotomy of strong and weak egos may be comparable to the personality continuum from neurotic extraversion to neurotic introversion. Furthermore, he expected that the individuals with the highest achievement motivation would be near the neurotic introversion end of the continuum ¹.

Applying Festinger's (1957) theory of cognitive dissonance to the interrupted task situation, *Rand (1963, p. 153-158) proposed a seven-stage sequence of degrees of dissonance, each degree of which may be experienced by an experimental subject, depending on the experimental instructions given and the subject's personality variables. In the first stage the tasks are experienced by the subjects as unimportant; no dissonance exists; $RU = RC$. In the second stage the tasks present a slight challenge to the subjects; a low degree of dissonance exists, which makes for a better recall of interrupted (challenging) than completed (uninteresting) tasks; $RU > RC$. In the third stage the subjects are still able to maintain a long-range perspective of behavior (attraction to interrupted tasks), but only when immediate success seems fairly certain (sensitivity to dissonance-reducing information, i.e., completed tasks); $RU = RC$. The fourth stage is characterized by one tendency only: the seeking of consonant information; $RU < RC$. In the fifth stage the subjects are extremely sensitive to indications of momentary success (completed tasks); they avoid dissonance-increasing information (interrupted tasks); $RU < RC$. In the sixth stage the subjects' sole aim is to avoid dissonance-increasing information; the tendency to seek consonant information drops to zero; $RU < RC$. The seventh and last stage is characterized by the active seeking of dissonance-increasing information (break-down-behavior); $RU > RC$.

*Rand (1963, p. 163-172) attempted to divide subjects (school children in particular) into classes consisting of the different stages of experienced dissonance on the basis of their sex and their anxiety scores. Under neutral

¹ Cf. Butterfield (1964).

experimental conditions low-anxiety boys are not expected to experience any dissonance (stage one). Low-anxiety girls, who become absorbed by a novel task situation somewhat more easily, are supposed to experience a slight degree of dissonance (stage two). High-anxiety girls, who have a strong tendency to seek out both dissonance-increasing and dissonance-decreasing information, are not expected to experience much dissonance in a neutral experimental situation (stages two and three). High-anxiety boys, who are characterized by the seeking out of dissonance-reducing information and the avoidance of dissonance-increasing information, are supposed to experience a high degree of dissonance (stage five). Although hypotheses concerning selective recall were given for each of the seven stages of experienced dissonance, Rand formulated these hypotheses explicitly only in the case of the two high-anxiety groups.

Compare: section 6.1.7.

2.6 *Theories of development*

The studies in which an effort was made to find a developmental trend in selective recall, task resumption, or repetition choice, may be divided into two main categories. Firstly, the studies in which a comparison was made between subjects of different age levels. Secondly, the experiments on task interruption in which the behavior of feeble-minded subjects was studied.

2.6.1 *Different age levels*

Zeigarnik herself was the first experimenter to compare the selective recall of children (5 to 10 years old) with that of adults. She theorized that the needs of children tend to press on in a rather unbridled fashion, and reported that especially the unintelligent, somewhat backward children recalled predominantly unfinished tasks ¹ (Zeigarnik 1927, p. 81-83).

With regard to the developmental trend in the forgetting of failures Rosenzweig ² and *Sanford (1946) defended antithetical assumptions. Whereas *Rosenzweig & Mason (1934, p. 258) stated that children who have reached a sufficient degree of intellectual maturity tend to repress

¹ However, according to the re-analysis made by the author of the present study no difference whatsoever could be detected between the recall difference scores of Zeigarnik's child and adult subjects (see section 1.1.3).

² See section 2.4 for a more detailed discussion.

failed tasks, *Sanford (1946, p. 234) felt that the forgetting of failures is pre-eminently a childish mode of defense ¹.

*Rosenzweig (1933*b*; 1945) furthermore postulated a need for vindication following failure with respect to the older children, while the younger children were said to respond according to the pleasure principle. This means that when a repetition choice is required of them, younger children will tend to repeat successes ² while older children will tend to resume failures ³. Or, in Cromwell's (1963, p. 64–65) formulation: the motivational system of the younger child might be labeled the pleasure-approach and pain-avoidance system. As development proceeds, the child begins to notice that he is often able to influence the outcome of events by his own actions: a shift occurs in the conceptualization of the locus of control from external to internal ⁴. The older child tends to approach objects or events not so much for their inherent satisfaction-giving properties, but rather with the express purpose of demonstrating behavioral effectiveness: the success-approach and failure-avoidance motivational system.

2.6.2 *Mental retardation*

A few theories on feeble-mindedness in relation to task interruption have been advanced.

Lewin's (1933*a*; 1935, p. 180–238) assumption read that the psychical systems of the moron are dynamically rigid. The tension systems established for different tasks are completely separate; discharge of the one is not accompanied by discharge of the other ⁵. The substitute value of one task for another is low, and consequently, the frequency of resumptions is high ⁶.

¹ The studies dealing with selective recall at various age levels did not, on the whole – with the exception of *Sanford's (1946) study – show a clear-cut association between age and recall difference scores (e.g., *Walsh, 1942; *Altea, 1955; *Butterfield, 1963; 1965). Cf. sections 5.4.2 and 5.4.3.

² Cf. Lewin (1936*b*, p. 926): “children of two or three years tend to repeat activities again and again. ... for older persons ... a spontaneous repetition of a successful act is not very likely.” Cf. *Nuttin (1953).

³ A significant developmental trend was found by *Rosenzweig (1933*b*; 1945). The results obtained by *Crandall & Rabson (1960), and *Butterfield (1963; 1965) with regard to this trend (re-analysis by the author of this study) were non-significant. Cf. the more consistent developmental trend in feeble-minded children (see the next sub-section).

⁴ *Bialer (1961, p. 304).

⁵ Cf. Kounin (1941*a, b*). Leach (1967, p. 12) omitted this aspect of Lewin's theory in her review of the rigidity concept.

⁶ Cf. *Köpke's (1933) positive, and *Rethlingshafer's (1941*b*) negative results.

Gottschaldt (1931; 1954*a*), however, theorized that the tension systems of the feeble-minded are rather diffuse¹. They may therefore be discharged by actions that bear only a very slight resemblance to the original activity. Lewin, in an attempt to fit Gottschaldt's (1931) contradictory data to his rigidity theory, added that rigidity also implies the lack of differentiation of a whole system into parts which are only slightly separated from each other. The systems are either completely separated by rigid walls or are one². It is therefore also possible that in feeble-minded children two tasks correspond to one and the same tension system, in which case substitute satisfaction is perfect.

In the course of years several objections have been raised to Lewin's rigidity theory, some of which were formulated with special reference to task interruption. Peterson (1942, p. 238-239) objected to Lewin's calling resumption an indication of rigidity. "The individual who when interrupted can change to another activity, and then return to the former, though he shows persistence in clinging to a goal, is at the same time flexible, in that he can change under pressure and yet return." *Takuma (1957) questioned the necessity of using the concept of mental rigidity in interpreting feeble-minded children's task resumption, because variations in the experimental design seemed to be of greater importance for resumption. Zigler (1966) observed that the apparent cognitive rigidity of the feeble-minded should be ascribed mainly to the social deprivation which frequently goes with institutionalization.

Cromwell (1963), who based his theory of mental retardation partly on Rotter's (1954) social learning theory, assumed that the average mental retardate, because of a relatively high frequency of failure experiences, has a lower generalized expectancy of success and a higher tendency towards avoidant behavior than the average normal subject. Although the mental retardate has an impaired ability to conceptualize himself as having succeeded or failed³, developmental changes in his reaction to success and failure can be observed. In several experiments in which a repetition choice was required of them, the younger feeble-minded children tended to return to the

¹ Cf. *Rösler (1955).

² Chown (1959, p. 197) suggested that the term "permeability" would have been more adequate because Lewin (1936*a*, p. 218) used the concept rigidity to describe a property of boundaries.

³ Cf. Frankenstein (1965, p. 185).

completed (successful) task, whereas the older retarded children tended to repeat the interrupted (failed) task ¹.

2.7 *S – R interpretations*

*Freeman (1930) was the first to become interested in the problem of task interruption from the behavioristic point of view. The main findings of *Freeman's (1930) experiment were: an increase in muscular tension of the quadriceps femoris at initiation of a task, a decrease as the performance progressed towards completion, and a notable increase during periods of interruption. These phenomena were explained with the aid of a neurological homeostatic model, combined with the postulate of a fixed expenditure of energy, and the assumption that rival neural impulses compete for a common path. It was furthermore assumed that the – at the time – dominant response pattern obtains reinforcement from the (less significant) actions of other centers. "The initial spread of excitation to centers producing tonic activity is a consequence of a 'set' which is initiated by instruction. This set is normally ended by completion of the task. The neural mechanism thus returns to a state of equilibrium Interruption of a task introduces a complication into this normal progress towards equilibrium. The accompanying increase in muscular tension cannot be dismissed solely as the result of spread from a new excitation. Instead there is evidence of a reciprocal effect, the tonic activity apparently reinforcing the neural action involved in the task-set" (*Freeman 1930, p. 329). If, however, the task is interrupted when the individual's major energies are already mobilized in support of a more basic pattern of excitation (e.g. the inhibition of micturition), the pattern involved in the more superficial activity (i.e. the experimental task) is not strong enough to ensure resumption of the task (*Freeman 1938, p. 282).

Another approach was *Boguslavsky's (1951) application of Guthrie's (1935) principle of S – R contiguity ² to the problem of task interruption.

¹ The developmental relation was found in the experiments by *Rosenzweig (1945); *Bialer & Cromwell (1960); *Spradlin (1960); *Bialer (1961); and *Miller (1961) (only in the condition when the subjects had been left alone by the experimenter). *McConnell (1961) did not find the developmental relation; *Miller (1961) did not find it when the subjects were timed by the experimenter.

² "A combination of stimuli which has accompanied a movement will on its recurrence tend to be followed by that movement". "The actual associative process is probably always dependent on a precise coincidence of the cue and the response for which it becomes a cue" (Guthrie 1952, p. 23 respectively p. 53).

He postulated that “the probability of a task’s occurrence in recall is a direct linear function of the amount of movement-produced stimulation associated with the task”¹. This means that in an experimental design in which interruption of a task is simultaneous with the presentation of a new task to which the subject responds at once, tasks that are preceded by interruption² will be recalled more frequently than tasks preceded by completion. This expectation is not warranted, however, if the subject cannot respond to the new task *immediately*. Even in case of a delay (interference) of two seconds, “stimuli resulting from interruption are associated only in part with the new task, since the subject is engaged in something else while the incidence of stimulation is at its peak” (*Boguslavsky 1951, p. 251).

The third behavioristic interpretation was given by *Smith (1953), who applied Hebb’s (1949) theory to the problem of task interruption. In a simple task, like Smith’s mirror-tracing, the subject’s problem is not how to execute any particular movement, but which of a number of familiar movements to carry out. The subject brings to such a task “an extensive set of previously developed cell-assemblies, which then became organized into a more comprehensive unit, the phase sequence”³. . . . “The signal to start . . . triggers the phase sequence; and it in turn, by virtue of its specific motor facilitation, guides the overt activity” (*Smith 1953, p. 35). A cell-assembly is capable of self-maintained action for a fraction of a second, and so is – for a few seconds at the longest – the phase sequence (Hebb 1949, p. 143). *Smith’s (1953) findings are in accordance with these estimates of Hebb’s. For the two seconds immediately following drawing (and not for any longer periods of time), Smith found that muscle tension dropped more after completion than after interruption⁴. A physiological process, however, “which ceases well

¹ *Boguslavsky (1951, p. 249).

² *Freeman’s (1930) “results indicate that the interruption of a task uniformly produces an increase in the muscle tonus, which tends to decrease with the passage of time. . . . Although Freeman investigated a relatively circumscribed muscular area, we may safely infer that the nature of the change observed by him is not restricted to that area but is indicative of a more general neuro-muscular transformation” (*Boguslavsky 1951, p. 248).

³ “Any frequently repeated, particular stimulation will lead to the slow development of a ‘cell-assembly’, a diffuse structure comprising cells in the cortex and diencephalon . . . capable of acting briefly as a closed system, delivering facilitation to other such systems and usually having a specific motor facilitation. A series of such events constitutes a ‘phase sequence’” (Hebb 1949, p. xix). “The assumption, in brief, is that a growth process accompanying synaptic activity makes the synapse more readily traversed” (Hebb 1949, p. 60).

⁴ This effect was furthermore confined to the muscles that were functionally involved in carrying out the movements, a result which makes *Boguslavsky’s (1951) generalization of *Freeman’s (1930) data a risky affair.

before the time when recall tests are administered can hardly be a sufficient answer”¹ for the superiority of interrupted tasks in recall. Smith therefore proposed an alternative explanation, also within the framework of Hebb’s theory. The thoroughly familiar (e.g., a simple completed task) arouses a well-organized phase sequence which, however, runs off so quickly, that many of the cell-assemblies are left refractory before they can be aroused: i.e., the synaptic changes of memory tend to make the well-organized phase sequence short-circuit so that it cannot hold the field for long. This gives less well-established phase sequences (e.g. uncompleted tasks) the opportunity to appear. In general, therefore, behavior is dominated by processes that are not fully organized (see Hebb 1949, p. 228–230).

A different interpretation of task resumption, within the theoretical framework of Yale frustration psychology², was proposed by *Nowlis (1941). The continuation of action is dependent on the existence of instigators – specified antecedent conditions of which any predicted response is the consequence. Instigators may operate simultaneously, and their combined effect represents the total amount of instigation to the response. An act which terminates a predicted sequence is called a goal response, i.e., “that reaction which reduces the strength of instigation to a degree at which it no longer has as much of a tendency to produce the predicted behavior sequence” (Dollard *et al.* 1939, p. 6). A behavior sequence may be stopped by an interfering agent as well as by a goal response. The most notable difference is that goal responses have a reinforcing effect that induces the learning of the preceding acts, while interference has no such effect (Dollard *et al.* 1939, p. 8). In an interruption experiment, completion of a task in accordance with the experimenter’s instructions represents a goal response (*Nowlis 1941, p. 306), while interruption may be considered an interfering agent. In an experiment where an interrupted task is followed by a completed one, two opposite tendencies may be noted³. On the one hand, completion of the second task may constitute a substitute response, which reduces to some degree the strength of the instigation to the first task; on the other hand, resumption of the first task may occur as a result of the reinforcing effect of the goal response(s) of the second task on the instigation to the first task⁴. Resumption

¹ *Smith (1953, p. 36).

² See, e.g., the first chapter of Dollard *et al.* (1939).

³ Cf. *Child & Grosslight (1947).

⁴ Compare also White’s (1936) completion hypothesis, which is an application and elaboration of Hullian (1931) principles: “The completion of a fractional anticipatory reaction tends to reinforce recent and concomitant S – R connections” (White 1936, p. 399).

will not occur, however, as a result of the instigation(s) to the task preceding the interruption, as interference does not reinforce the behavior sequence which led up to it ¹.

2.8 *Cognitive theory*

Making use of a machine model of human behavior, Miller, Galanter & Pribram (1960, p. 59–71) reformulated the dynamic property of an intention, which they considered a confusing aspect in Lewin's theorizing, and reinterpreted some of Zeigarnik's and Ovsiankina's findings. An intention was conceived of as the uncompleted parts of a Plan ² whose execution has already begun (p. 61). That part of the memory which is used for the execution of Plans is called the working memory. "When a Plan has been transferred into the working memory we recognize the special status of its incompleting parts by calling them 'intentions'" (p. 65).

With regard to interrupted simple, repetitious, continuous tasks ³, both Lewin and Miller *et al.* did not expect them to stand out in the subject's memory. In these cases, according to Lewinian theory, no definite tension system will be established. Moreover, continuous tasks cannot really be interrupted, because any point – and therefore also the point of interruption – may be regarded as the end point of the task by the subject ⁴. Miller *et al.*'s argument read "that such tasks require little or no record of what has been and what remains to be accomplished, and hence they have no special representation in the subject's working memory" (p. 66).

In the case of a continuous task with an end point which has been arbitrarily set by the experimenter (e.g. the subject is given a dish of beads and instructed to string *thirty* of them), Miller, Galanter & Pribram predicted that the subject will remember such a task if interruption takes place, be-

¹ *Nowlis (1941) only stressed the reinforcing effect of goal responses on the preceding behavior sequence. She did not mention interruption as representing an interfering agent, an analogy which – according to the present author – may be deduced from Dollard *et al.* (1939). The application of only part of the relevant Yale concepts to the interruption situation made Nowlis' interpretation somewhat shaky (cf. Woodworth & Schlosberg 1954, p. 692).

² A Plan, which is to the organism essentially what a program is to a computer, "is any hierarchical process in the organism that can control the order in which a sequence of operations is to be performed" (p. 16; italics omitted).

³ *fortlaufende Handlungen*.

⁴ Zeigarnik (1927, p. 50–56); Ovsiankina (1928, p. 355–357).

cause he had to count and then remember a number in order to keep his place. According to Miller *et al.* (p. 66), Lewin predicted “the same result because the task is now interruptable.” However, Zeigarnik’s discussion on continuous activities led to the conclusion that this kind of continuous task, when interrupted, is recalled none too frequently. The end point set by the experimenter is experienced by the subjects as so arbitrary that it may be shifted to any point earlier (and therefore even to the point of interruption) or later in the activity. Such conditions preclude the establishment of a separate tension system.

In the case of the interruption of a simple, repetitious task with a definite end which is dictated by the (limited) material presented (like, e.g., stringing *all* the beads from a pile) Lewin predicted recall and resumption because of undischarged tension systems. Miller *et al.*, however, did not expect a tendency either to resume or to recall, “since memory function is performed externally by the pile of beads, not by the subject” (p. 66). The latter hypothesis was put to the test by *Bechtel (1965).

2.9 *Social psychological variations*

The social psychological variations of the interruption experiments were centered around the question whether concepts like tension reduction, used in individual psychology, may also be applied when dealing with common objectives, or with group goals ¹.

The common objective of two or more individuals may be defined as a task, the demands of which are more important than those of any personal objective. The task, and not the self or the relation with the other (co-operative) person(s), is focal. In this frame of reference, *Lewis (1944, p. 115) said that “... similar behavior should be expected of the coöperating group and the highly ‘individualistic’ scientist absorbed in this task. Since the self is not focal, another person’s activities – the coöperating person’s – may be as satisfactory as your own”. With respect to the theoretical background, there is a rather close resemblance between studies on the role of field forces in motivation ² – the approach of which is basically individual – and Lewis’s

¹ Jones & Gerard (1967, p. 622) give a number of suggestions for research on the conditions for group goal internalization, which may be examined “... by means of the ‘group Zeigarnik’ procedure for identifying goals the individual has privately accepted as his own.”

² See, e.g., *Baltimore *et al.* (1953); Henle (1957).

two-person experiment, in which the tasks were started by a subject together with a planted co-worker, and completed by only one of them.

In a study by Koekebakker & Van Bergen which, in respect to the experimental design, very closely resembled Lewis's experiment, not the task as such, but the interpersonal relations between the team members, was focal. It was not completion of the common objective, of the task as such, that was regarded as the vital experience for the subjects, but the partner's completion of the jointly started task. It was hypothesized – though not verified – that individuals of high personal attraction would accept each other's task completion (tension reduction), while individuals of low personal attraction would not accept the partner's solution or completion (tension persistence) ¹.

Related to this problem is the question whether tension systems will be reduced if the individual group member did not contribute actively to completion of the task, but was to some degree "carried" by the group into a condition in which the task was completed, whether he liked it or not. This situation may, e.g., occur when the group goal is not task completion as such, but some superimposed goal, like winning a contest. This may sometimes even involve the tendency to avoid completion (*Horwitz 1954), as work on each single task is seen as merely instrumental to the attainment of the larger goal.

¹ See for Koekebakker & Van Bergen's two-person experiment: section 5.1.1; for the problems of manipulation and measurement of a-t-g by means of personal attraction, see Van Bergen & Koekebakker (1959; 1963).

Review of interruption studies

In order to effect a compilation of all studies ¹ on the Zeigarnik effect, task resumption, repetition choice, and related topics, a chronological presentation seemed to be the only one feasible. Such a presentation has the advantage of giving a clear picture of the rather chaotic development of a sub-branch of a science. On the other hand, it has the great disadvantage of not presenting the material in meaningful categories. A great many studies, however, escape systemization, and the exclusion of these studies was considered yet more detrimental.

Several measures have been taken to overcome the most serious difficulties of chronological presentation. Firstly, the main theoretical lines that can be detected in the research, are discussed in chapter 2. Secondly, many of the studies on selective recall are classified into a number of relevant categories and evaluated in the first part of chapter 6. Thirdly, the quantitative results of the recall experiments are presented in tabulated form in table 36, at the end of chapter 6. Finally, the most important references – if any – are given at the end of each abstract. For all other purposes of systemization the index should offer the solution.

The review of interruption studies given in this chapter is confined to research studies. Literature reviews or comments are discussed in connection with the research study in question. In every abstract, the name of the author(s), when first mentioned, is printed in small capitals. References made to studies reviewed in this chapter can be recognized by the asterisk attached to the author's name. Critical remarks made by the author of this study are printed in italics or given in footnotes. Results of a statistical re-analysis of the data by the author of this study are given in footnotes. All statistical results presented in the main text are taken from the original studies (mostly

¹ Without the assistance and inventiveness of the members of staff of the University Libraries in Amsterdam, Leyden, and Eindhoven, many of the required books and journals would not have been procured. Despite the effort to trace all relevant publications, it is still, of course, likely that some studies have been overlooked. The search for new studies was ended in autumn 1967.

because of lack of relevant data for a check). In general, the reviews are presented in alphabetical order, for each year, except where another sequence seemed more effective. References to abstracts of congress-papers and to reprints in "Readers" are only made in footnotes to the reviews of the main (or the original) publications.

1930

The first reaction to Zeigarnik's study came from SCHLOTE, one of Ach's students, in Göttingen. He began with an exact replication of Zeigarnik's main experiment (experiment I). *Although Schlote tried to explain away the differences between his and Zeigarnik's results, the recall difference scores of his four subjects are significantly smaller than those of Zeigarnik's 32 subjects (+2, +1, 0, -1)*¹. *Schlote's replication of experiment IVa (additional instruction "You are not to work on this task any more") does not verify Zeigarnik's results either*². Only his replication of experiment IV (additional instruction "This task will be resumed later") does not diverge from the original experiment³. However, subsequent questioning revealed that the subjects in this last experiment had either paid little attention to the additional instructions or had disbelieved them, a difficulty inherent in the use of pre-experimental verbal instructions. In general, Schlote's objections to Zeigarnik's experimental design amount to: the use of meaningful tasks, which might not have the same meaning for all of the subjects and which tend to be recalled in association clusters; the use of activities that are too simple to excite the subjects' interest, and the fact that it is impossible for the experimenter to localize the moment when the subject is most engrossed in his work.

Schlote's own study was intended to demonstrate that the predominance of uncompleted activities in recall follows from existing determining tendencies. He presented to his student subjects nonsense syllables of which they had to alter one prescribed letter. He thus used a series of homogeneous tasks. The subjects had to intend⁴ the prescribed activity which was then either executed or postponed. This constitutes a deviation from Zeigarnik's design: in Schlote's experiment the subjects merely intend the task, so that no interrupted activity takes place. The principal part of the test period

¹ Wilcoxon two-sample test: $W = 44$; $P < .05$.

² $W = 13$; $m = 9$; $n = 12$; $P < .002$.

³ $W = 28$; $m = 4$; $n = 12$; $P > .20$.

⁴ *vornehmen*.

consisted of the presentation of another nonsense syllable with the instruction to perform the first activity which comes to mind. The results showed significantly more intended activities than executed activities¹. This priority was reduced, however, when the subjects were tired and also when an intermission of some length was inserted between the series and the test period². These results, obtained with a completely different experimental design, are quite in agreement with Zeigarnik's results. *This makes the lack of agreement between Schlotte's replications and Zeigarnik's original experiments the more remarkable.*

Compare: *Sandvoss (1933); *Stoller (1935); *Ferradini (1952); *Altea (1955); and sections 2.1 and 2.2.

A completely different approach to the study of interrupted acts, namely in terms of neuro-muscular research, came from FREEMAN. He compared the tonus changes (in one of the muscles of the leg) occurring in equivalent periods of interrupted and uninterrupted mental work. His ten subjects (some "naïve", others "sophisticated" psychologists of Yale University) were given twenty simple problems, half of which were purely mental tasks, while the other half involved manual movements as well. Half of both these types of tasks were interrupted one minute after they were begun. The interruptions consisted of accidental interruptions (e.g., a sudden "rain" of small screws upon the subject) and deliberate interruptions (e.g., the subject was asked to lend the experimenter his pencil). As an incentive to maximal effort, competition was suggested by the experimental instructions. In 96 of the 100 cases the subjects continued or resumed their tasks notwithstanding interruption.

The initiation of the tasks was almost invariably accompanied by an increase in muscular tension, which decreased as the performance progressed towards completion. During the interruption tension again noticeably increased, while with resumption of the task a decrease in tonus usually occurred. During periods of interrupted work a strikingly greater increase of tonus was noted than during equivalent periods of uninterrupted work³. No significant differences were found to exist between the breakdowns (mental and manual tasks; accidental and deliberate interruption).

¹ Sign test: $n = 7$; $x = 0$; $P = .02$.

² The small number of subjects and the fact that some of them participated more than once prevented a proper statistical analysis. Only the main result could be analyzed by the sign test (see the previous footnote), where each subject counted once.

³ Wilcoxon matched-pairs signed-ranks test: $T_+ = 210$; $T_- = 0$; $n = 20$; $P = .000002$.

*Compare: *Boguslavsky (1951); *Bolin (1952); *McAllister (1952); *Smith (1953); *Forrest (1959); *Horwitz, Glass & Niyekawa (1964); and section 2.7.*

KRAUSS, in Giessen (Germany), very extensively studied the effects of the interruption of activities of one patient suffering from the Korsakov syndrome. Observed was: a desperate moving hither and thither, expressing some indeterminate need of activity which did not, however, result in resumption.

*Compare: *Talland (1960).*

1933

In 1933 three studies from Lewin's institute in Berlin, relevant to the question of interrupted activities, were published.

BROWN aimed at investigating the speed of discharge of tense systems belonging to different levels of reality of the life space. The assumption was made that the more unreal levels are more fluid than the more real levels. *However, the connotation reality-irreality is a far cry from the basic variables operationally defined.* This was done by utilizing activities that were and were not taken seriously by the subjects (freshmen of the University of Berlin), i.e., intelligence test items on the one hand and stop-gaps on the other ¹. All tasks were interrupted. Recall was given after 5 minutes, 30 minutes, 36 hours, and one week respectively. Except where recall was given after 5 minutes ², the 61 subjects recalled the test items significantly better than the items of the rest periods ³. This relative priority increased with time passed ⁴.

The same results were obtained when the test items and the rest tasks were interchanged. However, the scores of the 24 subjects of this group were somewhat lower. This might be due to the special characteristics of the tasks or to a change in experimenter. *The first group had been tested by Lewin himself, the second group by Brown.*

¹ In 1940 Lewin thought it "possible that the experiment of Brown does not deal with differences in the degree of reality but rather with differences between more peripheral activities as against more central ones on approximately the same level of reality" (Lewin 1940, p. 14).

² Wilcoxon matched-pairs signed-ranks test: $P = .16$.

³ For the different delayed recall groups: at least $P < .02$.

⁴ Whitney's extension of the U -statistic applied twice: $P < .01$ and $P < .05$.

Brown tried to reverse reality and irreality by means of experimental instructions after the tasks had been performed. After one week, the 11 subjects predominantly recalled tasks that they had performed as stop-gaps, but which had afterwards been announced as the test items ¹. *This result might be due to the anxiety of the subjects as to whether they had performed the rest tasks seriously enough rather than to a shift from irreality to reality* (cf. critical remarks by Ach 1935, p. 183–188).

*Compare: *Ferdinand (1957).*

In the second study from Lewin's institute, LISSNER ² studied the conditions under which a substitute activity has substitute value for the original, interrupted activity. Resumption in the substitute condition compared to resumption in a control experiment (85% resumption), was used as a criterion of substitute value. Lissner found that easy substitute tasks (resumption 66%) had less substitute value than difficult ones (33%) and, furthermore, that the substitute value increased with increasing similarity of the interrupted and substitute tasks. Lissner interpreted these results by assuming that, if there is a dynamic connection between the two tension systems, discharge of the tension of the substitute system means discharge of the system of the original task as well.

A shortcoming of the study is that the moment of interruption was stated ambiguously. Lissner first said that interruption took place when the subject was most engrossed in his work (p. 220), and later that it occurred when a fixed point in the execution of the tasks had been reached (p. 237).

*Compare: *Köpke (1933); *Adler (1939); *Henle (1942; 1944).*

The third study from Lewin's institute, by MAHLER ², dealt with the problem of whether substitute completions of different degrees of reality lead to discharge of quasi-needs. Reality was defined as the level of physical facts and unsolvable difficulties, irreality as the level of dreams, wishes, and omnipotence.

Mahler used Ovsiankina's experimental method with 155 students, and 35 children 6–10 years old, as subjects. Some of the interrupted tasks were finished on a somewhat less real level than they were begun: either by doing, or talking, or thinking. The main result was that the substitute value decreased with completion on a lower level of reality. However, this relation

¹ Wilcoxon matched-pairs signed-ranks test: $P = .002$.

² For a summary in English see: Escalona (1943).

also depended upon the specific task. Firstly, it was of decisive importance whether the goal of the original activity was reached by the completion of the substitute activity or not. Secondly, the substitute value of stating the solution verbally was very low for performance tasks, whereas it was very high for problem tasks.

It seemed to be difficult for the subjects to finish the problem tasks only by thinking. They very frequently told the experimenter the solution and thus made it a social reality. Such a solution may either have been experienced by the subjects as a *social* reality (evaluation of the accomplishment by the experimenter) or as a social *reality* (check of the correctness of the solution with others)¹.

Compare: *Lissner (1933); *Child & Grosslight (1947); *Rösler (1955); and section 2.2.

A psychiatric contribution came from GOLANT-RATNER & MENTESCHASCHWILI (Leningrad), who studied patients suffering from paralytic dementia, with Zeigarnik's experimental method and tasks. They found a difference between those patients who had, and those who had not as yet undergone malaria therapy². Before treatment the patients did not demonstrate a difference between the recall of uncompleted and completed tasks ($Mdn = 0$), while after remission, when the symptoms of stupefaction had disappeared, the uncompleted items were recalled more readily.

HARROWER (a student of Koffka's) produced a study within the realm of classical Gestalt psychology. Her aim was to demonstrate experimentally the value of the concept of organization outside of visual perception, amongst others, in the field of memory. The concept of organization was used to refer to the actual process, and the concept of structure to denote the results of the organizing process. The experimental material consisted of jokes, i.e., of structures. In a series of completed jokes read to the subjects (female students of Smith College) with the instruction to repeat them, one incomplete joke was given, and was spontaneously completed by all the students. Harrower's interpretation was in terms of the definite structure of the joke, which is felt as in need of completion without belonging in any way to the subjects' quasi-needs (p. 83). In experiments in which the jokes (some com-

¹ The concept of social reality in the latter meaning has been elaborated by Festinger (1950; 1957), and specifically by Festinger, Riecken & Schachter (1956).

² Wilcoxon two-sample test: $W = 20$; $m = 11$; $n = 8$; $P < .01$.

plete, some incomplete) that were read to the subjects had to be recalled, the following tendency¹ was found: jokes that were presented as incomplete were recalled better than jokes presented as complete, which included those that remained uncompleted and those that were finished by the subjects. *However, Harrower's conclusion that there is a difference in recall between the uncompleted and subject-completed jokes is incorrect. Even with her n-inflated data a significant difference could not be obtained.* The interpretation given by Harrower reads that "in the incomplete jokes the very incompleteness of the structure carries with it a tension toward its closure. All factors . . . which emphasize structure aid in the retention of that particular conscious content" (p. 102). Concerning the subject-completed jokes, she mentioned, besides tension, the ego interests and the additional energy required to construct (rather than to receive) a structure.

*Compare: *Torrey (1949); *Henle & Aull (1953); and sections 2.3 and 6.2.5.*

HARTMANN (Vienna) studied the phenomena of completion and incompleteness from a psychoanalytic point of view. He found a difference in recall between the compulsive neurotics and the control group which he studied². The subjects of the control group recalled more uncompleted than completed tasks, while there was no such difference for the compulsive neurotics³. In the interpretation, reference is made to the compulsive indecision of the patients and the mechanism of undoing which may, amongst others, consist of the compulsion to repeat the same acts. Both mechanisms contribute to blurring the difference between the uncompleted and the completed tasks, the latter failing to become subjectively concluded.

Experiments made by KÖPKE⁴ with feeble-minded children from Berlin, eight and nine years old, are referred to by Lewin (1933a, p. 321–330)⁵. The frequency of resumption of interrupted tasks was higher with the retarded

¹ Statistical re-analysis is not feasible because the data presented are summations of dependent observations, and because of (unexplained) reductions in the number of subjects halfway through some of the experiments.

² Wilcoxon two-sample test: $W = 15$; $m = 9$; $n = 5$; $P = .05$.

³ The median recall difference score for the compulsive neurotics was 0.

⁴ These experiments are probably the same as the ones which Lewin (1935, p. 185) ascribed to Köpke & Zeigarnik.

⁵ In English: Lewin (1935, p. 202–213). Cf. the abstract Lewin (1931c); and Lewin (1935, p. 185–190).

children (100% resumption, $n = 31$) than with a control group of normal children of seven and eight years old (79% resumption, $n = 34$). When a substitute task was interpolated, resumption with the normal children sank to 33%, with the morons and imbeciles only to 94%. Köpke then gradually increased the similarity of the main and substitute activities until they were practically identical. The substitute value, however, remained low (minimum resumption 86%). Lewin interpreted these results by assuming that the psychical systems of the moron are comparatively rigid. This would mean that for the substitute task, an independent tension system is set up without connection with the system of the main task and without the possibility of a simultaneous discharge of tension ¹.

The assumption of the dynamic rigidity of the feeble-minded led Lewin to make the following remarkable statement about the 100% resumption in Köpke's first experiment: "This abnormal frequency of resumption is a consequence of the fact that a [moron's] tension system, once it is built up, stays unchanged without being diffusely discharged" (Lewin 1935, p. 188). A 100% resumption may be called an "abnormal" frequency. However, the somewhat less "abnormal" frequency of 79%, means that 27 of the 34 normal children gave a 100% resumption. And what to think of Ovsiankina's subjects? In her first experiment with 28 students, for example, only 15 non-resumptions occurred out of 141 possibilities. Of these 15, 10 were due to 3 subjects only (and partly to the dreadful task of unraveling a skein of yarn). Only 5 non-resumptions out of 118 possibilities remain for the other 25 subjects (Ovsiankina 1928, p. 326). If Ovsiankina's findings are interpreted in the same way as Lewin interpreted Köpke's results, they might well read that in the 'twenties the students of the University of Berlin had the same rigid psychical systems as feeble-minded children ².

¹ Gottschaldt (1931), on the other hand, when working with feeble-minded children, had observed evasive substitute activities that were performed almost without any direction. He theorized that the tension systems of the imbecile are rather diffuse, and may therefore be discharged by actions that only very slightly resemble the original activity. Lewin, in an effort to fit Gottschaldt's (1931) contradictory data to his rigidity theory, presented a second deduction: "As a result of the rigidity of the systems we do not have in ... [feeble-minded children] the differentiation of the whole system into ... parts, slightly separated from each other, as are those of normal children. Therefore, the substitute action will discharge the whole system in the feeble-minded child more completely than in the normal child" (Lewin 1935, p. 189).

² A nicety in this context is, that one of the items of the Gough-Sanford Rigidity Scale reads: "I always finish tasks I start, even if they are not very important" (see Rokeach 1960, p. 418).

Compare: *Lissner (1933); *Rethlingshafer (1941*b*); Peterson (1942); *Rösler (1955); *Takuma (1957); and section 2.6.

McKINNON¹ devised an experiment in which the subjects ($n = 93$) worked on a series of tasks which were so difficult that practically all the subjects would find them impossible to solve. The subjects, who were left alone during the course of the experiment, were given an answer booklet with all the solutions, some of which they were permitted to consult (consulted solutions), whereas looking at others was strictly prohibited (prohibited solutions).

The hypothesis read that feelings of guilt are more potent initiators of the repression sequence than feelings of inferiority.

43% of the group of subjects violated the prohibition; most of these subjects showed no signs of guilt feelings. The order of frequency of recall for the violators was: prohibited solutions, consulted solutions, unconsulted problems²; and for the non-violators: consulted solutions, unconsulted problems. The small group of violators with guilt feelings recalled the prohibited solutions least frequently.

Compare: *Brenman (1947).

The study by SANDVOSS, another student of Ach's in Göttingen, is a direct sequel to *Schlote's (1930) experiments. The exact replication demonstrates the same predominant use of intended over executed activities made by the subjects in the test period. Sandvoss wondered whether these results might be ascribed to the subjects' knowing that the postponed activities were still to be executed. After eliminating the postponed execution of the intended activities from the experimental design, he obtained a priority of executed activities in the test period³. This result, however, was due to the fact that the intention (determining tendency) failed to work at all under these conditions. In order to study the role of consciousness relative to the determining tendency, Sandvoss tried to isolate the two variables. In some experiments, he announced just before the test period, that the intended activities need no longer be executed. In other experiments, he deprived the subjects of the chance to think about the activities during the intermission. In both variations, the predominance of the intended activities was reduced,

¹ Unpublished Ph. D. thesis, reported in McKinnon & Dukes (1962, p. 698-699).

² These tasks were left uncompleted by reason of the subject's own decision (not because of any interference of the experimenter).

³ The number of subjects (students) in each sub-study is too small ($n = 3$) to warrant statistical analysis. The results should therefore be seen as tendencies only.

although they were still in the majority. Consciousness and determining tendencies – if not separated – thus seemed to be positively correlated. A subsequent instruction to recall the intended activities demonstrated a positive correlation between the use of the intended activities and their recall.

Compare: *Stoller (1935); *Ferradini (1952); and section 2.1.

The object of an experiment by ROSENZWEIG (1933b)¹ was “to determine whether individuals prefer to repeat activities in which success or activities in which failure has previously been experienced” (p. 423). His subjects were 37 crippled and institutionalized children (Newton, Mass.) from 5;6 to 14;8 years old (median I.Q. 92). Two jigsaw puzzles were presented, one of which the subjects were allowed to finish (C); the other was stopped before completion (U). The experimental instruction “I am going to ask you to do some puzzles for me to see how well you can do and how much better than the other children” (p. 424) was given to ensure that the C-puzzle should be experienced as a success and the U-puzzle as a failure. When asked which one they liked better, the children generally preferred the C-puzzle². The answers to the question which puzzle they would rather do again, however, did not point to a significant difference³. Although the time spent on the puzzles varied enormously (ranging from 15 sec to 16½ min), length of time, and difficulty as expressed by it, did not affect repetition preference⁴. An examination of the data demonstrated a relation between chronological age and repetition preference: the older children chose U more frequently while the younger ones had a preference for C⁵. The relation between mental age and repetition preference was still stronger, but there was no significant relation between repetition preference and I.Q.⁶. Another relation was found between repetition choice and the trait of pride⁷, as rated by the teachers (the first pride rating)⁸. Rosenzweig interpreted these results by ascribing the

¹ Abstract of this study: Rosenzweig (1936).

² 32 C; 5 U; $P = .000007$.

³ 20 C; 17 U; $P = .74$.

⁴ $P > .10$.

⁵ Wilcoxon two-sample test: $W = 85$; $m = 17$; $n = 20$; $P < .002$.

⁶ $W = 37$; $P < .002$ respectively $W = 282$; $P > .20$.

⁷ It should be born in mind that feelings of pride, or desire to excell, had been made salient by the experimental instructions.

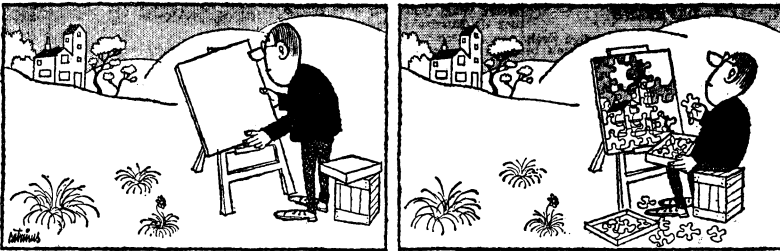
⁸ $W = 143$; $P < .01$. Two pride ratings, the reliability of which is not very high ($\tau = +.45$), were obtained. The more valid one of the two (according to *Rosenzweig & Mason 1934, p. 258) has been used for analysis.

difference in choice mainly to the extent to which failure was wounding to the children. He felt that a need for vindication was experienced more strongly by the older and prouder children who consequently preferred to repeat the U-puzzle. The younger children were, apparently, less vulnerable.

Compare: *Rosenzweig & Mason (1934); *Rosenzweig (1945); *Bialer & Cromwell (1960); *Crandall & Rabson (1960); *Spradlin (1960); *Bialer (1961); *McConnell (1961); *Miller (1961); *Butterfield (1963); Cromwell (1963); and sections 2.4 and 2.6.

1934

With the same children that *Rosenzweig (1933*b*) had as subjects in the preceding study, now $n = 40$, ROSENZWEIG & MASON performed another experiment “with the object of determining whether successful or unsuccessful activities are more apt to be remembered” (p. 264). *As the investigation was intended as an experimental study of repression, it would have been more adequate if they had aimed at determining whether successful or unsuccessful*



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activities are more apt to be “forgotten”. To arouse in the subjects a “genuine need”, the experiment was conducted as a contest with a prize awarded to the one who did best. Jigsaw puzzles were used; each child was given four to fourteen puzzles ¹, depending on how many it could do within forty-five minutes. To stress the failure aspect of uncompleted puzzles, the interruptions were accompanied by the remark “You didn’t do that one so well”. No

¹ Eleven subjects recalled evenly. Of them, 3 performed 4 puzzles, 3 did 6 and 3 did 8. “We can presume that here most of the subjects recalled evenly because they recalled all the puzzles that were given” (*Sanford 1946, p. 240). Or none of them, may be added, as was the case with two subjects (p. 251).

difference between recall of uncompleted (RU) and completed (RC) puzzles was obtained ¹.

On being questioned which puzzles had been finished and which had not, 25 subjects gave a number of incorrect replies; 20 of them made the error of calling more puzzles completed than was actual fact ².

A tendency was found (which was not, however, statistically significant), for the children who preferred to repeat C (*Rosenzweig 1933b) to have higher recall difference scores (RU > RC) than the children who had a repetition preference for U ³. No correlations of any importance could be found between the recall difference scores and chronological age, mental age, pride, or I.Q. ⁴. *Nevertheless the interpretation given is a sequel to the 1933b interpretation.* After making some rather ambiguous breakdowns, Rosenzweig & Mason concluded that "given an individual of sufficient intellectual maturity and a commensurate measure of pride, experiences that are unpleasant because they wound self-respect ... are ... less apt to be remembered than experiences that are gratifying to the ego. This is in keeping with the Freudian theory of repression" (p. 258) ⁵. *However, only non-significant tendencies in the expected direction could be found.* Of the 8 subjects who satisfied the required conditions (highest quartile of mental age, two highest pride ratings), 6 recalled more successes than failures ⁶. Moreover, the recall difference scores of these 8 subjects did not differ significantly from those of the other 32 subjects ⁷.

A peculiar additional finding was that subjects tended to recall puzzles on which they had spent less time better than puzzles on which they had spent more time ⁸. Furthermore, no noteworthy differences were found between the results of the two sexes; nor did the order in which the successful and unsuccessful puzzles were recalled reveal systematic differences.

¹ Wilcoxon matched-pairs signed-ranks test: $T_+ = 197$; $T_- = 238$; $T_v = 41$; $n = 29$; $P > .45$. To avoid confusion, positive recall difference scores are used when RU > RC. In Rosenzweig & Mason's paper the opposite was done.

² $P = .01$.

³ Wilcoxon two-sample test: $W = 241$; $m = 20$; $n = 17$; $.20 > P > .10$.

⁴ $\tau = -.003$ (C.A.); $\tau = +.08$ (M.A.); $\tau = +.05$ (pride); $\tau = +.06$ (I.Q.).

⁵ Many criticisms were directed against this last remark and against the requirement of sufficient intellectual maturity (see section 2.4). In this respect it is interesting to know that the age of the youngest subject was 5;6 (M.A. 4;2). In 1952, Rosenzweig (p. 342) commented that subjects approaching puberty were mature enough to be vulnerable.

⁶ $P = .29$.

⁷ $W = 165$; $m = 8$; $n = 32$; $P > .10$.

⁸ Kolmogorov-Smirnov one-sample test: $P = .01$.

Compare: *Pachauri (1935*b*; 1936); *Sanford (1946); *Bialer & Cromwell (1960); *Coopersmith (1960); *Crandall & Rabson (1960); *Bialer (1961); and sections 2.4 and 2.6.

STUMBUR¹ studied schizophrenic patients (from Leningrad) with Zeigarnik's experimental method and tasks². The data of the patients with pronounced primary symptoms did not demonstrate a difference between the recall of uncompleted and completed tasks³, whereas the patients in the defective stages recalled predominantly uncompleted items⁴.

Compare: *Winder (1952); *Tamkin (1957).

1935

MCKINNEY's experiments were aimed at testing the effect of interruption on the retention of a newly-learned task and not, like those of Zeigarnik, the retention of the name of an habitual task. 144 college students (Missouri) learned a stylus maze up to the point where they had completed one perfect trial. For half of the subjects, this was in accordance with the experimental instructions. The other subjects, however, had been told that they were to learn the maze up to the point where they had completed three perfect repetitions. Although they were thus interrupted in this endeavour, they had still traversed the maze once without any errors. Retention (relearning up to the point of completing three consecutive perfect trials) was tested after a lapse of one week, or after 24 hours. Between the two groups only slight and inconsistent differences were observed. Experiments with verbal learning tasks (107 subjects) showed the same inconsistent result. However, when the interruption occurred *before* (preferably immediately prior to) completion, retention of the interrupted learning task after 24 hours was greater in the case of both the maze and the nonsense syllables.

Compare: *Watson (1939).

STOLLER (cited by Ach 1935, p. 444–446) performed an experiment within the Würzburg tradition. There were two main deviations from *Schlote's (1930) experimental design. Firstly, by instructing his subjects (from Göttin-

¹ I am indebted to J. J. A. M. Simons for his translation from the Russian.

² The list of the tasks indicates the presentation of 9 uncompleted and 11 completed tasks (p. 264).

³ Mdn = 0; binomial test: $n = 11$; $P = .45$.

⁴ $n = 14$; $P = .002$.

gen) to change *two* letters of the nonsense syllables in a prescribed manner, Stoller was able to interrupt part of the activities halfway. Secondly, the test period consisted of the simultaneous presentation of one of the nonsense syllables used and three or four of the prescribed activities, amongst which the interrupted one, with the instruction to choose one of the activities with the purpose of executing it on the syllable. Several subjects (number not mentioned) always chose the interrupted activity. The other subjects who did not are characterized by Ach as introverts, because of their poor external orientation. However, when the experiment was introduced as a test of will-power, the interrupted activities were chosen by the "introverted" subjects too.

Compare: *Sandvoss (1933); and section 2.1.

In a critical review of Zeigarnik's experiments, PACHAURI (1935*a*) proposed another method of scoring, based on the assumption that uncompleted items tend to be recalled first, and then completed tasks ¹. Increase in the number of tasks recalled is accompanied by increase in similarity between RU and RC. To circumvent this disagreeable artefact, Pachauri proposed to allot four marks for each of the first three items recalled, three marks for each of the second three, etc. ².

In his own experiments, PACHAURI (1935*b*) also used the RU/RC score for comparison with Zeigarnik's results. He first studied the effect of duration on recall, and he therefore slightly exaggerated the disparity in time allowed to the various tasks. Under these conditions, recall of the uncompleted items only slightly exceeded recall of the completed items ³. Irrespective of interruption or completion, a correlation of +.67 between time spent on the tasks and frequency of recall was obtained ⁴.

In a second experiment with 36 London students and teachers as subjects, only verbal tasks (naming strings of objects) of a duration of 40 sec each were used. Completion was achieved by the remark "that will do". Preceded by "I want ten more", the interruption "time please" shortly followed. Between tasks and recall, a two minutes' cancellation test was interpolated. The results of these individually applied experiments do not differ from

¹ This order had been observed by Zeigarnik (1927, p. 11-12).

² Only *Walsh (1940; 1942) has since followed this suggestion.

³ Unfortunately Pachauri only gave his results as mean RU/RC. A statistical evaluation of the data cannot therefore be made.

⁴ This result is thus in flat contradiction with that obtained by *Rosenzweig & Mason (1934).

Zeigarnik's main results. The same holds true for a series of similar experiments applied to school classes (267 boys and girls, 10–14 years old).

To study the difficulty of the tasks, a third series of experiments was designed. Synonyms (or word opposites) beginning with a prescribed letter were required. Half of the tasks (of a duration of 15 or 8 sec) were very easy, the other half difficult to the point of impossibility. When the subjects (149 children, 10–14 years old) were informed that each word had a corresponding synonym (or word opposite), recall of the uncompleted items was slightly greater than recall of the completed items. However, when the additional instruction was omitted, the easy items surpassed the difficult ones in recall. Pachauri's interpretation reads that there is no preference in recall if the tasks are extremely difficult or of too short a duration.

Repetition of the experiments with the same subjects (children) reduced the difference in recall between uncompleted and completed items.

Compare: *Mittag (1955); *Clements (1959); and section 6.1.5.

1936

In a third series of experiments, PACHAURI (1936) studied the relation between selective recall on the one hand, and general inertia, persistence of motive, memory and intelligence on the other. Most correlations obtained were rather low.

Two different forms of a verbal test were presented to the same subjects (80 London boys and girls of 13–14 years old). The RU/RC scores of the two forms, however, correlated very poorly ($r = +.09$), either due to the special tasks of the two forms or to a repetition effect. The correlation between the RU/RC scores of these two forms taken together, and of the synonyms and opposites tests, was very low as well: $+.13$. Between the results of boys and girls no differences in selective recall were obtained.

Compare: *Rosenzweig & Mason (1934); *Walsh (1940; 1942); *Abel (1941); *Rethlingshafer (1942); Peterson (1942); *Caron & Wallach (1959); *McClintock (1962).

1937

In one of KENDIG's studies in perseveration¹, 40 Radcliffe students, under the impression that they were performing an intelligence test, were inter-

¹ Kendig used perseveration with the meaning of mental inertia (Kendig & Shevach 1937, p. 225).

rupted in one of two tasks. The tasks were: (a) the rapid enumeration of 30 words beginning with 'C' (which was intended to be seen as a success), and (b) the rapid enumeration of 40 words beginning with 'S' (interruption at 30: which was intended to be seen as a failure). The four possible permutations were used. After two weeks the subjects received a questionnaire on perseveration of C-words and S-words. The results were expressed only as an indication: "the emphasis in the ... perseverative activity ... [was] upon the task which was failed. If this task was also the last, there ... [was] a further augmentation of this selective perseveration" (p. 258).

A study by RICKERS-OVSIANKINA ¹ of 71 male adult schizophrenic patients of Worcester State Hospital was intended to test the hypothesis that, at least in the peripheral personality layers, schizophrenics are unable to produce segregated tension systems sufficiently firm to result in the execution of a goal-directed activity. The experimental method used was similar to Ovsiankina's (1928) with normal subjects. The behavior of the schizophrenics as compared with the normal subjects was less goal-directed; it was characterized by frequent interruptions of their own accord, and a low proportion of resumptions.

Compare: *Bennett (1942); *Winder (1952).

1938

The purpose of ABEL'S investigation with 75 New York adolescents, was to study the relation between selective recall and neuro-circulatory reactions (pulse rate and blood pressure under different conditions). The desire to do well was induced by means of the experimental instructions. Subjects with a high degree of functional unfitness ($n = 25$) predominantly recalled completed tasks, while subjects with a greater neuro-circulatory efficiency ($n = 24$) recalled somewhat more uncompleted than completed items ². Abel interpreted this result by assuming that functionally unfit individuals do not adjust themselves as easily, concerned as they are with their personal achievement, and not with the task at hand.

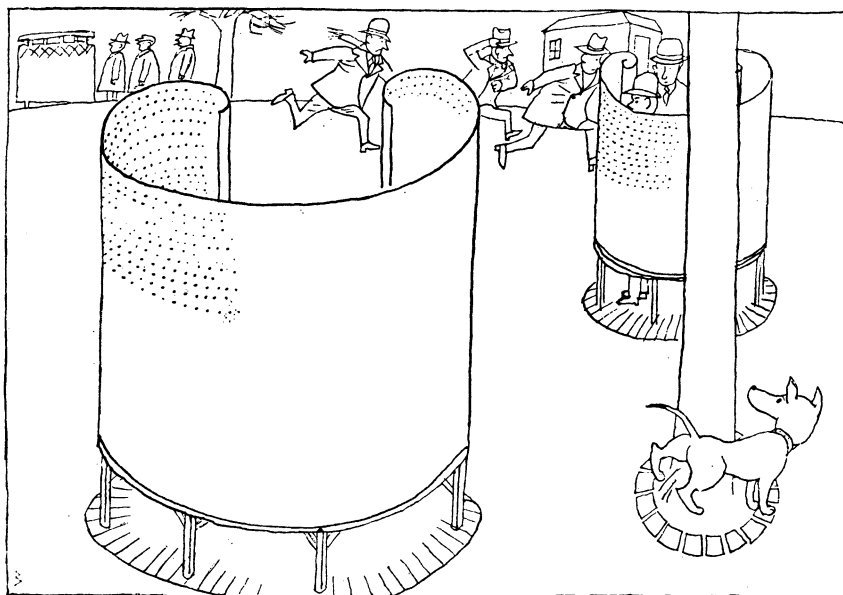
Compare: *McAllister (1952).

FREEMAN, continuing his work on neural reinforcement, argued that a blocking of the discharge of a basic physiological tension will affect oper-

¹ Abstract of this study: Rickers-Ovsiankina (1936).

² Binomial test: $P = .0003$ respectively $P = .09$.

ations in more superficial neural strata. He specifically studied the effect of interrupted and completed work (with eye-hand coordination tests) occasioned by the inhibition of micturition. Twenty male subjects (from Illinois) were studied under control conditions, in the pre-micturitional period (when micturition could be delayed no longer after one litre of water had been drunk) and in the post-micturitional period. In each session they performed two pursuit tasks, the second one being interrupted either by an electric shock or by a change of the illumination. In the post-micturitional period 2 subjects did not resume the interrupted task, 6 showed a feeble attempt and 12 a well-defined attempt to resume. In the pre-micturitional period there were 5 non-resumptions, 12 feeble attempts and only 3 complete re-



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sumptions. A greater tendency to resume or to continue interrupted acts in the post-micturitional rather than in the pre-micturitional period was thus observed¹. I.e., "if the task is interrupted when the individual's major energies are already mobilized in support of a more basic pattern of excitation there is less tendency for it to be resumed" (p. 282).

Compare: *Freeman (1930); and section 2.7.

¹ Wilcoxon matched-pairs signed-ranks test: $T_+ = 78$; $T_- = 0$; $n = 12$; $P = .0005$.

One of the main questions that KATZ attempted to answer in her study was based on the reflection that "it is quite conceivable that the resumption may indicate merely the need of the organism for activity of some sort, rather than a tendency to discharge the specific tension system corresponding to the interrupted task" (p. 3). She therefore wished to determine the effect of the presence of other tasks on the frequency of resumption. Furthermore, she investigated whether the stage at which the task is interrupted affects the frequency of resumption.

Subjects were 177 children (from Minnesota and Ohio) between $4\frac{1}{2}$ and $5\frac{1}{2}$ years old, whose intelligence was within the normal range. They took part in 486 experiments altogether, i.e., most of them were subjects in three experiments. There were three experimental situations: (a) with the main task and the interrupting task only, (b) one alternative task in addition to these two, and (c) two alternative additional tasks. The interruption occurred either around the beginning of the task, or near the middle, or at about three-quarters of the way through, or near the end of the task. After finishing the interrupting task the children were free to engage in an activity or leave the room.

For the interruptions occurring during the three earlier stages of the tasks, resumption was 93%, 91%, and 93% respectively, whereas interruption near the end of the task resulted in only 81% resumption. According to Katz, the differences between interruption near the end and interruption at any of the other stages are statistically significant. *However, the significance of the results may be an artefact of the n-inflation (every child counted three or two times). As the observations are not independent, a statistical re-evaluation cannot be made. These results do, however, differ from Ovsiankina's, who obtained the lowest resumption when the interruption took place shortly after the middle of the task.*

Resumption where no alternative task was given was 93%, whereas the percentages of resumption where one and two alternative tasks were given were 87 and 86 respectively. The alternative tasks had no differential effect on resumption at different points of interruption. After resuming the interrupted task, more than half the subjects also completed the other task(s). No differences in resumption were found either between children with high and low I.Q.s, or between children who came from underprivileged homes and those who came from homes distinctly above the average in socio-economic status. However, resumption varied with the nature of the main activity, the range being 98% for a mosaic puzzle to 81% for crayoning balloons. A remarkable finding was that resistance to interruption occurred proportionally as frequently in cases of non-resumption as in cases of resumption.

Compare: *Adler & Kounin (1939); *Rethlingshafer (1941c); Peterson (1942); *Rosenzweig (1945); *Baltimore *et al.* (1953); *Cohen (1953); *Henle & Aull (1953); *Miller, Swanson & Beardslee (1960).

The purpose of MARROW's (1938a) experiment was "to check Zeigarnik's results employing an improved procedure" (p. 12). The alterations introduced consisted of a standardized experimental instruction, a uniform attitude of the experimenter towards all subjects, a series of twenty paper and pencil tasks of approximately equal duration, and the presentation of the tasks in three different serial orders. Marrow introduced a percentage score, $RU/(RU + RC)$, because addition of the scores used by Zeigarnik, RU/RC , was not warranted. The subjects were 30 students¹ (21 males and 9 females) of elementary psychology at New York University. Like Zeigarnik's subjects they recalled a preponderance of uncompleted items².

Marrow's warning that there was some tendency for the scores of subjects with a superior memory ability to be lower is, however, not borne out by the data. The recall difference scores of the 12 subjects with the highest total recall ($RU + RC$) do not differ significantly from those of the subjects with the lowest total recall³. It should be noted that in using this check, only the deviation from zero and not the sign must be taken into account (Marrow used both for his computations).

The effect of the presentation of the tasks using different serial orders was negligible. *So was the effect of the serial position of the tasks on selective recall, although Marrow concluded otherwise. However, an application of Whitney's extension of the U-statistic (twice) by the author of the present study did not reveal a consistent rank order of the various serial positions⁴. Only the first and the last task were notable for their very high total recall.*

¹ Marrow tested 108 students, but only analyzed the data of the last 30 subjects. He gave the following reason for this peculiar procedure: comparison with the other three experiments. However, 30 subjects were eliminated from the third experiment, and another 15 from the fourth.

² Combination of three Wilcoxon two-sample tests (comparison of a-tasks and b-tasks) for the three serial orders: $W = 432$; $m = n = 15$; $P = .00002$. This method of analysis was designed by Hemelrijk and computed by the Mathematical Centre in Amsterdam (see section 4.3).

³ Wilcoxon two-sample test: $W = 122$; $P > .20$.

⁴ Computations were made from the data of an unpublished table (on file in the New York University Library).

The correlation between the recall of tasks in uncompleted and in completed condition was rather high ¹.

The aim of the second experiment (MARROW 1938*b*) was to produce a reversal of the subject's interpretation with respect to the completion or non-completion of a task, through a change in the instructions. These were altered to read: "On such tasks as you indicate to me by your manner of handling and by the speed with which you work that you have sufficient mastery of the task, it will not be necessary for you to finish that task" (p. 38). A total reversal of the recall data was obtained: the 30 subjects recalled a majority of completed items ². Marrow's interpretation of this result reads that "the condition of interruption before external completion is interpreted by the subject as a fulfillment of his intention, while the condition of external completion is interpreted as a failure to fulfill his intention" (p. 42).

The remaining two experiments were designed to answer the question whether "with increased motivation, with presumably an increased strength of tension, there will be found a still more accentuated difference in recall value between the tasks in which the goal is attained and those in which it is not" (p. 45). Two forms of motivation were used, encouragement and discouragement. After the fifth and after the fifteenth task, encouragement and discouragement instructions, respectively, were repeated. The subjects recalled a preponderance of uncompleted tasks, regardless of which of the two motivation factors they had worked under ³. The subjects working under encouragement ($n = 30$) obtained even higher recall difference scores than obtained in the first experiment ⁴.

Further remarks made in connection with the first experiment are equally applicable to the other three experiments.

Compare: Lazarus, Deese & Osler (1952, p. 302); *Ito (1957); and sections 5.2.2, 5.2.3, 5.3.1, 5.3.2, 5.3.3, and 6.1.4.

A single line in *Marrow's paper (1938*a*, p. 10–11) refers to HEIDER, who used a group method in work on the subject of selective recall. Heider ⁵ was kind enough to give additional information on request. While giving a course in introductory psychology at Smith College, he illustrated the

¹ $\tau = +.51$.

² Wilcoxon matched-pairs signed-ranks test: $T_+ = 37.5$; $T_- = 340.5$; $T_v = 303$; $n = 27$; $P < .01$.

³ $P < .01$.

⁴ Wilcoxon two-sample test: $z = 2.47$; $P = .01$.

⁵ F. Heider, personal communication, July 7, 1962.

Zeigarnik effect by a simple demonstration. He dictated a number of sentences to the students; half the sentences were dictated at a speed at which it was impossible for the students to take them down completely. During each of these demonstrations, the students tended to recall a majority of uncompleted sentences.

As part of the studies at the Harvard Psychological Clinic, TROWBRIDGE presented an intelligence test in the form of a series of jigsaw puzzles to fifteen male college students. Recall was required immediately at the end of the session, and once again after a period of five weeks. No significant difference between recall of uncompleted and completed tasks was found. A correlation of only $+ .24$ was obtained between the recall difference scores of immediate and delayed recall.

Compare: *Rosenzweig (1943).

1939

ADLER¹ studied the relation between cognition and substitute value with children from 7 to 10 years of age as subjects. After interruption of the original task, the subject had to finish a second task which was identical to the interrupted one. If the tasks were viewed by the children as being related specifically to themselves (i.e. building a house for Mary and then finishing a similar house for Johnny) the substitute value of the second task was low. If, however, house-building as such was stressed, the second task had considerable substitute value for the older but not for the younger children.

Compare: *Lissner (1933); *Adler & Kounin (1939); *Henle & Aull (1953).

ADLER & KOUNIN wanted "to determine whether it is necessary to postulate a quasi-need as a determining factor in the resumption of interrupted tasks, or whether resumption can be attributed solely to the nature of the task-object, per se" (p. 265-266). The subjects (22 preschool children, from Iowa, 4-5 years old, mean I.Q. 131) were confronted with two identical tasks. One of these was interrupted halfway, and an interpolated task was given. The second task had already been done in part before the subject entered the room. After completion of the interpolated task, 20 of the 22 subjects resumed and finished the first task - their "own" task - within one

¹ Unpublished thesis; not available. Reference has been made to it by Lewin (1946, p. 278).

minute. Only six children later completed the "foreign" task too. This result is in agreement with Ovsiankina's (1928, p. 344-346).

Compare: *Katz (1938); *Adler (1939); *Baltimore *et al.* (1953); *Henle & Aull (1953).

The tasks used in an experiment by WATSON (cited in McColl 1939, p. 146-147) consisted of writing nonsense syllables twenty times. Recall of the syllables when interruption occurred after the 15th repetition was better than when it occurred after the 5th repetition; recall when interruption occurred after the 10th repetition, and recall after completion were even lower.

Compare: *McKinney (1935).

1940

GURNEE, WITZEMAN & HELLER attempted to test Koffka's theory that "... where no tension toward completion is induced, memory traces of open systems are likely to be less stable ... than memory traces of closed systems ...; but where such tension toward completion is induced, the open system will manifest greater survival value than the closed system" (p. 66). In the situation where no tension was induced, open and closed irregular drawings were learned for later recognition by 32 male college students. However, when these drawings were mixed with others, recognition of the learned open and closed drawings was almost equal.

In the situation where tension was induced, the subjects were interrupted while tracing the pattern of ten closed figures by the fact that their hands were obstructed; ten other figures were completed. No significant differences between the recognition of interrupted and completed figures were shown in the results of either the 32 male students or 22 school children (10-12 years old). Thus neither part of Koffka's (1935) theory could be verified.

Compare: *Prentice (1943); *Postman & Solomon (1950); and sections 2.3 and 6.2.5.

MARTIN studied the effect of interruption on reminiscence. His subjects were 200 young men attending an industrial school for delinquents in Pennsylvania and living in single cells. Immediate recall was required from all of the boys. They were then split into four groups of 50; second recall was required after two minutes, two days, one week, and two weeks respectively. It was assumed that tension systems were established both towards completion of the tasks and towards the completion of the recall of all the tasks. Many

more uncompleted than completed tasks were given in immediate recall ¹. The same was true of the reminisced material given after 2 minutes ². Because of the stable organization of the completed tasks, and the tension built up towards recall of all of the tasks, it was hypothesized that when recall was again required after a period of 2 days or more, the completed tasks would be reminisced relatively better than the uncompleted ones. This did indeed occur, though mostly not statistically significant ³.

*Compare: *Black (1947).*

WALSH performed six experiments on the effect of frustration on volitional acts. It was postulated that a determining tendency, initiated by a previous volition at the acceptance of the task, underlies the work on a task ⁴. Frustration was operationally defined in terms of task interruption.

The subjects were 140 British school children, 11–12 years of age, who were required to perform 20 simple tasks. The design of the first experiment provided for a large discrepancy between the time allowed for work on a task which was to be completed (2–3 min) and on a task which was to remain uncompleted (4–7 sec). The result was that completed items were recalled significantly more frequently than uncompleted items ⁵. Besides the effect of the great differences in task duration, it was felt that the results might have been affected by the children's not having been quite at their ease. They seemed to be more intent on behaving politely than on working on and completing the tasks.

In the other five experiments (series of tasks which varied in difficulty; two interruption series, A and B; individual and group experiments) the subjects were more at their ease and the discrepancy between the duration of U and C tasks was diminished. The results showed a significantly larger RU than RC ⁶. No difference between the recall scores of the two interruption series was obtained. Selective recall was found to be correlated with perseveration, not with I.Q.

¹ Wilcoxon matched-pairs signed-ranks test. Analysis of the twenty tasks: $P < .0001$.

² $P < .005$.

³ $P = .13$, $P = .04$, and $P > .31$ respectively. Martin's analysis with χ^2 more often yielded (probably incorrect) significant results. However, the direction of the reminiscence difference scores was the same as that of the re-analysis made by the author of the present study. The latter also had to correct mistakes in the tables of p. 16–17.

⁴ Cf. Aveling (1926).

⁵ Wilcoxon matched-pairs signed-ranks test: $T_+ = 18$; $T_- = 172$; $T_v = 154$; $n = 19$; $P = .001$.

⁶ At least $P < .01$.

A group of 20 high school girls, 11–13 years of age, who were tested on the same morning that an air-raid warning had been given and were still very excited, recalled significantly more completed than uncompleted tasks ¹.

Compare: *Pachauri (1935*a, b*; 1936); *Walsh (1942).

1941

In a preliminary study, ABEL attempted to use the interrupted task technique (recall) for the construction of a test of behavior dynamics. Of the 18 tasks used, four were eliminated from the scoring because of their high recall value (primacy, recency, and interest factors). Subjects were 277 high school students and 66 college freshmen from New York. Part of them worked under instructions which were intended to produce competitive feelings, and some of the subjects were induced to regard the experiment as a task orientation.

Contrary to *Rosenzweig's (1933*a*; 1943) results, no difference in recall was found between the two groups. Abel assumed that the latter group also regarded the tasks as a test. The correlations between uncompleted and completed items recalled were low and negative. The data of one of the schools (155 subjects) revealed some – though non-significant – difference between the two interruption series. No such difference whatever was obtained from the data of the other schools and colleges.

Within the mixed schools differences between the results of the two sexes were obtained, the girls ($n = 127$) recalling relatively more uncompleted, the boys ($n = 76$) relatively more completed tasks. Between the results of the high school and the college subjects some difference was also found: the school subjects recalled predominantly uncompleted tasks, the college students relatively more completed items. Abel ascribed this difference to a sophisticated and critical attitude of the college students. No correlations of any importance between the recall scores and I.Q. were obtained (range + .25 to – .06).

There was some tendency for subjects with high recall difference scores to recall uncompleted items initially and vice versa. A peculiar finding was a trend for subjects with high recall difference scores (i.e. many uncompleted tasks) to number the items on the recall sheet more frequently than did subjects with low scores. According to Abel it seemed that “numbering recalled items is not just a check on memory ... By numbering a task it was

¹ Binomial test: $P < .01$.

emphasized and made a more important entity, instead of being considered only as a less important part of a battery of tests" (p. 22).

Compare: *Pachauri (1936); and section 5.1.1

The problem of success and failure as related to task resumption was treated by NOWLIS from an S — R point of view (Yale group, Dollard *et al.* 1939). Two tasks were used, the first of which was interrupted, the second completed. By means of verbal instructions at the moment of interruption of the first task or at completion of the second task, success and failure were induced. The two tasks, performed under success, failure, or neutral conditions, make for nine permutations. In each of these nine experimental groups, twenty subjects (180 undergraduate Yale men in all) were tested ¹. The problem under investigation was "essentially that of determining the effect on resumption of the occurrence or non-occurrence of ... three goal responses [completion, reaction to success, and reaction to avoidance of failure] both at the point of interruption of the first activity and superimposed on the completion of the second" (p. 307–308). The most outstanding result was that the second task acted as a substitute for the first (total resumption 34%). The results for success and failure induction in the first (interrupted) task were inconclusive; the neutral conditions led to the relatively greatest number of resumptions (depending mainly on the combination with success on the second task), while there was no difference whatsoever between success and failure conditions. The success induction following the second (completed) task, however, led to significantly more resumptions of the first task than did either the neutral or failure inductions ². The latter result was interpreted by pointing to the reinforcing effect (under success conditions) of *three* goal responses on the second task to the first task, while in the case of the other conditions it is a matter of only one or two goal responses.

Compare: *Child & Grosslight (1947); *Weiner (1965 *b*); and section 2.7.

RETHLINGSHAFER published five papers (1940; 1941*a, b, c*; 1942) on the data she obtained for behavior, following interruption, of 29 institutionalized feeble-minded children (morons), 29 normal children, and 41 college sophomores (from Maryland and North Carolina). The children were equated according to mental age (6–10 years). Of the eleven tests used, Rethlings-

¹ In a few cases, the experimental conditions were fitted to the obvious behavior (doing very well or poorly) of the subjects.

² It was, as Sears (1944, p. 320) interpreted, "as if the achievement of substitute gratification raised hope that the original goal might be reached after all".

hafer (1940) considered the one in which the material was rather meaningless as the most superior test of a general tendency to continue. Behavior following interruption was classified into 17 categories (1941a) ranging from “complete-refusal-to-be-interrupted” to “no-refusal-to-be-interrupted and no resumption”. Intermediate categories were, e.g., “part-refusal-to-be-interrupted and delayed resumption of one minute” and “no-refusal-to-be-interrupted and immediate resumption”. A scale of equal units, said to be ordered from a strong to a weak tendency to continue, was constructed by converting the percentages of behavior in each of the 17 classifications into standard deviation values.

Rethlingshafer (1941c), in defending the combination of two variables – resistance to interruption, and resumption – in one scale, tried to demonstrate a difference in eagerness to resume between the subjects who did and who did not (partly) refuse to be interrupted. *However, the differences found (within each of the three groups of subjects) should probably be attributed to chance*¹.

In comparing the three groups of subjects (adults, normal and feeble-minded children), it was found that in general they exhibited the same types of behavior following interruption (1941c). When substitute tasks were presented, no differences between the results of feeble-minded and normal children were obtained (1941b). With increased similarity between the substitute and the original activity, the normal children tended to resume the task somewhat more frequently than the feeble-minded. Rethlingshafer did not know how to interpret this finding, which is quite contrary to *Köpke’s (1933) results.

Peterson (1942) objected very strongly to Rethlingshafer’s “tendency-to-continue” scale. He objected partly for reasons of scale construction but especially because the scale consists of the combination of two variables, resistance to interruption, and resumption, which do not measure the same phenomenon, even if correlated. He proposed to designate the tendency to continue in an ongoing activity as “perseveration”, and to reserve the term “persistence” for the tendency to continue towards a goal² (e.g., resumption after interruption). In the same line Peterson (1942, p. 238–239) objected

¹ A statistical evaluation is not possible, as the numbers are based upon activities which are not independent, and not upon subjects. The negative comment is, therefore, only based upon a rough estimate.

² A comparable distinction was made by Kendig & Shevach (1937, p. 225), who conceived of perseveration as mental inertia, and for whom persistence had the connotations of conscious and volitional.

to Lewin's (1935) calling resumption an indication of rigidity. "The individual who when interrupted can change to another activity, and then return to the former, though he shows persistence in clinging to a goal, is at the same time flexible, in that he can change under pressure and yet return" ¹.

Compare: *Köpke (1933); *Pachauri (1936); *Katz (1938); *Rösler (1955); *McClintock (1962); and section 2.6.

1942

REHLINGSHAFFER's 38 college subjects performed not only experiments concerning resumption and recall of interrupted activities (only a slight superiority of RU to RC was obtained), but also tests of persistence and tests of perseveration. By means of a factor analysis of 29 tests, seven factors were extracted, the first one being identified as a general habit of finishing any task, once started ². Rather high weights (above .40) on this factor were received by, e.g., the amount of increasingly difficult material done and the time spent on it, resumption and recall of interrupted activities. *However, the correlation between resumption and recall was low* ³.

Compare: *Pachauri (1936); *Rethlingshafer (1941); *McClintock (1962).

BENNETT investigated the forces determining substitute value in the central personality regions of 25 normal subjects (nurses, amongst others), and 45 schizophrenics (Worcester State Hospital). The first one of two tasks, eliciting the projection of crucial past experiences, was interrupted. During the work the experimenter left the room since her presence "seemed for some subjects merely to make the situation more restricted and to suggest to them an actual prohibition on resumption, whereas for others it seemed to represent an obligation to continue the first task" (BENNETT 1941, p. 46). For the schizophrenics resumption was high (at least 72%), both for a task tapping the central personality regions of the subjects and for a neutral task serving as interruption agent. Of the 25 normal subjects, however, only 4 resumed the

¹ Cf. Honkavaara's (1958) distinction between the concepts of perseveration and rigidity.

² In a later paper Rethlingshafer (1943, p. 399-400) reflected on "... the length of time such a general habit might operate", and thought it "... conceivable that some people might tend to carry on their activities over long periods of time when apparently the original motives were dead, being restimulated at intervals by such verbalised attitudes as 'I always finish what I start'."

³ $r = +.17$: computed from the factorial matrix (p. 75).

task within two minutes. This number increased to 14 within a ten minutes' interval. The differences between these results and those of Ovsiankina (1928) and *Rickers-Ovsiankina (1937), who presumably only touched peripheral personality layers, is interpreted by assuming the existence of a rigid boundary between the central and peripheral personality regions of the schizophrenic patient. Furthermore, because of the seemingly high substitute value of the interrupting task for the normal subjects, the central layers of the normal personality were assumed to have a greater fluidity than the peripheral layers.

Compare: *Winder (1952).

CARTWRIGHT attempted to gain further insight into the effect of interruption, completion, and failure on the attractiveness of activities. His subjects were 35 Radcliffe and Harvard undergraduates. The experimental data consisted of changes in preference ratings of twelve tasks, which were made each time the subject had worked on one of them. In general, the results were not univocal. With regard to the interrupted task – in which the interruption was effected through the pretence of a mistake made the by experimenter – an increase in attractiveness was interpreted by means of Lewin's tension system theory, a decrease by the subjects' anticipation of failure, and no change by the subjects' attempts to rectify the experimenter's mistake. With regard to the completed task, both increase and decrease in attractiveness were interpreted in terms of level of aspiration: an increase because of the subjects' attempt to better their previous performance, and a decrease because it would be meaningless to repeat the task (too easy). Cartwright treated a decrease after failure as self-evident. An increase after failure was interpreted either as a challenge or because of a need to erase the failure by subsequent success on the same activity.

Less equivocal were the results with respect to tasks rated as similar to the performed tasks. In general preference ratings changed into the same direction.

The background of HENLE's study on substitution was formed by the hypothesis "that those principles which have been found to govern the organization of perceptual fields apply also to the organization of the fields which include the tension systems underlying behavior" (p. 33). The release of the tension of one system through another was assumed to be the essential process in substitution. Fifteen experiments were performed with 275 subjects of several American colleges. The results of 34 subjects were not taken

into account because these subjects had either felt satiated with the tasks or unable to perform them, or because they failed to comply with the conditions of the experiment. The results of preliminary experiments were that when a substitute task similar to the original task was given, resumption occurred in 52% of the cases, whereas the percentages were over 90% when no substitute was given.

The main hypothesis, taken from Köhler & Von Restorff (1935), read "that a completed task B will have substitute value for a previous unfinished task A if conditions are such that pair formation between the corresponding tension systems b and a can take place" (p. 62). However, both in the case of a homogeneous series of tasks (a series in which pair formation cannot spontaneously take place) and in a non-homogeneous series (constructed to favor pair formation) resumption was high and substitution thus failed to appear. A check was made to ascertain that this unexpected result was not due to the particular emphasis on the unfinished task, which was the only incomplete item in a series of completed tasks. The result might, furthermore, be due to the high positive valence of the critical tasks in the non-homogeneous series. It was indeed shown in experiments designed for the purpose, that the higher the valence of the critical tasks for the subjects, the smaller was the possibility of substitution of one for the other. Substitution failed to appear when tasks of highest valence were employed, whereas with tasks of very low valence there was probably no question of substitution at all. Therefore only tasks of middle valence should be employed.

It was also shown that feelings evoked by previous successes have an effect on substitution. "When subjects came to the critical tasks with feelings of success, substitution failed to appear, whereas, in the absence of the effects of success ... substitution could be demonstrated" (p. 96).

When tasks of middle valence were employed and successes were ruled out, substitution failed to appear in a homogeneous series of tasks (94% resumption), whereas it did occur in a non-homogeneous series (44% resumption). The main hypothesis was thus verified under these special conditions.

Compare: *Lissner (1933); *Henle (1944); *Gordon & Thurlow (1958); and section 2.3.

One of the conclusions from a study made by ROSENZWEIG & SARASON with 64 college students (from Clark and Newark) as subjects, was that "there is a strong tendency for subjects who do not demonstrate repression to be less hypnotizable, more extrapunitive, and less impunitive than those who do"¹

¹ Rosenzweig (1934; 1938a, b) dealt with the way in which individuals seem to vary in

(p. 16). However, the association between the scores on the Rosenzweig Picture-Frustration Study and those on the recall test (jigsaw puzzles) were not significant (p. 16).

In the experiment, jigsaw puzzles were presented in the guise of an intelligence test. The number of puzzles was decreased from 18 to 14 because of signs of fatigue and irritability. Recall of more completed than uncompleted puzzles was taken as an indication of repression¹. The interruption technique was also utilized as part of a frustration test with paper-and-pencil tasks². However, the correlation between recall of the test items and recall of the puzzles was inconclusive (for three groups of subjects $r_s = +.21$, $+.07$, and $-.29$ respectively). Not only recall but also a word-hunt test (recognition of the names of the puzzles in a congeries of words scrambled together) was attempted with 23 subjects. The correlation between recognition and recall was, however, low and even negative ($r_s = -.12$), notwithstanding the likelihood that the word-hunt test influenced subsequent recall.

Compare: *Postman & Solomon (1950); *Lelkens (1964); and section 2.4.

In continuation of her 1940 studies on the effect of frustration on volitional acts, WALSH performed ten more experiments with 301 British school children (10–16 years old) as subjects.

On a November afternoon in 1940, after the subjects had experienced a serious air-raid in the morning, two experiments on selective recall were conducted, one with girls and one with boys as subjects. No significant differences between recall of uncompleted and completed tasks were obtained³. However, when the experiments were repeated under more favorable circumstances with similar groups of children as subjects, RU was signif-

their immediate reaction to frustration or failure. He observed that subjects who at the time of interruption (failure) were inclined to blame the external world, as e.g., the puzzles or the experimenter (extrapunitive reaction) or were inclined to blame themselves (intro-punitive reaction) tended to recall their failures. Those subjects, on the other hand, who tended to gloss over their failures as if inevitable and tried to rationalize them away at the time of interruption (impunitive reaction) recalled their successes better than their failures. Only the last group of subjects displayed stimulus repression (1938a, p. 486).

¹ In the second part of the paper (SARASON & ROSENZWEIG 1942, p. 163), however, the validity of this test of repression was questioned. Cf. Barber (1964, p. 300–301).

² Validation studies showed that this test was "a poor indicator of an individual's reactions to frustration" (p. 9).

³ Wilcoxon matched-pairs signed-ranks test: $T_+ = 178$; $T_- = 98$; $T_v = 80$; $n = 23$; $P > .10$ (girls); $T_+ = 182.5$; $T_- = 142.5$; $T_v = 40$; $n = 25$; $P > .10$ (boys).

icantly larger than RC^1 , at least for recall given after 10 minutes; after 24 hours gave a non-significant $RU < RC^2$.

In order to test Bartlett's (1932) hypothesis that the things a person is interested in are remembered best, an experiment was designed in which the completed activities were matched to the subjects as regarded their interest value. The uncompleted tasks consisted of ordinary (rather dull) activities. The subjects were classified as being choleric, melancholic, sanguine, or phlegmatic, and for each of these four categories a special set of ten tasks which were to be completed was devised. Nevertheless the recall scores showed a significant majority of uncompleted items³. So did the scores of an experiment on the effect of fatigue on selective recall⁴. This experiment was conducted after the subjects had done strenuous laundry work for three hours and arithmetic tests for two hours! Another significant $RU > RC$ was obtained in an experiment on the influence of emotion on selective recall⁵. This study was performed on the very morning that the Cambridge School Certificate results were due to arrive.

Selective recall was found to be correlated with perseveration, not with I.Q.

Walsh suggested, on the basis of the means of the U/C scores (1.8; 1.7; 1.5) that there is a tendency for selective recall to fall between the ages of 10 to 14 years. *If, however, the median $RU - RC$ scores are used instead no concomitant variation of age and selective recall can be detected (+2; +3; +1).*

The results of the statistical analyses are based on total recall scores. Scores computed on recall before the hesitation period, however, led to similar results.

According to Walsh, U-tasks were not only recalled more frequently but also earlier than C-tasks. This conclusion was based on a differential scoring system adapted from that of Pachauri (1935a)⁶. Walsh refined the system by attributing a weight of 20 to the first task recalled, 19 to the second, etcetera, etcetera. *However, if the first and the second task recalled are scruti-*

¹ $T_+ = 329$; $T_- = 49$; $n = 27$; $P < .01$ (boys, individually); $T_+ = 370.5$; $T_- = 7.5$; $n = 27$; $P < .01$ (girls, in groups).

² $T_+ = 87$; $T_- = 189$; $T_v = 102$; $n = 23$; $P > .10$ (girls).

³ $T_+ = 339.5$; $T_- = 66.5$; $T_v = 273$; $n = 28$; $P < .01$ (boys); $T_+ = 359$; $T_- = 19$; $T_v = 340$; $n = 27$; $P < .01$ (girls).

⁴ $T_+ = 329.5$; $T_- = 21.5$; $T_v = 308$; $n = 26$; $P < .01$.

⁵ $T_+ = 250.5$; $T_- = 49.5$; $T_v = 201$; $n = 24$; $P < .01$.

⁶ Not from that of Lewin and Zeigarnik (1927), as *Walsh (1940, p. 41) suggested.

nized separately, it will be found that the large majority of the first tasks recalled are U-tasks, whereas for the second item recalled, the frequency of U-tasks and C-tasks did not differ significantly in any of the experiments.

*Compare: *Pachauri (1936); *Baler (1950); and section 2.6.*

1943

In an experiment at the Harvard Psychological Clinic with 60 college students, ROSENZWEIG¹ used 18 jigsaw puzzles. The experiment was introduced to half the subjects as a preliminary to test the tasks (informal conditions), and to the other half as an intelligence test (formal conditions). Two hypotheses were to be tested. The first one was "that under the informal conditions, the unfinished tasks would be better recalled than the finished ones because need-persistent responses alone would be operative and would make for the easier recall of tasks with which undischarged tension was associated" (p. 67). The second one read that "subjects in the formal group were expected to recall finished tasks ... more frequently than ... unsuccessful ones, the assumption being that with the arousal of pride and accompanying ego-defense in case of failure, the individual's needs for inviolacy would take precedence over the task-tension making for recall of the unfinished tasks" (p. 68). *These hypotheses were not substantiated by the results of the experiment², although Rosenzweig more or less stated that they did.* What Rosenzweig did find was a dissimilarity in recall difference scores between the two groups of subjects³. *In an effort to interpret the results of the formal group, who on the whole recalled (slightly) more rather than less items in all, Rosenzweig became very confused with regard to the repression concept. He even speculated that "repression may be regarded as encompassing not only the forgetting of the unpleasant but the (conscious or unconscious) persistence of the unfinished" (p. 72).*

*Compare: *Trowbridge (1938); *Abel (1941); *Glixman (1949); Alper (1952); *Eriksen (1952b); Rosenzweig (1952); *Forrest (1959); and sections 2.4 and 5.1.2.*

¹ Abstracts of this study: Rosenzweig (1933a; 1941).

² Wilcoxon matched-pairs signed-ranks test. Informal conditions: $T_+ = 242$; $T_- = 109$; $T_v = 133$; $n = 26$; $.10 > P > .05$. Formal conditions: $T_+ = 143$; $T_- = 182$; $n = 25$; $T_v = 39$; $P > .50$.

³ Wilcoxon two-sample test: $z = 2.14$; $P = .03$.

In an attempt to test Koffka's hypothesis that "the very tensions which remain in the incomplete task-systems may keep them at a greater degree of organization" (Koffka 1935, p. 340), PRENTICE designed an experiment, and used four groups of ten subjects each. Two series of tasks were successively presented to each of the groups. When half the tasks of the first series were interrupted, less retroactive inhibition was produced by a second series of tasks (all completed), than when the tasks of the first series were all either completed or interrupted. No difference in recall was found between the last two variables. When a completely different activity (18 min of reading an interesting book) was interpolated, in place of a second series of tasks, there was no difference in recall.

More uncompleted tasks relative to completed ones were recalled after reading than after the second task series. This result might have been due to similarity between the two series of tasks, to a substitute value of the completed tasks of the second series, and/or to a quicker "destruction" of tensions after relatively intense work (Prentice 1944, p. 334).

Compare: *Gurnee, Witzeman & Heller (1940); *Hays (1952); and section 2.3.

1944

As a preliminary to his study on the experimental production of resistance, FRANK compared the reaction of twelve Cornell students to interruption by the experimenter, with their reaction to interruption by an individual apparently unconnected with the experiment. No subject displayed any resistance to interruption by the experimenter. When, however, the interruption was performed by an apparently unauthorized person, it was strongly resisted. According to Frank, these results "suggest that an individual volunteering to take part in an experiment makes an implied contract which strongly inhibits resistance to any activity required by the experimenter" (p. 25).

HENLE ¹, having employed substitute tasks similar to the original tasks in 1942, continued her investigation with experiments on the effect of valence on substitute value in series of dissimilar tasks. Fifty college undergraduates served as subjects. The overall results as regards valence were in agreement with *Henle (1942). Furthermore, it was shown that "when dissimilar tasks

¹ Reprinted in McClelland (1955) p. 529-536.

are used, a substituted task will have substitute value for an interrupted one of lower valence than itself, but not for one whose valence is higher" (p. 17). The tasks used were of highest and of middle valence.

Compare: *Lissner (1933); *Gordon & Thurlow (1958).

LEWIS, in introducing social psychological aspects into interruption experiments, started with two propositions. Firstly, "in truly coöperative work ... the common-objective ... is more important than any personal objective. ... Since the self is not focal, another person's activities ... may be as satisfactory as your own" (p. 115). And secondly, "competing behavior involves seeing the objective situation as relevant to the personal need to win, or for prestige. Only personal activities, therefore, can be satisfactory" (p. 116).

In Lewis' experiment, each of 14 Brooklyn College students performed 18 heterogeneous tasks¹ jointly with another student who acted as planted co-worker. The stooge had procured the subjects by asking them "to come and help her do some work" for her boss. All tasks were begun jointly, but



Vignette of "2 Beren Snackbar", Zeestraat 58, The Hague, by kind permission of the owner.

were completed either by the subject or the co-worker alone. This variable was manipulated by the co-worker, without disrupting a smoothly running, co-operative work situation very much. As hypothesized, no significant

¹ The names of these tasks were presented by Alper & Black (1949) on a checklist to 70 Harvard and Radcliffe undergraduates. The instructions read in short: "If you were asked to finish each of these tasks within a specified time limit, would you consider it a reflection on your intelligence if you were unable to complete them within the specified time limit?" (p. 297). The frequency distribution demonstrated that the 18 tasks were not equally acceptable as intelligence-test tasks to the subjects. The three most frequently checked items were: solving anagrams, adding up numbers, and rearranging words into meaningful sentences.

difference ¹ was obtained between recall of self-completed tasks and those completed by the co-operating partner ².

A differentiation between routine, "division-of-labor" tasks, and non-routine, "exchange-of-ideas" tasks did not lead to a significant difference in recall scores ³, although Lewis gave a rather lengthy interpretation of such a difference.

*Compare: *Lewis & Franklin (1944); *Alper (1946b); and sections 2.9 and 5.1.1.*

Four additional experiments, ramifying from *Lewis's (1944) results, were reported by LEWIS & FRANKLIN. First of all Zeigarnik's results were checked, using 24 Brooklyn students and Lewis's 18 tasks. Half the subjects received an explicit test-of-the-tasks instruction. They recalled predominantly uncompleted tasks ⁴. The instruction to the other half of the subjects read: "I have some tasks here which I should like to have you do. Please work any way you like. This is in preparation for some experiments I want to perform next semester. This is a kind of preliminary" (p. 196). In this case, the subjects recalled many more completed than uncompleted items ⁵. The interpretation was in terms of ego-enhancement, which was partly ascribed to the experimental instructions and partly to "the strong system of reward for personal achievement in which Brooklyn College students have for the most part been bred" (p. 199). *Nevertheless, the result is remarkable for two reasons. Firstly, the shorter instruction resembles Zeigarnik's much more closely than does the explicit test-of-the-tasks instruction ⁶. And secondly, according to a remark of Brown's, the emphasis on achievement was probably not of less importance for the Berlin students in the 'twenties ⁷ than for Lewis & Franklin's Brooklyn students.*

¹ An experimental hypothesis which is identical to the null hypothesis cannot be "proved". If the data do not lead to a rejection of H_0 at a chosen level of significance, it does not mean that H_0 may be accepted, as nothing is known about the probability of a Type II error. In Lewis's case, however, where 8 of the 14 subjects recalled tasks which they themselves completed and tasks completed by the co-worker in equal numbers, it seems quite safe (though illicit) to accept the hypothesis of no difference. See on this problem, e.g., Wilson & Miller (1964).

² Wilcoxon matched-pairs signed-ranks test: $T_+ = 6.5$; $T_- = 14.5$; $T_v = 8$; $n = 6$; $P > .44$.

³ Wilcoxon two-sample test: $W = 42$; $m = 12$; $n = 6$; $P = .20$.

⁴ Wilcoxon matched-pairs signed-ranks test: $T_+ = 55$; $T_- = 0$; $n = 10$; $P = .002$.

⁵ $T_+ = 0$; $T_- = 66$; $n = 11$; $P = .001$.

⁶ Cf. Osgood (1953, p. 586).

⁷ "Die Studenten der Berliner Universität pflegen sich sehr für die akademische Arbeit und das Vorwärtkommen in ihren Studium einzusetzen" (*Brown 1933, p. 7-8).

To check whether co-operative work prevented the assumption of responsibility for any particular task, both the subject and the co-worker, working together in a third experiment, were interrupted by a teacher. Half the tasks were left incomplete in this way. Although the 11 subjects recalled more uncompleted than completed items, the difference is not quite statistically significant ¹.

The last experiment was designed to show what effect objective completion by another agent in a non-co-operative situation would have on recall of the tasks. The interrupted tasks were completed by the experimenter while the subject ($n = 23$) watched. Thus all tasks were objectively completed. More interrupted tasks were recalled under these conditions ².

A comparison of the four experiments revealed the following order with regard to the relative majority of uncompleted to completed items in recall: working alone under task-orientation, co-operative work interrupted by an authority, all tasks completed in a non-co-operative situation, half the tasks completed by a co-operating partner ³. Lewis & Franklin stated that these experiments "offer support to the thesis that man's motivation in work is often a direct function of the requirements of the task he has undertaken. ... The goal is reached when the task is done; the agency of doing need not be the self" (p. 214).

Compare: *Baltimore *et al.* (1953); and sections 2.9 and 6.1.4.

In order to determine relative recall under normal waking, and under hypnotic conditions, ROSENTHAL used the interrupted task technique to induce success and failure. Subjects were 13 Princeton undergraduates, susceptible to hypnosis. Under normal waking conditions, failure items were recalled less well than success items, while under hypnosis, both types of items were recalled equally well.

Compare: *Brenman (1947); *Fuchs (1954); *Hilgard & Hommel (1961); *O'Connell (1966).

1945

*Rosenzweig's (1933*b*) experiment on repetition preference performed with crippled children, was replicated by ROSENZWEIG with 70 normal children

¹ $T_+ = 44.5$; $T_- = 10.5$; $T_v = 34$; $n = 10$; $P > .08$.

² $T_+ = 178$; $T_- = 53$; $T_v = 125$; $n = 21$; $P < .05$.

³ Whitney's extension of the U -statistic applied twice: $\rho = .57$; $u = +.92$; $v = -.94$; $P < .01$ and $\rho = .34$; $u = +.94$; $v = -2.65$; $P < .05$.

(from Worcester, Mass.), of 4 to 14 years old, in 1945. The main result of the previous study was substantiated: the younger children preferred to repeat successes, and the older children chose to repeat the puzzles they had failed to complete. The same tendency was observed in a small group ($n = 12$) of mentally deficient children.

Another group of 36 normal children ("younger" ones, 5 to 7 years old) was not asked for their preferences but was left alone instead. During the absence of the experimenter 17 subjects repeated the success-puzzle, 9 resumed the failure-puzzle, and 10 did not work on either puzzle.

Compare: *Katz (1938); *Bialer & Cromwell (1960); *Crandall & Rabson (1960); *Spradlin (1960); *Bialer (1961); *Miller (1961); *Stedman (1962); *Butterfield (1963; 1965); and sections 2.4 and 2.6.

1946

In the first of two reports on the data given by ten male undergraduates (from Harvard), ALPER (1946*b*) stated that her intention had been to test the hypothesis that "in a given sample of subjects, unselected for personality factors, there will be no statistically significant differences between the incidental recall of completed and incompleting tasks" (p. 405-406)¹. The tasks consisted of assembling scrambled phrases into meaningful sentences. Some tasks were unsolvable and some allowed for more than one correct solution. The subjects were told to look for alternative solutions until the given time was up. Selective recall as given by the same subjects was studied in two different psychological contexts. First in a friendly, informal situation (testing the tasks) and, a week later, in a situation designed to threaten self-esteem (intelligence test; presence of two stooges: an attractive girl, and a boy who triumphantly announced the many correct solutions he found). The time between the sentence series and recall was either 10 or 15 min, and was occupied by drawing and/or a projective test.

The conditions threatening self-esteem were found to be less favorable for productivity (fewer solutions were given) and for RU + RC than the informal conditions. No significant differences were obtained between uncompleted and completed items recalled both in the informal session and in the session threatening self-esteem; nor were there significant differences be-

¹ As was already stated (in the section on *Lewis 1944), the null hypothesis cannot be proved. Moreover, by working with a small sample, H_0 would be very easily "proven". With $n = 10$ and $\alpha = .05$ the Type II error must be very great (cf. Van Bergen & Koekebakker 1959, p. 92).

tween the two sessions with regard to recall difference scores.¹ The direction of the selective recall, though not significant, is contrary to *Rosenzweig's (1943) results. Alper argued that "the direction of recall is dynamically related to the self-esteem needs of the individual" (p. 417). An elaboration based on the correlation between personality data and selective recall is given by *Alper (1948).

*A few remarks concerning Alper's experimental design should be made. Firstly, all completed tasks (giving one solution) may have remained subjectively uncompleted through reason of the instruction to search for alternative solutions. Secondly, the interpolation of other activities lasting ten or more minutes between the task series and recall, lowered the relative priority of the uncompleted items in recall in Zeigarnik's (1927, p. 74-77) study. Thirdly, it is possibly easier to recall a meaningful sentence (completed task) than a collection of unconnected words or merely some of these words. Fourthly, it may be doubted whether a homogeneous task series is very well suited for studies on selective recall (Birenbaum 1930, p. 229-232), as no significant differences in recall between uncompleted and completed jigsaw puzzles were obtained by *Rosenzweig & Mason (1934), *Rosenzweig (1943), and *Trowbridge (1938). Only *Pachauri (1935b) found a difference (naming strings of objects). It should be noted that, according to earlier studies, all four factors tend to counteract a priority of uncompleted tasks in recall.*

*Compare: *Black (1947); *Alper (1948; 1952; 1957); *Glixman (1948; 1949); *Eriksen (1952a); Rosenzweig (1952); *Zolik (1955); and section 6.1.6.*

SANFORD² replicated *Rosenzweig & Mason's (1934) experiment with 49 normal children of 7 to 15 years old. 2½ years later he presented a different set of puzzles to 26 of the same subjects. In both experiments, a slight and non-significant majority³ of the children recalled more completed than uncompleted puzzles. There was a tendency to recall relatively more failures both with increasing chronological and increasing mental age. Furthermore, an association between self-criticism and the recall of a relatively greater number of failures was obtained. *The association between recall and the*

¹ Wilcoxon matched-pairs signed-ranks test. Informal session: $T_+ = 16$; $T_- = 39$; $T_v = 23$; $n = 10$; $P = .28$. Session threatening self-esteem: $T_+ = 17$; $T_- = 11$; $T_v = 6$; $n = 7$; $P = .69$. Difference between informal session and session threatening self-esteem: $T_+ = 11$; $T_- = 44$; $T_v = 33$; $n = 10$; $P = .11$.

² Abstract of this study: Sanford, Adkins, Miller & Cobb (1943, p. 314-315).

³ Binomial test: $P = .18$.

tendency to continue was, however, not clear-cut (although Sanford stated that it was), and was based on only part of the data. He concluded “that the tendency to recall failures better than successes is an expression of the age-linked factor of ego strength – and that forgetting failures is preëminently a childish mode of defense” (p. 234). This conclusion, the reverse of that reached by *Rosenzweig & Mason (1934), was also presented as part of the criticism of *Rosenzweig & Mason’s interpretations.

*Compare: *Sanford & Risser (1948); and section 2.6.*

1947

In a study on selective reminiscence, BLACK gave half of her 36 Harvard and Radcliffe subjects task-oriented instructions; the other half were given ego-oriented instructions (intelligence test to eliminate students because of overcrowding). Written recall was required immediately and half an hour later; immediately and one day later; and immediately and one week later. The material consisted of rearranging twelve sentences¹, each of which had several solutions (taken from *Alper 1946*b*). If a subject could not complete a sentence that was to be finished, the experimenter helped. Subjects working under both task orientation and ego orientation recalled significantly more completed tasks (in immediate recall)². Delayed selective recall did not differ much from immediate selective recall for any of the breakdowns³. As no statistical differences between the orientation groups were obtained on the Psychological Insight Test, Black supposed that the experimental instructions had not induced two really different attitudes toward the situation⁴.

BRENMAN found that subjects who had performed a series of completed and interrupted tasks while in a state of deep hypnosis followed by amnesia, preferred to perform completed tasks when asked for their preference in the normal waking state. The result was interpreted by assuming that a more central need, i.e. the need to please or obey the experimenter, would have

¹ The choice of material was based on a study by Alper & Black (1949).

² This finding differs from *Alper’s (1946*b*) non-significant results. Wilcoxon matched-pairs signed-ranks test. Task orientation: $T_v = 60$; $n = 12$; $P = .02$; ego orientation: $T_v = 111$; $n = 15$; $P = .0005$.

³ Different results on reminiscence experiments were obtained by *Martin (1940): immediate recall $RU > RC$ (significant); delayed recall $RU > RC$ (partly non-significant).

⁴ Task-oriented and ego-oriented instructions need not necessarily arouse task involvement respectively ego involvement (Alper 1946*a*).

drowned the quasi-needs to finish the tasks. If so, the subject under hypnosis would regard the interruption as a prohibition, and his preference for the completed tasks could be regarded as a wish to avoid the "taboo" activities. "It was assumed that if this hypothesis were correct, a *severe* prohibition to continue with a task even in the normal state should have a roughly similar result" (p. 230). Accordingly, control experiments were conducted with two groups of college students (from Kansas) in the normal waking state. The interruption was either mild and friendly or severe and slightly threatening (prohibitive). Recall and preference ratings were required. The subjects of both groups combined a preference for completed activities with a superior recall of interrupted tasks ¹. *No difference was found between the results of the two groups* ², despite Brenman's suggestion that the hypothesis was verified by the data.

Compare: *McKinnon (1933); *Rosenzweig & Mason (1934); *Rosenthal (1944); *Fuchs (1954); *Coopersmith (1960); *Hilgard & Hommel (1961); *Butterfield (1963; 1965); *O'Connell (1966).

With the idea of a dual effect of substitute activity on the tendency to resume (drive reduction: no resumption, and reinforcement: resumption) as a starting-point, CHILD & GROSSLIGHT designed an experiment which they performed on 117 feeble-minded children (8 to 18 years old). Two types of substitute activity were introduced: a similar-goal substitute and a similar-act substitute. A control activity with no relation to the original activity was also used. The choice of these activities was based on the following reflections: "Reduction of the drives which would lead to resumption should be produced to the extent that the goals of the original activity are attained in the substitute activity. Increased anticipation of success in the original activity should be produced to the extent that the instrumental acts of the original activity are performed in the substitute activity and there lead to some kind of success" (reinforcement of original activity) (p. 229). "It was [thus] predicted that in comparison with a group engaging in the control activity, a group engaging in the similar-goal substitute would show a decreased tendency and a group engaging in the similar-act substitute would show an increased tendency, to resume the original activity" (p. 230). The

¹ Although the latter not significantly so: Wilcoxon matched-pairs signed-ranks test: $T_+ = 30$; $T_- = 6$; $T_v = 24$; $n = 8$; $P = .11$ (mild interruption); $T_+ = 25$; $T_- = 3$; $T_v = 22$; $n = 7$; $P = .08$ (prohibitive interruption).

² Wilcoxon two-sample test: $W = 57$; $n = 7$; $m = 9$; $P = .80$ (recall); $W = 52$; $P = .61$ (preference).

number of resumptions were not, however, significantly different for the three groups: similar-act group 68%, both of the other groups 49%.

Compare: *Mahler (1933); *Nowlis (1941); and section 2.7.

NUTTIN used a design inspired by Zeigarnik to examine whether task-tension as such (without the modifying effect of success) has any influence on the strength of connections. He compared a system of persisting task-tension (unfinished task) with a system in which the tension was discharged (finished task). Embodied in both systems were pairs of words that might differ in strength of connection. In individual experiments 71 Flemish school boys were given an interesting short story in French which they had to translate into Dutch. If there were words they did not know they had to ask for the translation. The text contained 5 or 6 words the subjects could not have known. For half the subjects the translation was interrupted three lines before the end, so that they did not know how the story ended. The other half of the subjects finished the whole translation. After a five minutes' interval, which was spent in manual work, each subject was required to translate the words he had previously not known. The subjects whose task was interrupted gave significantly more correct translations than the boys who had finished the whole text (the data are given in detail in *Nuttin 1953, p. 349). It should be noted that no task-tension was attached to the pairs of words themselves, as the subjects did not need them in order to finish their work.

Nuttin concluded that the connections embodied in a system of persisting task-tension are more strongly established than the connections in a system in which tension has been discharged.

1948

ALPER's second report was based, even more than her first (*Alper 1946b), on the premise "that the direction of selective recall is a function not so much of the objective fact of completion or incompleteness of the task ... as of the personality structure of the individual" (p. 104). A detailed analysis of the personality data of the ten subjects, based on a forty-hour laboratory study, was given. Two major patterns of selective recall were isolated. The first, the strong ego pattern¹, included those subjects "who recall a preponderance of

¹ Ego strength was described by Alper as "to know what one wants to do and has the capacity realistically to do, and to do it" (p. 114). Referring to an unpublished paper by Murray, she quoted: "Ego-Strength manifests itself chiefly as a successful Achievement, giving proof of the power to persist" (p. 114). Cf. Levine (1955, p. 123).

incompleted tasks when self-esteem is not objectively threatened and a preponderance of completed tasks when self-esteem is objectively threatened" (p. 130). They had a high frustration-tolerance for failure. The second pattern, the weak ego pattern, was the reverse of the first. It consisted of "the recall of a preponderance of completed tasks when there is no objective threat to self-esteem but of incompleted tasks when such threat is experimentally induced" (p. 131). These subjects had a low frustration-tolerance for failure, and seemed to be able to protect their self-esteem only when the threat was not objectively present. Under stress they broke down and recalled failures.

Compare: *Atkinson (1953); *Eriksen (1954); *Jourard (1954); *Alper (1957); *Lowe (1961); and section 2.5.

In the instructor's manual of their laboratory manual, MCKINNON & HENLE emphasize the balance between good rapport with the subject and firm control on the part of the experimenter in a Zeigarnik study "since the success of the experiment depends upon it" (p. 10). The results obtained by 23 student experimenters do not significantly favor the uncompleted tasks in recall¹.

SANFORD & RISSER presented an extension of *Sanford's (1946) experiment. Apart from jigsaw puzzles, Sanford also worked with a series of words (instruction: rhyming as rapidly as possible). Success/failure was induced by telling the subjects (9–15 years old) that the number of rhyming words they had named was 1, 2, or 3 above/below average. 15 subjects did the rhymes only, 26 subjects rhymes and puzzles in one session (see *Sanford 1946). Recall was required at the end of both task series. In both rhyming experiments, a negligible majority² of the subjects recalled more failures than successes. The direction³ of this result was different from that of the puzzles. This difference⁴ was interpreted by assuming a mental completion in the case of the rhyme words, which would not be possible with the puzzles.

Risser designed an experiment on identification. He had as subjects 25 mothers who performed design-puzzles in their own homes, in the presence of their 11 to 13-year-old daughters. Most of the mothers took their failures

¹ Binomial test: $P = .19$.

² Binomial test: $P > .42$.

³ The tendency for the puzzles is also non-significant: $P = .17$.

⁴ There is no significant difference in selective recall between rhymes and puzzles. Fisher's exact probability test: $P > .10$.

(unfinished designs) very hard, and so did many of the daughters. Other daughters just bounced happily up and down in their seats on seeing their mothers fail. The tenseness of the situation was such that one mother, e.g., slapped her daughter. The mothers recalled significantly more successes than failures ¹, a difference which had vanished almost completely when recall was again required four months later. The daughters, however, did not recall significantly more of their mothers' successes than failures ².

Sanford & Risser concluded that their "two experiments together seem to support the proposition that ... self-defensive forgetting is most likely to occur when the need to regain self-respect is maximal and when the possibilities of accomplishing this by constructive striving are minimal" (p. 260).

*Compare: *Baltimore et al. (1953).*

1949

GILMORE reported an experiment in which 258 subjects (students) at the end of the task series (the uncompleted tasks were unsolvable) "judged the test as a whole as having one of three purposes, with more or less ego involvement" (p. 386). In immediate recall no difference between the three groups was noted. At the end of three weeks, subjects who had interpreted the test as having little personal significance recalled significantly more completed than uncompleted tasks, while the subjects who interpreted the situation as an intelligence test recalled evenly (at both times). *For contradictory results see *Gilmore (1954).*

The purpose of GLIXMAN's experiment was to determine the effects of increasing threat to self-esteem on recall of completed and uncompleted activities. Two hypotheses were formulated: "The recall of incompleted activities will decrease as the stress is increased", and "The recall of completed activities will increase as the stress is increased" (p. 285). 120 students from an introductory course in psychology at the University of California were the (involuntary) subjects. Three situations, representing a continuum of stress, were created. The experimental instructions ranged from a statement expressing the experimenter's interest in the tasks to one which presented the task as a test for weeding out unsuccessful students. Subjects in the high-stress situations recalled significantly less uncompleted activities than sub-

¹ $P = .04$.

² $P = .33$.

jects in the low-stress situation. With regard to recall of the completed tasks no significant differences were obtained. The results remained the same with or without the interpolation of a 15 minutes' resumption and repetition period.

In another publication, Glixman (1948) compared three experiments in which the effect of threat to self-esteem upon recall was studied, viz., *Rosenzweig (1943), *Alper (1946*b*), and *Glixman (1949). All three were designed in much the same manner to answer the same question, but yielded three different answers, he said. He therefore re-analyzed the first two studies in a manner analogous to that in which he had analyzed his own, i.e., by means of intersession comparisons. His objection to an intrasession measure was that changes in it may come about by a change in recall of the uncompleted tasks, by a change in the recall of the completed tasks, or by both. The recall difference scores which Glixman – for comparison purposes – computed from his own data, only demonstrated small differences between recall of uncompleted and completed tasks within each of the three sessions, and small and inconsistent differences between the three stress situations.

The result of Glixman's re-analysis ¹ was:

“Recall of incompleting activities as stress increases:
 Rosenzweig: Non-significant decrease ...
 Alper: Near-significant decrease ...
 Glixman: *Significant decrease* ...
 Recall of completed activities as stress increases:
 Rosenzweig: Near-significant increase ...
 Alper: *Significant decrease* ...
 Glixman: Non-significant decrease ...” (p. 504).

Glixman attempted to reconcile the results despite the differences between them. Firstly, between those of Alper and his own: he suggested that because of the plurality of possible solutions with Alper's sentence tasks, the completed tasks represented failures to the subjects. Secondly, Rosenzweig's stress situation was less threatening than Glixman's, who therefore advanced the following hypothesis: “... as stress increases through the lower part of a stress scale, there is an increase in recall of completed tasks; as stress continues to increase, this compensatory reaction disappears and there appears a decrease in recall of incompleting tasks” (p. 505).

¹ It is amazing that Glixman, in re-analyzing Rosenzweig's data, copied the mistakes of one of *Rosenzweig's (1943, p. 69) tables and text (Glixman 1948, p. 494) without a check: 17 should read 16, and 8 should read 9.

Glixman's two papers initiated quite a discussion on the adequacy of recall of interrupted tasks as a measuring device. Sears (1950) pointed out the contradictory results of several studies and, relying heavily on *Glixman's (1948; 1949) analysis of the data, seriously questioned the validity of the interruption technique as a device for ensuring feelings of failure. "... this cumbersome method introduces an additional variable – the Zeigarnik effect – that is already known to influence recall, the very process that serves as the dependent variable in the experiments. ... When a research operation requires as much discussion of its 'psychological meaning' as interruption does, it is time to find a new operation" (Sears 1950, p. 113). Similar remarks, albeit less extreme, were made by Cameron (1950, p. 194)¹.

In 1952 Alper produced a defence against the attacks made by *Glixman (1948; 1949), Sears (1950) and Cameron (1950), and pointed out that neither the hypotheses nor the experimental designs of the three experiments in question (*Rosenzweig 1943; *Alper 1946*b*; *Glixman 1949) were the same. Analyzing Rosenzweig's two and Glixman's three experimental situations separately, she did not find a significant difference between the recall of uncompleted and completed items within each of them. She then concluded: "Thus, the intrasession analysis of Rosenzweig's, Alper's and Glixman's group data yields *identical*, not diverse selective recall data!" (Alper 1952, p. 81). Her preference for an intrasession measurement and rejection of inter-session comparisons are based upon the "psychological interdependence of completion and incompleteness which the interrupted task method imposes on" the subject (Alper 1952, p. 82).

Rosenzweig (1952), in his turn, followed with a reply to Alper (1952). He found it "... difficult to see why anyone should expect similar results, let alone identical ones, from three experimental situations as widely different as those of Alper [1946*b*], Glixman [1948] and Rosenzweig [1943]" (Rosenzweig 1952, p. 344). He agreed with Alper that intrasession measures of recall are essential. In defending the relation of maturity to ego-defensive repression as stated by *Rosenzweig & Mason (1934), he wrote: "The only point to which my original study was directed in its bearing on repression concerned the stage at which the ego of the child might be sufficiently developed to be wounded by experiences of failure in the particular competition involved" (Rosenzweig 1952, p. 342).

Compare: *Eriksen (1952*b*); *Forrest (1959); and section 2.4.

¹ In spite of these discussions it was stated in a publication of 1951 (Thomae, p. 21) that hardly any attention was paid to Rosenzweig's studies.

In trying to avoid the confusing connection between interruption and failure, KENDLER permitted her 22 subjects (freshmen and sophomores from Iowa) to complete all the jigsaw puzzles, which were presented as an intelligence test. After each task the score was announced, in order to ensure that the subjects experienced success after half the puzzles and failure after the other half. Significantly more successes than failures were recalled. The purpose of the study, to demonstrate repression (inhibition of recall), was, however, not realized. A comparison with a control group of ten subjects (where no success-failure induction took place) did not reveal a significant decrease of recall through the failure induction. On the other hand, it was shown that the success induction significantly increased recall.

Compare: *Taylor (1953); *Junker (1960).

TORREY, who attempted “to study ‘motivated’ behavior, not from the point of view of specific and relatively separate ‘drives’ or ‘needs’, but from the side of the structure of the subject’s own psychological field” (p. 192), worked within the realm of classical Gestalt psychology. Her intention was “to demonstrate that if ‘gestaltedness’ in a figure is a significant variable in how readily it is perceived as a unified figure, then ‘gestaltedness’ in a cognitive structure should be significant in the production of tension” (p. 193). “If a task, including all the kinesthetic, visual, and tactual perceptions that go with performing it, can be thought of as analogous to a visual pattern, then a well-patterned task, one which has a definite ending with steps leading logically to it, should have a tendency to complete itself. If the activity of completing it is interrupted, the structure should ‘cry out’ for completion somehow and the objective lack of closure should be a source of tension whose release would consist in the completion of the task” (p. 194).

Pairs of tasks, consisting of one “good” Gestalt ¹ and one formless task, were presented to 33 college sophomores at the University of California. All tasks were interrupted, with the exception of a few dummy ones. After the task series, the order of which was determined by the subjects themselves, the experimenter left for 15 minutes, allowing the subjects to do whatever they liked. 15 subjects did not resume any tasks. Of the 18 subjects who resumed one or more tasks, 16 resumed a “good” task first ². Because of the small number of tasks (six), recall was almost perfect. Therefore the order of recall within each pair of tasks was used as a recall measure. Of the 33 sub-

¹ For a comment on the concept of the “good Gestalt” see, e.g., Eysenck (1942).

² Binomial test: $P = .002$.

jects, 27 listed more “good” tasks first¹. Torrey concluded from the data “that behavior can be initiated, i.e., ‘motivated’, by structural characteristics in the stimulus” (p. 202). However, she also admitted that resumption is a function of *more* than visual stimulation by an unfinished task alone: “Perhaps the well-formulated plan of how the task shall be done is the most important additional aspect of the task actually begun *by* the subject” (p. 203).

Compare: *Harrower (1933); *Henle & Aull (1953); and sections 2.3 and 6.2.5.

1950

In BALER’s Ph. D. thesis, memory of completed and uncompleted tasks was related to personal values. Subjects were 60 students from Boston University whose results showed an important difference between two value scores on the Allport-Vernon *Study of Values* (1931). The tasks consisted of 24 reading selections, half of which were related to the subject’s higher value and half to his lower value. High value selections were recalled significantly better than low value selections, and completed tasks were recalled significantly better than uncompleted tasks. Of the two independent variables, the value variable was said to be the more important², *although it is not significantly so*³. Order of recall was reflected in the value variable (high-value selections first) but not in the completion/incompletion variable. Baler did not obtain a significant interaction (by means of analysis of variance) between the two variables. *However, if the high-low value breakdown is made and recall difference scores are used, it is found that within the low value selections completed items were recalled significantly better than uncompleted ones*⁴. *The difference within the high value selections was negligible*⁵.

Compare: *Walsh (1942).

DANCKER’s purpose was to study the effect of dystrophia on a person’s needs and activity. Her subjects were 21 East-German patients whose clinical

¹ $P = .0003$.

² Baler demonstrated this conclusion only by pointing out that the P -value for value was smaller than that for completion/incompletion. This, however, does not show whether the difference is significant or not.

³ Sign test: $x = 16$; $n = 44$; $P = .10$.

⁴ $x = 12$; $n = 46$; $P = .002$.

⁵ $x = 20$; $n = 48$; $P = .31$.

diagnosis read: protein deficiency, oedema, and hypotonia. The experimental results, obtained in a situation closely similar to Zeigarnik's first experiment, show a highly significant priority of completed tasks in recall. A control group of ten healthy subjects recalled predominantly uncompleted tasks. Dancker, observing that these scores were somewhat lower¹ than Zeigarnik's, pointed to man's better physical condition in the years 1924-1926, when food was not being rationed.

In contrast to the healthy subjects, the dystrophics tended to persevere in their work on the tasks, especially with the manual tasks. *However, this tendency to continue was only demonstrated for one task (and, rarely, for two) per subject.* The patients seemed to be rather indifferent to the rest of the tasks. The healthy control subjects, on the other hand, demonstrated feelings of satiation, and sometimes refused to finish a special task.

Dancker interpreted the results of the dystrophics by reminding us that they are continuously occupied with the all-important unsatisfied need for food, a psychic field in which only weak quasi-needs, and a tension system with thin boundaries can be established.

The assumption that common motivational principles govern perceptual response and retention led POSTMAN & SOLOMON to predict differences in the speed with which stimuli representing completed and uncompleted tasks are recognized when presented under threshold conditions. Ten seven-letter anagrams were presented to 18 Harvard students; approximately half the anagrams were completed. Because of a subsequent tachistoscopic recognition experiment, it was necessary for the subjects to know the solution of each of the anagrams. All solutions were therefore announced by the experimenter.

For the group as a whole there was no significant difference in recognition thresholds for completed and uncompleted tasks. However, ten subjects showed a significant (and four subjects a near-significant) difference of sensitivity in favor of either one or the other. "There is every reason to suppose that, as in memory, so in perceptual recognition, the direction of the difference depends on the subject's habitual ways of 'handling' his successes and failures" (p. 356-357).

*However, *Rosenzweig & Sarason (1942) obtained a low and even negative correlation between recognition and recall (a word-hunt test was used).*

*Compare: *Gurnee, Witzeman & Heller (1940); *McAllister (1952).*

¹ The difference, however, is far from significant: Wilcoxon two-sample test: $z = .58$; $P = .56$.

1951

BOGUSLAVSKY attacked Zeigarnik's methodology and her theoretical interpretations from a behavioristic point of view. He especially emphasized "that the effects of interruption are not limited to the task which is interrupted, but may extend to any activity which immediately follows interruption" (p. 249). The combination of Guthrie's (1935) principle that learning takes place when a stimulus occurs in close contiguity with a movement, and *Freeman's (1930) finding that muscular tension increases at interruption, led Boguslavsky to postulate that "the probability of a task's occurrence in recall is a direct linear function of the amount of movement-produced stimulation associated with the task" (p. 249).

In an experiment by Boguslavsky & Guthrie¹ with 80 college students as subjects, the interruption of a task was simultaneous with the presentation of a new task, to which the subject responded at once. This was effectuated by printing the task instructions at the top of the sheet of each paper and pencil test. It was predicted, firstly, that tasks preceded by interruption would be recalled more frequently than tasks preceded by completion (because of a higher amount of movement-produced stimulation); and secondly, that completed tasks would be recalled more frequently than interrupted ones because of the difference in duration (32, respectively 24 seconds). Only the first hypothesis was verified by the data ($P = .03$), the second one fell short of significance ($P = .23$).

The experimental situation of a second study by Boguslavsky & Guthrie with 40 students as subjects differed from the first in that the subjects failed to respond to the new task immediately. This was accomplished by giving oral instead of written instructions with the paper and pencil tasks, so that a readjustment from visual to auditory stimulation was required of the subjects. "Thus stimuli resulting from interruption are associated only in part with the new task, since the subject is engaged in something else while the incidence of stimulation is at its peak" (p. 251). Two hypotheses were derived from the postulates. Firstly, "tasks preceded by interruption should occur *less* frequently in recall than tasks preceded by completion" (p. 252); and secondly, a priority of completed tasks was predicted. The differences were in the predicted directions, though not significantly so². With regard

¹ Abstract of this study: Boguslavsky & Guthrie (1941).

² Wilcoxon matched-pairs signed-ranks test. First experiment: $T_+ = 91$; $T_- = 99$; $T_v = 8$; $n = 19$ (tasks); $P = .89$. Second experiment: $T_+ = 50$; $T_- = 121$; $T_v = 71$; $n = 18$ (tasks); $P = .13$.

to the influence of completion or interruption of the preceding task on recall, it should be noted that "contrasting results [between the first and the second experiment] were obtained merely through variation in the sense modality of instructions" (p. 254).

Zeigarnik's main experiment was re-analyzed in the same way: "Interruption of a task fails to terminate the subject's preoccupation with it, and the presentation of a new task occurs some time after the termination of interrupted activity"¹ (p. 253). A significant difference in recall between tasks preceded by completion and tasks preceded by interruption was neither expected nor obtained.

Compare: *Bolin (1952); *McAllister (1952); *Smith (1953); *Forrest (1959); *Horwitz, Glass & Niyekawa (1964); and section 2.7.

Next to the factor RU/RC, the most important factor in DE MONCHAUX's² four-factor design was that of isolation/crowding of U-items, respectively C-items, within a series of tasks. The hypothesis that, within the same series, isolated items are recalled more frequently than crowded items, was taken from Von Restorff (1933). The other factors were the sequence of U- and C-presentations (the tasks themselves were given positions randomly), and the type of experimental design. Analysis of variance was applied to the data.

Subjects were 180 London secondary school boys, 12 to 15 years old, with an I.Q. of 90-110. The task was a "Juggle-Jigsaw" puzzle task; i.e., each separate task consisted of juggling a simple drawing cut into two pieces to its right place on the bottom of a box. The experiments were partly performed with one child, holding the box with two hands (either with or without naming of the items), and partly with two children working as a pair. The latter were instructed to use one hand each. Recall was required after three minutes' interpolation, during which easy pencil mazes were worked on.

When equal numbers of U-tasks and C-tasks were presented, RU was significantly larger than RC for the boys working in pairs, and for the individual children who also named the pictures³. The subjects who were not

¹ The second point is not quite correct, as Zeigarnik interrupted her subjects by presenting the new task with the words "Now do this, please" (Zeigarnik 1927, p. 20). Thus, with regard to task instructions, Zeigarnik's experiment is more or less comparable to Bogulavsky & Guthrie's second experiment.

² Unpublished Ph. D. thesis. The most important result of the study is mentioned by De Monchaux & Keir (1961, p. 130).

³ The results of the author's re-analysis (which are, on the whole, in agreement with De Monchaux's analysis of variance) are given. Wilcoxon matched-pairs signed-ranks test: $T_v = 115$; $n = 18$; $P = .01$ respectively $T_v = 91$; $n = 15$; $P = .01$.

induced to name the pictures obtained a median recall difference score of 0¹.

In the cases where the U-tasks were the isolated items (ratio 5:15) the subjects in all three experimental variations recalled relatively more uncompleted than completed items². However, when the U-tasks were the crowded items (ratio 15:5), the null hypothesis of no difference between RU and RC could not be discarded for any of the three experimental variations³.

Compare: section 5.4.1.

SCHOLZ's East-German study⁴ is mentioned by Ferdinand (1959, p. 465) to illustrate his statement that the Zeigarnik effect is considered one of the exceptionally well-founded facts of experimental psychology⁵.

1952

The results of an unpublished study by BLOOM⁶ are, amongst others, that "subjects who recalled a preponderance of failures tended to increase their motivation on a level of aspiration experiment following failure, while subjects recalling a preponderance of successes lowered their goals following failure" (*Lowe 1961, p. 304). "Subjects who had a balanced recall pattern differed from the extreme groups in ... a more flexible approach to the frustrating situations facing them" (*Lowe 1961, p. 306-307).

Compare: *Uematsu (1956); *Junker (1960).

An experiment performed by BOLIN was intended to determine whether the amount of neuromuscular activity contiguous with the performance of a task is related to recall of the task, whether it varies with interruption and completion of the tasks, and whether the Zeigarnik effect could be reproduced.

Sixteen college students served as subjects. They performed twenty paper

¹ $T_+ = 62.5$; $T_- = 42.5$; $T_v = 20$; $n = 14$; $P > .54$.

² Method of 2×2 comparing of probabilities and combination of 10 independent tests for each subject: $z = 4.85$; $P < .00006$ (pairs); $z = 2.79$; $P = .005$ (naming); $z = 2.09$; $P = .04$ (no naming).

³ $z = 1.14$; $P = .25$ (pairs); $z = .6$; $P = .55$ (naming); $z = .53$; $P = .60$ (no naming).

⁴ As the study had not quite been finished, the unpublished thesis could not be borrowed from the University Library in Jena.

⁵ "Der Zeigarnik-Effekt rechnet zu den besonders gut gesicherten Fakten der experimentellen Psychologie..." (Ferdinand 1959, p. 465).

⁶ Unpublished thesis not available. Reference has been made to it by *Lowe (1961).

and pencil tests while galvanic skin responses (of the inactive hand and arm) were measured. An effort was made to make the subjects feel as much at ease as possible, e.g. by minimizing the psychological aspects of the study, and by positioning the experimenter in a place imperceptible to the subjects.

None of the three hypotheses could be verified by the data: the null hypothesis could not be rejected for any of them. Of the 16 subjects, 11 recalled a preponderance of completed tasks, 4 recalled a preponderance of uncompleted items ¹, and 1 subject recalled evenly.

Compare: *Freeman (1930); *Boguslavsky (1951); *McAllister (1952); *Smith (1953); *Forrest (1959); *Horwitz, Glass & Niyekawa (1964); and section 2.7.

ERIKSEN (1952a) designed an experiment to test the following hypothesis: "In a situation where failure is ego-threatening, individuals who have a high success-to-failure recall ratio will show a greater degree of perceptual defense than will individuals with a low success-to-failure recall ratio" (p. 230). Subjects were 61 male students ² (from Johns Hopkins University). The tasks consisted of assembling 14 scrambled phrases, selected from Alper's (1946b) material. To part of the subjects (experimental group) the experiment was introduced as an intelligence test (with successful stooges scattered throughout the group), and in part of them (control group) task-orientation was induced. *Though there was a difference between the recall difference scores of the two groups, the superiority of RC in the experimental group and the superiority of RU in the control group did not approach an acceptable level of significance* ³. More striking, however, was the finding that the variance of the recall difference scores of the experimental group was more than six times as great as that of the control group.

The 7 subjects who had the highest and the 7 who had the lowest recall difference scores in the experimental group co-operated in an experiment on perceptual defense. The results were that "individuals whose memory for ego-threat is not impaired tend to perceive ego-threatening stimuli as readily as they do nonthreatening stimuli" (p. 234), and that "those who respond to failure-induced ego-threat by forgetting their failures show a similar defense in perception" (p. 234).

¹ Binomial test: $P = .12$.

² Originally 84 subjects were tested. However, 27% of them were discarded "owing to their failure to complete the solvable sentences" (p. 230).

³ By determining confidence intervals of the means.

Compare: *Eriksen (1952*b*); *Lazarus & Longo (1953); *Zolik (1955); *Lowe (1961); and section 2.5.

Expecting "individuals to show consistency in their response to different threatening situations"¹ (p. 442), ERIKSEN (1952*b*) designed an experiment comparable to *Eriksen (1952*a*). The 67 male subjects² predominantly recalled completed sentences, the experimental group significantly more, however, than the control group³. Subjects with the highest and subjects with the lowest recall difference scores (ten of each) were selected for a learning experiment. The results were that subjects "who show evidence of defensive forgetting in the completed-uncompleted task situation are found to require more trials to learn and relearn affective words than neutral words" (p. 445). The other group of ten subjects learned affective words at least as easily as neutral words.

Compare: *Lazarus & Longo (1953); *Forrest (1959); and section 2.5.

FERRADINI's experimental situation is probably more comparable to the Achian studies⁴ (though he does not mention them) than to Zeigarnik's. Simple drawings were shown to 80 subjects (from Milan). When a blue sign was given they had to name them; a red sign meant that they were to remain silent. In immediate as well as delayed recall (up to 24 hours), a preponderance of completed items was recalled. Ferradini interpreted this result in terms of the higher attention value (speech and auditory perceptions in addition to the visual stimulus) of the completed relative to the uncompleted tasks. He therefore interpolated the naming of all the pictures, and then proceeded with 60 subjects by having them either repeat the name or not. The result was that somewhat more uncompleted than completed tasks were recalled.

Compare: *Altea (1955).

¹ Eriksen accepted *Rosenzweig (1943), *Lewis & Franklin (1944), and *Glixman's (1949) conclusion "that under ego involvement *Ss*, as a group, tend to favor completed ... tasks in their recall as opposed to uncompleted ... tasks" (p. 442). This was, however, not found significantly either in Rosenzweig's or in Glixman's experiment. *Rosenzweig (1943) obtained a significant difference between the recall difference scores of subjects under formal and informal conditions, and *Glixman (1949) obtained a significant decrease in the recall of uncompleted activities as stress increased.

² Originally 112 subjects were tested. However, the results of 40% were discarded, "because of failure to complete all of the solvable sentences" (p. 443).

³ By determining confidence intervals for the means.

⁴ *Schlote (1930) and *Sandvoss (1933).

Apart from two kinds of situational instructions (intelligence test versus assistance of the experimenter), HAYS used two forms of interpolated tasks (reading interesting or dull prose material) at the end of each of four experimental tasks. The results of 27 Harvard students indicated that the form of the interpolated tasks had an effect on recall (the degree of precision of the recall was also taken into account). Relatively more completed tasks were recalled when the interpolated prose material was complex. On the other hand, relatively more interrupted tasks were recalled when the interpolated tasks were dull. The difference between the two conditions was significant ($P < .005$). The difference between the two situational instructions was, however, only near significant ($P = .08$).

Compare: *Prentice (1943).

The hypothesis advanced by McALLISTER read that "... covert activity should be reduced to a minimum after completion of a task but should remain on a relatively high level after interruption" (p. 7). Galvanic skin response (GSR), muscle potentials (EMG), and rate of heart beat (EKG) were taken as indices for covert activity. In the first part of the experiment, the activity (consisting of work on anagrams) was announced as being required only for the physiological measurements: the interruptions were announced as rest periods. In the second part of the experiment with the same 18 subjects (college students, of whom 17 male), the speed at which the anagrams were solved was announced as being related to intelligence: interruption meant failure. Three anagrams were finished, three were interrupted and followed by resumption, and three were interrupted without consequent resumption (the solution was given by the experimenter). After seven minutes of relaxation, recognition of the anagrams (exposure time half a second) was required.

No significant differences between the completed and interrupted (both ways) anagrams were obtained either in recognition, or in GSR, EKG and EMG. Nor were significant differences in recognition obtained between the first and the second part of the experiment.

Compare: *Abel (1938); *Postman & Solomon (1950); *Bolin (1952); *Smith (1953); *Forrest (1959); *Horwitz, Glass & Niyekawa (1964); and section 2.7.

NISTRI studied the resumption of interrupted tasks by 63 patients (60 to 87 years old) suffering from arteriosclerosis (in Siena, Italy). 36 subjects did not resume any of the tasks, and none of them completed all three tasks

presented. A replication of Zeigarnik's experiment was not possible with these patients.

Compare: *Altea (1955).

WINDER performed recall and resumption experiments with 70 schizophrenic male patients (from California) as subjects. The paranoid schizophrenics recalled and resumed more interrupted than completed tasks, while the non-paranoid schizophrenics did not display any clearcut preference.

Compare: *Stumbur (1934); *Rickers-Ovsiankina (1937); *Bennett (1942); *Tamkin (1957).

1953

ATKINSON's¹ investigation "was an attempt to determine the effect of strength of achievement motivation on recall of interrupted and completed tasks" (p. 381). Three experimental situations (the first relaxed, the other two with task and achievement orientation) were used in order to vary the perception of success and failure. The results of the 83 male subjects (from the University of Michigan) were divided into two groups on the basis of their *n* Achievement scores. These scores were acquired from the imaginative stories written by the subjects in the period between performance of the tasks and recall². With a single exception (low *n* Achievers, achievement orientation) the subjects in the six breakdowns recalled more uncompleted than completed tasks, albeit, in general, non-significant. The recall scores of the subjects low in *n* Achievement were significantly greater under relaxed than under achievement orientation ($P < .05$), while the opposite was true of subjects high in *n* Achievement ($P < .10$). Under task orientation the scores occupied a middle position. The interpretation read that high *n* Achievers are predominantly success-oriented, while subjects low in *n* Achievement are more concerned with avoiding feelings of failure. In the relaxed situation, the high *n* Achievers did not have the feeling that their personal accomplishment was at stake and were thus disinterested, while the low *n* Achievers were motivated to comply with the experimenter's instructions in a situation that de-emphasized personal achievement.

The divergent results of several interruption studies were discussed in the light of the subjects' volunteering. "Ss who volunteer are characteristically

¹ Atkinson (1951; 1955) is an abstract respectively an adaptation of this study.

² For critical comments on this procedure, see Klinger (1966).

more highly motivated to achieve than a group of randomly selected or drafted Ss" (p. 389).

Atkinson's results were presented in a three-way breakdown in need Achievement scores by McClelland, Atkinson, Clark & Lowell (1953, p. 264-273). The differences observed by Atkinson between the high and the low *n* Achievement group largely consisted in differences between the top third and middle third, while the bottom third did not show a significant trend. In order to clarify enigmatic results such as this McClelland *et al.* (1953) stated that their aim in future would be to compute two separate *n* Achievement scores (one for fear of failure and one for hope of success).

In an attempt to construe such a measure of fear of failure and to avoid the confusion that had arisen through the compound need-Achievement score (fear of failure and hope of success), Moulton (1958) re-analyzed Atkinson's *n* Achievement protocols (imaginative stories) of the achievement and the relaxed orientation ($n = 24$, respectively $n = 27$). Rank correlations were, amongst others, computed between recall difference scores and fear of failure ($-.61$), and hope of success ($+.31$), under achievement orientation. Under relaxed orientation the correlations were around zero.

Compare: *Alper (1948; 1957); *Atkinson & Raphelson (1956); *Götzl (1960); *Green (1963); Atkinson (1964); *Martin & Davidson (1964); *Weiner (1965*b*; 1966*a*); and sections 2.5 and 6.1.7.

The object of the unpublished M. A. thesis by BALTIMORE, DOSCHER, EHRENBERG, KOPP, LERNER & SIMON¹ was to investigate the role of field forces in motivation. They separated the forces arising from the ego from those arising out of the demands of the situation by means of the "observer technique". Of every two subjects, one was asked to function as an observer in an interrupted-task experiment. The observer's instructions were designed to focus attention on the way in which the subject approaches the activities. In this way the observer does not establish tensions in relation to the tasks but, in perceiving what is going on, field forces may influence his behavior.

In a preliminary experiment² with 24 subject-observer pairs no difference whatsoever was found between RU and RC, neither for the observer, nor for the subject³. The interpretation of this result read that several of the

¹ The main results of this study have been published by Henle (1957).

² Tasks that were perceived as failed, instead of interrupted, were eliminated from the calculation by Baltimore *et al.*

³ The results of the two interruption series A and B, which are largely each others' complement, are given separately. It is therefore possible to apply the statistical analysis

observers did not have the proper interested and non-involved observer-attitude¹. They became, e.g., 'romantically interested' in their subjects, developed feelings of competition with them, or resented their own dull work.

In a second experiment, those cases in which the proper observation conditions were not met were eliminated. This amounted to the elimination of 40 pairs out of 70(!). The procedure adopted was that each of the six experimenters reported the circumstances of the experiment and the contents of an interview with the observer to the five other experimenters. "On the basis of this report, and *without knowledge of the results of the test of recall*, the other members of the group decided whether the ... [proper] conditions had been met" (p. 54). The 30 accepted observers recalled predominantly uncompleted tasks², which was taken as an indication of the effect on memory of the perceived requirements of the field. Recall given by the 40 rejected observers showed a non-significant slight preference for completed items³. The subjects' recall scores in either group did not differ significantly from 0⁴.

In a "resumption" experiment with the same type of subjects (varying in age from adolescents to middle-aged persons, and in education from high school seniors to professional people) 35 of 55 pairs were eliminated. 17 of the 20 accepted observers chose the interrupted task to perform for themselves when given a choice of a set of four tasks similar to those the subject had just worked on. None of the eliminated observers, however, chose the interrupted task. This result is again interpreted as being in support of the effect of field forces in motivation.

Compare: section 6.1.5.

CANTER compared the recall difference scores of 44 epileptic patients with those of 45 patients whose seizures were symptoms of psychological maladjustment (males, from Fitzsimons Army Hospital). Jigsaw puzzles were used under intelligence test instructions and recall was required after an interval of 15 minutes. The psychogenic group recalled significantly more successes

designed by Hemelrijk (see section 4.3). Wilcoxon two-sample test (before blocking): $W = 101$; $P > .20$ (observers); $W = 132$; $P > .20$ (subjects).

¹ The attitude required of the onlooker in this study is completely different from the identification assumption in Risser's experiment (*Sanford & Risser 1948).

² $W = 51$; $m = n = 15$; $P < .002$.

³ $W = 175$; $m = 9$; $n = 31$; $P = .10$.

⁴ $P > .20$.

than the epileptics¹, which was taken as an indication of repression in the members of the psychogenic group.

COHEN tried to find evidence of a goal gradient by measuring the frequency of recall of interrupted tasks at various distances from the goal of completion of the tasks. Paper and pencil tasks of four different lengths were given to 40 school children (13 and 14 years old, from Manchester). All tasks were interrupted when the children doing the shortest task had completed about four-fifth of it. For the boys (not for the girls) a goal gradient was observed: the number of recalls increased as the interruption took place nearer the end of the task. Cohen refrained from an interpretation of the difference between the results of the two sexes.

*It should be noted that the results of Zeigarnik (1927), Ovsiankina (1928) and *Katz (1938), with regard to the moment of interruption, are not consistent (although Cohen stated that they are). According to Zeigarnik (1927, p. 56–58), recall is greater if the task is interrupted in the middle or at the end rather than in the beginning. Ovsiankina (1928, p. 328–330), however, reported high resumption both at the beginning and at the end, while the lowest resumption occurred shortly after the middle of the task. And *Katz (1938) found that the lowest resumption occurred when interruption took place near the end of the task, a result which indicates the reverse of a “goal gradient”.*

FATTU & MECH studied the effects of interruption on performance in a “trouble-shooting” situation. The subjects, 27 female students from Indiana University, were required to operate gear-train apparatuses and to locate malfunctions. One-third of the subjects were interrupted in their work immediately after they had perceived the signal that something was wrong with the gear-train, and were required to verbalize their opinions as to where the defect was located. After this they were instructed to search for the defect. Another third of the subjects were allowed to complete each task, i.e. to locate the defect, after which they were required to state how they had decided where the defect was located. The last third of the subjects were not questioned by the experimenter at all. “No differential effects in troubleshooting performance were found that could be attributed to interruption or completion” (p. 163).

HENLE & AULL discussed two possible explanations of the resumption of unfinished tasks as mentioned in literature. First, “the decisive factor for

¹ Kolmogorov-Smirnov two-sample test: $K_D = 17$; $P < .02$.

resumption might be the need tension created when the subject originally undertook to perform the task" (p. 81). Secondly, "resumption might arise primarily from the subject's perception of the incompleteness of the task itself and his recognition that the task requires action" (p. 81). It was pointed out that the first explanation, given by Ovsiankina (1928) and *Adler & Kounin (1939), is inconsistent with the Lewinian theoretical framework (behavior is a function of both person and environment) from which the studies evolved.

In order to determine the meaning of the interrupted and the incomplete task for the subjects, the experiment of *Adler & Kounin (1939) was replicated with 20 kindergarten children (5 and 6 years old, from New Jersey). All the children immediately resumed and completed their own interrupted task. Adler & Kounin's assumption of the psychological identity of the two tasks was, however, challenged by the qualitative data of the replication. "The child, in the course of working with the I-task, gives it a specific meaning or a new function which the U-task lacks" (p. 86). E.g., the task of building a fence around a house acquired the meaning of preventing the dog from running away¹. Other subjects announced a plan of action or indicated that they considered the uncompleted task a model. "The demands of the two activities can thus no longer be considered to be alike" (p. 86), and "the question of what factor is decisive for the resumption of interrupted activities ... is thus reopened" (p. 88).

Compare: *Katz (1938); *Adler (1939); *Baltimore *et al.* (1953).

In order to test the same hypothesis as that of *Eriksen (1952*b*) (consistency of defenses to threat) LAZARUS & LONGO selected from *Eriksen's (1952*a*) subjects those individuals ($n = 9$) who had the highest and those ($n = 15$) who had the lowest recall difference scores. The subjects learned ten pairs of nonsense syllables, half of which were followed by an electric shock. No differences in learning between the two groups of subjects were obtained. After 24 hours, recall and re-learning were required. With regard to recall the difference was significant²: subjects who had remembered their successes best recalled the non-shock syllables most effectively, and subjects who had

¹ Compare the incapacity of the Marquesans to continue work which another man had started. "... a man brought in to finish an uncompleted job would be able to tell where the other builder had left off in the actual construction of the house or canoe, but he would not know what magic had been used or how far the ritual had gone, and therefore would be unable to proceed with the task" (Linton 1939, p. 146).

² Fisher's exact probability test: $P = .006$.

favored the recall of failures gave a corresponding – though non-significant – predominant recall of the shock syllables. Non-significant differences in the same directions were found for re-learning. The conclusion taken from the findings of a difference in recall and no difference in learning, was “that we are dealing with a retroactive defense process such as is assumed in the concept of repression” (p. 498).

Compare: section 2.5.

A replication of NUTTIN's (p. 343–351) experiment of *1947 was performed. Instead of an interval of five minutes between the task and the translation of the six words, an interval ranging from 15 minutes to an hour was inserted, during which books were catalogued for the library. This interval occupation turned out to be so interesting that no significant difference between the results of the interrupted group and the “completed” group was obtained. However, class replications with 48 and 70 boys (15–17 years old) – the tasks had been announced as a promotion trial – resulted in significantly more correct translations for the interrupted groups, after an hours' interval, and even after an interval of 24 hours.

According to Nuttin, constructive development from goal to goal is the most important aspect of human activity. This corresponds to an “open task” attitude (need persistence) which is the most general attitude in daily life. Open tasks possess two characteristics: sanctions referring to the response given (i.e., success or failure), and information referring to the task itself that has to be accomplished (p. 312). Closed tasks, on the other hand, with a definite end point and the abandonment of a certain line of action, are an exception outside the laboratory. Apart from need reduction, they offer no further perspective¹. The activity of normal adults is directed to tasks in which success has not yet been experienced, while a repetition of successes means regression to a non-constructive infantile level.

SCODEL, comparing the personality structures of 29 male ulcer patients of relatively low socio-economic status and 30 male nonpsychosomatic neurotic patients with the same background (both groups in psychotherapy in San Francisco), found that the ulcer patients recalled relatively more completed than uncompleted tasks²), while the (unexpected) slight preference for un-

¹ For a treatise in English on the differential effect of open tasks (with future time perspective) and closed tasks (without future time perspective), see Nuttin (1964).

² $P < .01$, inferred from confidence interval of the mean.

completed tasks of the neurotic patients did not differ significantly from 0.
Compare: *Caron & Wallach (1959).

Within the theoretical context of Hebb's (1949) behaviorism, SMITH studied differences in muscle tension as shown by completed and interrupted mirror-tracing tasks. Subjects were 15 college students and members of the service personnel from an Air Force station. Continuous electromyographic recordings were obtained from five muscle groups (active arm, chin, neck, forehead, passive arm). The subjects remained motionless for a period of one minute preceding and following work. Over-all tension measured during the expectation, task and post period did not differ significantly for interrupted and completed tasks. A comparison of the last 2 sec of drawing, and the 2 sec immediately following, showed that muscle tension fell more after completion than after interruption. The effect was confined to the muscles functionally involved in carrying out the movements, and to the muscles associated most directly with speech. The effect was not due to the unexpectedness of the interruption, because a comparison of the results of the subjects who had been told of the interruption beforehand and those who had not, rather indicated the reverse. With regard to the active arm, "a smooth, progressive increase in tension [was observed], apparently as a function of distance from the goal" (p. 33-34). Furthermore, those subjects "who showed the greatest rise in tension during drawing also showed the greatest tendency to maintain this tension when interrupted" (p. 34). The interpretation is in terms of Hebb's (1949) variable "phase sequence"¹, which is said to be capable of self-maintained action for a few seconds. Smith's aim, to throw light on the question of differential recall by comparing Lewin's tension systems with his (Smith's) muscle tensions, was thoroughly frustrated by the results. "A process which ceases well before the time when recall tests are administered can hardly be a sufficient answer" (p. 36).

Compare: *Freeman (1930); *Boguslavsky (1951); *Bolin (1952); *McAllister (1952); *Forrest (1959); *Horwitz, Glass & Niyekawa (1964); and section 2.7.

To avoid the confusing connection between completion-incompletion and success-failure, TAYLOR had half his 82 student subjects complete all the jigsaw puzzles presented, while the other half did not complete any of the puzzles. Success and failure were induced (each on half the tasks) by means

¹ For Hebb's description of the concept of phase sequence, see section 2.7.

of experimental instructions. The main results were: "Successes were recalled only slightly more frequently than failures ..., completed puzzles were recalled more frequently than incompleting ones. When subjects who recalled a predominance of successes were compared on the clinical tests to those who recalled primarily failures, the number of statistically significant differences obtained were no more than might be expected by chance" (p. 353). However, a difference in total recall was obtained: subjects who recalled few puzzles tended to recall more successes than failures while, on the other hand, subjects who recalled a large number of puzzles tended to recall failures more frequently ($r = -.24$, $P = .05$). Recall of a small number of puzzles was taken as an indication of repression. Another relation was found, viz., "those subjects who expressed positive feeling for the course ($r = -.38$, $P = .05$) and the instructor ($r = -.36$) recalled fewer puzzles. These results suggest a relationship between the liking of an authority figure and the desire to please this individual by avoiding a threat to self-esteem" (p. 354).

Compare: *Kendler (1949); *Steininger (1957).

1954

AZUMA ¹ studied some of the conditions determining the resumption of an interrupted task.

In an experiment aimed at studying the relation between selective recall on the one hand and ego strength, hysteria and psychasthenia on the other hand, ERIKSEN ² probably used the subjects and the recall data from *Eriksen (1952b). Ego strength was defined as "the individual's capacity for appraising the reasonable limits in his interpretations and perceptions of his environment" (p. 46), and measured by judging what were and were not reasonable interpretations of inkblots. Hysteria and psychasthenia were measured by the respective scales in the Minnesota Multiphasic Personality Inventory. The results indicated that "ego strength is directly related to the tendency to recall relatively more incompleting than completed tasks when the situation is not objectively self-esteem threatening, and inversely related to this tendency when the situation does objectively threaten self-esteem" (p. 49-50). In the latter situation, hysteria was inversely related to the recall of relatively more uncompleted tasks (also when scores on the ego-strength scale were partialled

¹ Reference from Umemoto (1959). Azuma's publication could not be procured in time to warrant a discussion in this section.

² Abstract of this study: Eriksen (1952c).

out), while psychasthenia was directly related to the recall of relatively more uncompleted tasks. However, the latter correlation was not significant when the intercorrelation with ego strength was partialled out.

Compare: *Alper (1948; 1957); *Jourard (1954); and section 2.5.

FUCHS studied the functional relation between cognitive and dynamic processes with special reference to the theory of reproduction.

During work on a task – which was either completed or interrupted – a cognitive connection was established between the task and a nonsense syllable. Later this syllable, as one of a row, was presented as an activating stimulus, with the instruction to perform a prescribed activity (changing of syllable) on each. Reaction times and recognition of the critical syllable were used as measurements. In this way the influence of the motivation – when reactivated by the critical syllable – was reflected in the conditioned inhibition of the heterogeneous activity (changing of syllable), even if the reactivated dynamic process did not elicit cognitive reproduction.

To 19 teenagers (from Marburg, Germany) the experiment was one of a series of vocational guidance tests (examination). The nine interrupted subjects demonstrated an extraordinarily high reaction time on the first presentation of the critical syllable, and all of them recognized it from the examination they had performed. The ten vocational guidance subjects who had completed the task, and 20 school children (14–18 years old) who had performed as a favor to the experimenter¹, did not show any significant deviation from the reaction times of the neutral syllables. Moreover, only five of these thirty subjects recognized the critical syllable. An experiment (using two subjects and various suggestions) in which the connection between task and nonsense syllable was established under hypnosis, yielded similar results².

Compare: *Rosenthal (1944); *Brenman (1947); *Hilgard & Hommel (1961); *O'Connell (1966); and section 2.2.

In a study by GILMORE, comparable to *Gilmore (1949), the degree of stress in the experimental situation was determined by each individual subject, not by the experimenter. After recall, the subjects had to check one of three

¹ Ex post facto, on the basis of a post-experimental interview, the data of 5 of the 39 subjects were analyzed as belonging to the other experimental condition (examination₃ or helping the experimenter), even though Fuchs realized that several of the post-experimental remarks might have been rationalizations.

² English translation of the hypnosis experiment: Fuchs (1955).

reasons (timing of the tasks; establishing test norms; intelligence test) for which the tasks had been given. Of the 444 subjects (students of San Jose State College), 129 interpreted the experimental situation as low stress, 171 as median, and 144 as high stress. It was hypothesized that the low stress group would recall more uncompleted than completed tasks, and that the high stress group would recall more successes than failures. The latter part of the hypothesis, stated in Lewinian terms, read: "the failed tasks are isolated from the psychological field and thereby are less available for recall" (p. 360). In all three groups there was a recall preference for successful tasks. The difference between completed and uncompleted tasks recalled was significant except in the low stress group. Gilmore concluded that "with increasing degrees of threat interpretation, Ss demonstrated an increasing recall preference for the successfully completed tasks" (p. 364). *The results are not in agreement with *Gilmore (1949), a report which is not mentioned in the 1954 paper.*

HORWITZ¹ used Zeigarnik's method as a measuring instrument in an experimental study of individual motivation in relation to group goals. Subjects were 18 groups of five girls from sororities at the University of Michigan. The group members worked together on a series of jigsaw puzzles without, however, knowing each other's contribution. The situation was presented as a contest in group co-operativeness between the sororities. In order to avoid losing marks, a subject might sometimes consider it wiser not to complete a particular puzzle. Halfway through the work on each puzzle, therefore, votes were taken as to whether or not the individual member desired the group to complete the task. Work on the puzzles was then either halted, partly completed i.e. interrupted, or fully completed.

The main result was that the interrupted puzzles were recalled better than both the halted and the completed tasks. Whether the halted or the completed puzzles were recalled better depended on the vote cast by the group member. In the case of a "yes" vote (continue with the work) the halted tasks were in the majority, while in the case of a "no" vote the completed tasks were recalled better, though not quite significantly so.

¹ The abridged version in Cartwright & Zander (1953, p. 361-385; 1960, p. 370-394) precludes a full understanding of Horwitz' paper. Not only have essential details been omitted, but the following remark has also been left out: "If, in fact, the subject had an initial tension system to complete each of the various tasks - which assumption, in view of the difficulties of producing the Zeigarnik effect, is always open to question - ..." (Horwitz 1954, p. 6). Abstract of the study: Horowitz [sic!] (1951).

By means of post-experimental open-ended questionnaires, the attitudes towards the group decisions were determined, viz. accepting, acquiescing in, rejecting, and fearing. The less the group decision was accepted by the members, the more puzzles were recalled (except in the case of the fearful attitude).

Furthermore, Horwitz determined whether the individual's vote had been in agreement or disagreement with the group decision. For those subjects who differed from the group less than half of the time, i.e., seven times or less, disagreements were "either about equally recalled or somewhat more frequently recalled than agreements. But where subjects differed on eight occasions, i.e., on over half of the total votes cast, a sharp reversal occurred and the recall of agreements exceeded that of disagreements" (p. 33). Horwitz interpreted this finding by assuming that the last group of subjects lost their task orientation and replaced it with the goal of being in agreement with the group. *However, a difference between a few (seven) and many (eight) disagreements (the point of the sharp reversal in recall) can only be "experienced" after all the votes have been cast!*

*Compare: *Horwitz & Lee (1954); and section 2.9.*

The social psychological experiment by HORWITZ & LEE¹, based on the problem of individual agreement or disagreement with the group, was a continuation of *Horwitz' (1954) study. When the individual member's vote was in agreement with the group decision, the task was considered as a finished task; in case of disagreement the task was assumed to be unfinished. The subjects (8 groups of 5 girls each from sororities at the University of Illinois) also stated at the time of each vote whether they expected the outcome of the group decision to be "continue with the work", or "stop work on this puzzle" (state of decision), or whether they wavered as to the outcome of the group decision and felt it "might turn out either way" (state of indecision). Decided subjects, displaying a goal-directed activity, recalled significantly more disagreement than agreement puzzles. Subjects in a state of indecision, on the other hand, recalled more agreement than disagreement puzzles (near significant). This was interpreted by co-ordinating the state of indecision to a fluid psychological field: "then tension systems will tend to be expressed in a wish-fulfilling manner" (p. 202).

Compare: section 2.9.

¹ Abstract of this study: Horwitz & Lee (1952).

In an experiment with 58 nursing students (from Buffalo) as subjects, in which an atmosphere of stress was induced, JOURARD did not find a difference between recall of completed and uncompleted tasks ($P > .50$). The correlation between selective recall and ego strength (based upon Rorschach factors), was practically zero (.02). A separate analysis of the five different types of tasks used, did not reveal any significant deviation from $RU = RC$ (equal recall). Recall was required twice: firstly after 5 minutes and again after 17 minutes. The correlation in recall difference scores between first and delayed recall was +.62.

Compare: *Alper (1948; 1957); *Eriksen (1954); *Zolik (1955); *Fisher & Cleveland (1956); and section 2.5.

YOKOYAMA & YOKOYAMA¹ studied the effect of stress on the recall of completed and interrupted tasks.

1955

With 50 boys, 6 to 14 years old (from Cagliari, Italy), ALTEA used the experimental resumption situation of *Nistri (1952) and the corrected recall situation of *Ferradini (1952).

All four tasks presented were resumed by 18 boys; 28 subjects did not resume any task. The recall data were in general (though not significantly) in favor of the completed items: 26 subjects. 15 boys recalled more uncompleted tasks and 9 boys recalled evenly. No significant correlation with age was obtained. Between recall and resumption no significant association was found; of the 18 boys who resumed all tasks only 7 showed a Zeigarnik effect.

A slightly different experiment was performed with 30 subjects, 8 to 10 years old. Half the cards, that – at a signal – had to be named (see *Ferradini 1952), held drawings and half were only colored. Recall was computed separately for both types of tasks. With regard to the figures more uncompleted than completed items were recalled, while for the colors the completed items were in the majority.

Compare: section 2.6.

300 young workers (14–19 years old, from East Berlin) were MITTAG's subjects in several experiments, in which two subjects at a time worked on 18

¹ Reference from Umemoto (1959). Yokoyama & Yokoyama's publication could not be procured in time to warrant a discussion in this section.

paper and pencil tasks. In the first experiment, a relaxed situation, like Zeigarnik's, was created. The 32 subjects recalled significantly more uncompleted than completed tasks.

In a series of several other experiments, the tasks were announced as a test of general knowledge (this referred only to the completed tasks), interspersed with interval-tasks (represented by the uncompleted tasks). The accent had therefore been placed solely upon the completed tasks, and the subjects recalled significantly more completed than uncompleted items. This held true for skilled as well as unskilled workers, although it was much more pronounced for the former. However, when a premium was awarded to the unskilled laborers for each completed task, their recall did not differ from that of the skilled workers. The attitude towards work was found to be more positive for the skilled workers. Further interpretation was mostly in terms of social-economic class consciousness, and was based on Gottschaldt's theory of personality, which stresses the importance for behavior of the situation, the constitutional factors and the historic-economic determinants as well (Gottschaldt 1954b)¹. No differences were found between the results of technical workers and tailors. When recall was required 24 hours, one week, or one month later, the priority of the completed tasks was less than in immediate recall, although the differences between recall of the two types of items still remained significant.

A change or reversal of the experimental instructions given between the task series and recall diminished the priority of the completed tasks, but did not change the direction of recall.

When only half the interval tasks remained uncompleted, the order of recall was: completed main tasks, uncompleted interval tasks, and completed interval tasks, thus indicating that tensions remained for the unfinished interval tasks.

Between recall and interest in the tasks, a correlation of +.68 was obtained. Furthermore, it was found that difficult tasks were recalled better than easy ones. This result seems to contradict *Pachauri's (1935b). However, Mittag presented his conclusion only for tasks which, though difficult, were within the range of a subject's ability, thus excluding Pachauri's tasks that were "impossibly difficult".

Further experiments on success and failure resulted in an almost equal recall of completed and uncompleted items for subjects who were socially

¹ In 1961 Gottschaldt (p. 9), referring to Mittag's work amongst others, even spoke of a theorem of the dialectical development of personality.

well adjusted. Insecure subjects recalled significantly more uncompleted than completed items while the reverse was true of ambitious subjects. Mittag's interpretation was in terms of the subjects' evaluation of their performance. The adjusted subjects gave a realistic evaluation. Recall of the other two groups, however, indicated a distortion of the real circumstances: the ambitious subjects tried to belittle their failures and boast of their successes, while the insecure subjects over-evaluated their failures and tended to disregard their successes.

Compare: *Brown (1933); *Ferdinand (1957).

The problem studied in RÖSLER's series of experiments was which of two contradictory theories of feeble-mindedness is the correct one: Lewin's (1933a; 1935) theory of rigidity and goal fixation, or Gottschaldt's (1931; 1954a) theory of diffuse tension systems and vagueness of goal structure. Or, stated operationally: if the theory of goal fixation is correct, the tensions will lead to a relatively better recall of the unfinished tasks¹ and to a stronger reaction to interruption than with normal children; and if the theory of diffuse tension systems is correct, relative recall of unfinished tasks and reaction to interruption will be less with feeble-minded than with normal children.

Subjects were 109 feeble-minded individuals (8–26 years old) and 115 normal children (3–13 years old) from East Germany. In a replication of Zeigarnik's first experiment (only a few of the tasks were different), the normal children recalled significantly more uncompleted than completed tasks, the morons recalled evenly, and for the imbeciles RU was significantly smaller than RC. There was a tendency for the normal children to continue, and for the feeble-minded to stop at the interruption. When only continuous activities² were used, the normal school children showed symptoms of satiation, e.g., sighs, complaints, hasty work, and talks with the experimenter. Many of them tended to stop immediately at the interruption. But so did more than half of the morons, who, for the rest, demonstrated their joy with this kind of tasks. On the other hand, the pre-school children and the imbeciles tended to continue with the activity. For the continuous activities,

¹ It is not correct to deduce from Lewin's theory the hypothesis that the feeble-minded should recall a majority of uncompleted tasks. In connection with *Köpke's (1933) experiments, Lewin had stated that the task had still to be within the feeble-minded's sight in order for resumption to occur. As the tasks are out of sight in a recall experiment, there is no reason to expect $RU > RC$ with feeble-minded children.

² *fortlaufende Handlungen.*

the morons recalled significantly more RU than RC, while the normal children and the imbeciles recalled evenly¹. These results were interpreted by assuming that normal children have the capacity to establish tension systems for differentiated tasks, while the small sub-parts of continuous activities and especially the material itself are considered as adequate units for feeble-minded to establish tension systems.

Recall given the next day demonstrated a predominance of completed tasks (the Zeigarnik material), which was significant for the morons, and which became significant for the normal school children only when colored material was used. It was hypothesized that completed tasks represent a better memory Gestalt which, however, will only be evident in a relatively tensionless field (e.g., one day later or after the purpose of the experiment had been explained).

Repeated recall was required in order to test whether the naming of the tasks, i.e. recall, has substitute value for actual work on the tasks, i.e. completion². This is probably not the case, as the normal children recalled significantly more RU than RC both the first and the second time. For the feeble-minded, RU was significantly smaller than RC both times.

*Compare: *Rethlingshafer (1941b, c); Peterson (1942); and sections 2.6 and 6.1.5.*

ZOLIK tried to determine the relation between selective recall in an ego-threatening situation and personality variables.

In his initial experiment, 128 white American high school boys (14–19 years old) served as experimental subjects (ego-threatening situation) and 41 boys as control subjects. The tasks consisted of scrambled sentences, half of which were unsolvable. Both groups recalled relatively more completed than uncompleted sentences, the control group to a significantly greater extent than the experimental group.

For the main part of the experiment, 40 subjects were selected, half of whom had recalled relatively more completed tasks, while the other half had recalled relatively more uncompleted sentences. The latter group experienced a significantly greater amount of anxiety than the former group. The two groups of subjects differed significantly in degree of ego strength (as measured

¹ It thus appears that there is no one to one relation between the reaction to the interruption and recall.

² In connection with this problem, *Mahler (1933) was mentioned. However, one of Mahler's findings was that for performance tasks (i.e. Rösler's type of tasks) the substitute value of stating the solution verbally was very low.

by the Rorschach test, see *Eriksen, 1954), which the completed recall subjects displayed to a greater degree. In the self structure of this group, furthermore, the self concept was more congruous with the ideal self concept than it was in the self structure of the uncompleted recall subjects. In order to interpret this phenomenon in a Rogerian way¹, Zolik considered the self structure the primary factor and explained the difference in recall between the two groups by means of the tendency to reduce the incongruity between the experience and the structure of the self. "For those individuals whose perceptions of the self are more closely related to their ideal self the recall of failure or incompleting tasks would not serve to reduce the incongruity between the experience and structure of the self, but would tend to be more anxiety provoking and more threatening" (p. 49). "Conversely, those persons who are consciously aware of the lack of consistency between their self concept and ideal self concept are oriented in memory towards material which tends to reinforce this self structure. To recall completed or successful material would only serve to increase the incongruity between the experience and structure of the self and further increase the ego-threat" (p. 50).

Zolik correlated completion/incompletion with success/failure and did not find a clear-cut correspondence. He measured the latter variable by means of recall of success and failure related words and by recognition of success and failure related blurred words.

Compare: *Alper (1946*b*; 1948; 1957); *Eriksen (1952*a*); *Jourard (1954); *Coopersmith (1960); *Lowe (1961); and section 2.5.

1956

ATKINSON & RAPHELSON partly replicated *Atkinson's (1953) experiment. The recall difference scores of 20 male student subjects (task and achievement orientation only) did not show significant differences between high and low *n* Achievers; nor did a division of the subjects on the basis of their need Affiliation scores lead to significant differences in RU – RC scores².

The general trend in a second experiment, of relaxed orientation only, was to recall a majority of completed tasks (21 male student subjects). No significant differences were obtained between any of the breakdowns with regard to *n* Achievement and *n* Affiliation.

¹ See especially Rogers (1951, p. 498–517).

² The trends found in selective recall – though non-significant – were opposite for subjects high in *n* Achievement and subjects high in *n* Affiliation (see table 34, section 6.1.7; cf. Goldin 1964, p. 370).

The experiments were also performed with 36 female subjects but the data were not, however, included in the report.

Compare: McClelland *et al.* (1953); *Alper (1957); *Martin & Davidson (1964); *Weiner (1965*b*; 1966*a*); and sections 2.5 and 6.1.7.

The data of *Jourard (1954) were re-analyzed by FISHER & CLEVELAND¹ in order to test the hypothesis “that individuals who conceive of their body boundaries as thick and impermeable would have a greater need to recall incompleted tasks than individuals who have a less armored conception of their body boundaries” (p. 36). The measure of the body image dimension was derived from the Rorschach test. The difference between the two body image groups was significant in the predicted direction at the time of second recall, which took place after 17 minutes ($P = .01$); the first recall (after 5 minutes) did not reveal a significant association. The result was interpreted in terms of Lewinian theory: “the more that an individual is characterized by firm boundaries the more likely he is to build up segregated tension systems ...” (p. 39).

RALPH’s study² was set up to investigate selective recall at different age levels (subjects were 70 boys of six and nine years old) and under varying experimental instructions (task- and ego-oriented). The only significant result obtained was that the nine-year-old boys showed a Zeigarnik effect (jigsaw puzzles were used) under task-oriented instructions.

Compare: *Sanford (1946); and section 2.6.

The purpose of UEMATSU’s study³ was to investigate the relation between level of aspiration and the resumption of interrupted tasks. The subjects, 32 Japanese secondary school boys, worked on a Kraepelin test. After working on each of 20 rows (tasks) they were required to estimate how much time (in seconds) they thought they would need to complete the work on the next task and, when they had completed that task, whether they experienced success or failure. In this way the level of aspiration was to be tested.

After the 14th row, when the subjects seemed to have become involved in the tasks, the work on arithmetic operations was interrupted and a personality inventory was given. For each subject resumption was studied under two conditions: presence and absence of the experimenter. In both con-

¹ This study is also discussed in Fisher & Cleveland (1958, p. 124–128).

² Only abstract available.

³ I am indebted to K. W. Lim for his translation from the Japanese.

ditions the most frequent reaction was non-resumption. Even when the experimenter stayed in the room, as many as 26 of the 32 subjects did not resume the Kraepelin test. The subjects who had raised their level of aspiration step by step and the subjects who had set themselves unrealistic goals were most inclined to resume the interrupted work. A complete lack of resumption, on the other hand, was displayed most clearly by the subjects with low positive goal discrepancy scores and the subjects whose behavior pattern was rather rigid.

*Compare: *Bloom (1952).*

1957

In an experiment in which personality structure served as the independent variable, ALPER followed the same experimental procedure as in her *1946*b* study. Subjects were 18 male Harvard undergraduates, half of which were identified as having strong egos, the other half as having weak egos. Under both ego and task orientation, the two groups of subjects recalled more completed than uncompleted tasks. Under ego orientation, the Strong Egos displayed this priority significantly more than the Weak Egos. Under task orientation, the difference was not significant. *As the direction of the recall was the same for all four breakdowns, one cannot say that Alper found a strong ego and a weak ego recall pattern* (as described in *Alper 1948).

In the second part of the paper, Alper suggested that there might be an inverse relationship between *n* Achievement and ego strength.

*Compare: *Atkinson (1953); *Eriksen (1954); *Jourard (1954); *Zolik (1955); *Atkinson & Raphelson (1956); *Lowe (1961); and sections 2.5 and 6.1.7.*

CARON & WALLACH's purpose was to answer two main questions. "1. Is superior recall of successes in an intelligence test situation ... a function of selective forgetting (repression) of failures or selective learning in favor of successes? 2. Is superior recall of failures in this situation ... a function of selective remembering or selective learning in favor of failures?" (p. 380). 117 Harvard freshmen served as subjects. *Post hoc* they were divided into a group that had attended a public high school and a group that had attended a private prep school, as this variable had been found to be associated with selective recall.

Although Caron & Wallach called the private school subjects success-recallers and the public school subjects failure-recallers, there was a general

recall bias in favor of the completed tasks (scrambled sentences were used) in both groups.

Recall was required twice. For half the subjects the initial induced stress was relieved just prior to the second recall test by means of the explanation that the entire test situation had been a hoax (quasi-therapeutic session).

If the success-recallers had tended towards repression of the failed sentences, the uncompleted items would have re-emerged in the second recall. If, on the other hand, the selective recall was a question of selective learning, there would have been a deficiency in the original registration and no shift from first to second recall could be expected. The latter result was indeed obtained.

If Lewin's task tension theory would have been applicable to the failure-recallers, due to the dissipation of the tension during the interpolated relief period, a decrease of the uncompleted items could be expected in the second recall. The learning position again predicts no shift in recall, which once more was the result of the experiment. A third recall (two days later) confirmed these results.

An additional doubt with regard to the theory of repression of the failed items was expressed by pointing out that not the failing of particular items but the failing of the *test* is threatening to the subject.

*Compare: *Caron & Wallach (1959).*

The principal problem that FERDINAND'S¹ work concentrates on is whether the recollection of activities is influenced by their personal importance. He started with a replication of several of *Brown's (1933) experiments on reality – irreality and obtained very similar results. Subjects were 127 children of the highest lower school classes (13 and 14 years of age) in Düsseldorf and Duisburg. Ferdinand speaks of the personal importance of the activities rather than of the qualification "reality – irreality."

In his own experimental variations of Brown's design (with 226 subjects), Ferdinand varied the degree of completion and incompleteness of the very important test items and the unimportant in-betweens. The test items were either interrupted, interrupted by the announcement of the mark, completed, or completed by the announcement of the mark. The in-between tasks were either completed, interrupted, or interrupted by the instruction that they were to be finished later.

¹ Ph. D. thesis in mimeographed form. Ferdinand (1959) is the printed version which does not, however, contain the complete tables.

It was found that the test items were considered subjectively completed only when the marks were announced (whether the items had been objectively finished or not), and that the in-betweens were considered subjectively uncompleted only when the instruction was given that they were to be resumed later. The combination of these conditions led to a superior recall of the in-between tasks, i.e., of the uncompleted tasks. Whenever the test items with mark announcement were combined with another condition of the in-between tasks, no significant difference in recall was obtained, whether it was given after 30 minutes (Ferdinand's usual time interval), after 24 hours, or after one week.

Compare: *Mittag (1955).

ITO¹ tried to avoid the confusing connection between completion-incompletion and success-failure by creating a C – S condition (completion = success, incompletion = failure) and a C – F condition (completion = failure, incompletion = success). Each condition was studied with subjects who had been given the impression that their intelligence was being measured in a competitive situation (stress), as well as with subjects who had been given the impression that the tasks were being tested in a co-operative situation (non-stress). The subjects were 82 Japanese children (40 boys and 42 girls) in their last year of primary or first year of secondary school. They were tested two at a time.

In both the non-stress conditions, failed tasks were recalled relatively better than successful tasks, whether they had been interrupted² or not³. In the two stress conditions, on the other hand, successful tasks were recalled better than failed tasks, whether they had been interrupted⁴ or not⁵. *The latter results, however, are not statistically significant, despite Ito's efforts to make them appear significant*⁶.

Compare: *Marrow (1938b).

¹ I am indebted to K. W. Lim for his translation from the Japanese.

² Wilcoxon matched-pairs signed-ranks test: $T_+ = 120$; $T_- = 16$; $T_v = 104$; $n = 16$; $P = .005$.

³ $T_+ = 16.5$; $T_- = 38.5$; $T_v = 22$; $n = 10$; $P > .28$. In table 5, p. 262, the frequencies of the RI column should be read one row lower than they are printed.

⁴ $T_+ = 140$; $T_- = 70$; $n = 20$; $P = .20$.

⁵ $T_+ = 44$; $T_- = 109$; $n = 17$; $P = .13$.

⁶ By means of $\alpha = .10$; by attaching more importance to the result of the χ^2 -test on the combined frequencies (which indicated significance) than to the result of the t-test on the detailed recall scores (which did not); and by eliminating the scores of the three subjects who gave the most extreme scores into the "wrong" direction. (Cf. Jahoda 1959, p. 99:

SMOCK's experimental instructions were designed to arouse either anxiety or task-orientation in his subjects (60 fourth and fifth grade children from Cedar Rapids). Twelve jigsaw puzzles were used, on half of which were pictures chosen from the Blacky Test (arousal of defensive processes), while the other half had neutral connotations. Under conditions of ego-involvement the children recalled relatively fewer uncompleted, as compared to completed, puzzles than under task-oriented conditions. The difference between the two types of recall for each condition was not, however, significant. The sequence in which the pieces of the puzzles were placed was different for the two groups. The task-oriented subjects responded to the picture, whereas the ego-oriented children responded to the border details. The Blacky Test Pictures were recalled less frequently than the neutral tasks. The point of interruption, either halfway or three-quarters of the way through the puzzle, did not prove to be a significant factor.

The most important result of STEININGER's ¹ success-failure study with 96 American high school students as subjects, was that the more difficult and challenging problems appeared to be recalled better than the other tasks, regardless of the main success-failure conditions.

Compare: *Taylor (1953); *Junker (1960).

TAKUMA ² designed several experiments on task resumption in order to study the problem of whether the feeble-minded child is mentally rigid or not. Experimental variations were, amongst others, the presence or absence of the experimenter, the type of tasks ³, the moment of interruption, and the manner of interruption. The subjects were 43 institutionalized feeble-minded Japanese children (24 boys and 19 girls, 10-15 years old, I.Q. 30-50).

The most outstanding results were the high frequency of resumption after the experimenter had left the room ⁴, and a general lack of resumption in the presence of the experimenter. There were, however, some exceptions to the

“There is a tacit implication in many ... experiments that those insubordinate subjects who are outside the hypothesis-confirming majority are a nuisance. The fewer there are of them... the better.”)

¹ Only abstract available.

² I am indebted to K. W. Lim for his translation from the Japanese.

³ Eight tasks similar to Ovsiankina's (1928) were used.

⁴ The fact that resumption took place practically without exception proves that it was, amongst other things, independent of the type of tasks (whether continuous activities or tasks with a clear-cut end), of the moment of interruption (varying from the beginning of the work to just before completion), and the duration of the interruption (25 or 45 min).

latter result. If the task was interrupted just before completion, or if the interruptions were accidental, or if the interrupted activity was a free drawing, most children resumed even in the presence of the experimenter.

Takuma questioned the necessity of the concept of mental rigidity for the interpretation of feeble-minded children's task resumption, because the variations in the experimental design were shown to be of such great importance for resumption.

Compare: *Köpke (1933); *Rösler (1955); *Miller (1961); *Sternlicht & Wexler (1966); and section 2.6.

TAMKIN compared 24 male schizophrenic patients with a control group of 24 normal men (from Virginia). Under intelligence test conditions, the schizophrenics recalled relatively more uncompleted jigsaw puzzles, while the normals recalled evenly¹. No relation between recall and ego strength (as measured by self-acceptance scores) was obtained. *Unfortunately the results cannot be adequately compared with *Winder's (1952) because no differentiation was made within the group of schizophrenics.*

Compare: *Stumbur (1934).

1958

GORDON & THURLOW² argued that it is not quite clear whether the valence of the substituted or of the original task was chiefly responsible for *Henle's (1944) results on substitution. In experiments with 32 children (age 4½–6½ years) as subjects the original tasks were either of high or low valence whereas the substitute tasks were of middle valence. In both cases resumption was significantly lower when the substitute task was offered than when it was not. However, although substitution was significantly demonstrated when a medium valence task followed both a high-valence (contrary to *Henle 1944) and a low-valence interrupted task, the results of a large number of the subjects did not show a substitution effect at all. The percentages of resumption still remained fairly high: for original tasks of high and low valence, 78% and 50% respectively.

Information on an unpublished study by RAPHELSON, HORWITZ & POSCHEL has been given by Horwitz (1958). Part of the subjects were informed that

¹ Binomial test: $P = .04$ respectively $P = .61$.

² Reprinted in Lindzey & Hall (1965), p. 216–217.

completion of half of the tasks would almost certainly result in success on a retest; part of the subjects were informed that completion of half of the tasks almost certainly indicated failure on a retest. A non-veridical attitude in the failure condition would be one which denied the strong negative valence of an incomplete task; the same response would be veridical in the success condition. The result was that successes were favored in recall by "non-veridical" subjects, and that failures were favored in recall by "veridical" subjects. "The critical variable in differential recall was found to be the veridicality of the subjects' expressed attitude toward failure, rather than the absence or presence of expressions of fear of failure as such" (Horwitz 1958, p. 206).

1959

Forty-two subjects from the experiment by *Caron & Wallach (1957) received a battery of 38 tests by CARON & WALLACH. The data were factor-analyzed and the tests with the highest loading on the various factors correlated with the recall difference scores. None of the five factors (neuroticism, intellectual flexibility, extraversion, other-orientation, and perseverance for achievement) correlated significantly with the recall difference scores.

Compare: *Pachauri (1936); *Scodel (1953); Inglis (1960).

In an experiment with 48 subjects, CLEMENTS¹ tried to answer quite a number of questions by using, and introducing as independent variables: (a) anxiety of the subjects (four degrees); (b) ego-oriented instructions/task-oriented instructions at the beginning of the session, and (c) prior to recall; (d) with /without forewarning of completion and incompleteness. The tasks consisted of writing down examples of a given category (e.g., vegetables) during a period of one minute. Completion depended on writing down that number of examples which was at least equal to the norm score, which was announced either during the performance (= forewarning) or after.

The forewarned subjects tended to recall relatively more completed tasks, while the subjects who had not been forewarned (all of whom had received pre-experimental ego-oriented instructions) recalled relatively more uncompleted tasks. For high-anxious subjects $RC > RU$, while for low-anxious subjects $RU > RC$.

Compare: *Pachauri (1935b); *Rand (1963).

¹ Only abstract available.

FORREST rashly adopted *Rosenzweig (1943) and *Glixman's (1949) conclusion that ego-oriented subjects show a reversal of the Zeigarnik effect¹. "If it can be shown that under these conditions also, an increase in muscular tension accompanies interruption, then it automatically follows that it is wrong to attribute any mnemonic significance to the higher tension" (p. 181). Electromyographic recordings were obtained from the active arm of each of 40 women undergraduates of the University of London. The instructions were aimed at establishing a task orientation in half of the subjects and an ego orientation in the other half. In a mirror-drawing task eight diagrams were used, half of which were interrupted. A cancellation test of 10 minutes' duration was interpolated between drawing and recall. Recall difference scores (RU - RC) were significantly higher for the task-oriented than for the ego-oriented group ($P < .01$). A comparison of average muscular tensions did not reveal a significant difference between the two groups. In the first post-drawing second, the interrupted tasks were accompanied by a higher tension level than had been shown for the completed tasks in both groups ($P < .05$). During the next four seconds there was a considerable drop in tension and the differences disappeared. "There thus seems no good reason for supposing that the high muscular tension recorded after the interruption of a motor task is anything more than a motor phenomenon due to the sudden prevention of the continuance of a skilled movement" (p. 184).

Compare: *Freeman (1930); *Boguslavsky (1951); *Bolin (1952); *McAllister (1952); *Smith (1953); *Horwitz, Glass & Niyekawa (1964); and section 2.7.

JÄGER studied the influence on recall of the length of the time interval between the test situation and its reproduction. His subjects were 203 applicants for higher government posts in West Germany. As part of the usual test situation, the names of the nine sub-tests of an intelligence test were announced several times, and the subjects also had to write them down. Recall of these names was required after 30 minutes, 1 day, 2 days, and 6-9 days (the last by post). After 30 minutes, relatively more names of uncompleted than of completed tests were recalled, whereas from a period of two days onward this difference was reversed. For tests that were subjectively experienced as failures or successes, the same results were obtained.

JÄGER (1960) assumed that failure, because of its pronounced valence,

¹ A significant reversal of the Zeigarnik effect was not, however, found in either Rosenzweig's or Glixman's experiment. See also *Eriksen (1952b).

would represent the strongest component in the trace field shortly after the test, and would thus be dominant over wish- and defense-mechanisms. After some time, however, the valences and the firmness of the trace field will be reduced. Then the need for success and fear of failure (defenses) may become dominant. In this way Jäger attempted to interpret the reversal from higher failure to higher success recall with the passing of time.

1960

BIALER & CROMWELL replicated *Rosenzweig's (1945) experiment on repetition preference with 23 mentally defective children (from Nashville), 6 to 14 years old, as subjects. Rosenzweig's finding was substantiated: the younger children preferred to repeat puzzles in which success had previously been experienced, and the older children chose to repeat the failed puzzles. The result holds good with regard to chronological age as well as mental age. Between the results of boys and girls no differences were found.

Compare: *Rosenzweig (1933*b*); *Rosenzweig & Mason (1934); *Crandall & Rabson (1960); *Spradlin (1960); *Bialer (1961); *McConnell (1961); *Miller (1961); *Stedman (1962); *Sternlicht & Wexler (1966); and section 2.6.

The purpose of COOPERSMITH's ¹ experiment was to investigate the relationship between several indices of self-esteem, achievement motivation, and the recall and repetition of success and failure experiences. Subjects were 48 middle-class children of 10 to 12 years old (from Ithaca). They were divided into four groups of twelve children each on the basis of their subjective (self rating) and behavioral (teachers' ratings) evaluations of self-esteem (see Coopersmith 1959*a*). Twelve tasks (six pairs of two equivalent ones) were administered under conditions designed to threaten self-esteem. Between this test and recall, achievement motivation was determined (± 15 min).

Irrespective of the degree of self-esteem, the children tended to recall more successes than failures ². With regard to repetition choice (between the success and failure task of each pair), the groups whose subjective and behavioral ratings showed agreement, repeated significantly more successes than failures, while groups whose ratings disagreed repeated failures signif-

¹ Abstract of this study: Coopersmith (1959*b*).

² Binomial test: $P = .0009$.

icantly more frequently than successes ¹. A low and negative correlation was obtained between recall and repetition, whereas the correlations with achievement motivation were difficult to interpret.

Coopersmith suggested that the confusion about the relation between ego strength and recall might be due to a failure to distinguish between the concepts of appropriateness and strength. "Appropriateness refers to a response suitable to a particular situation and ... based upon familiarity with a given environment and perceptual sensitivity to its cues", while "strength refers to the ability to tolerate adversity and ... is achieved by states of high motivation" (p. 316).

Compare: *Rosenzweig & Mason (1934); *Brenman (1947); *Zolik (1955); *Butterfield (1963; 1965).

CRANDALL & RABSON replicated *Rosenzweig's (1945) experiment on repetition preference with 59 middle-class children (from Ohio), three to nine years of age. Compared to the nursery-school children the older children (early grade school) showed a non-significant tendency to prefer repeating the previously-failed puzzle. Intelligence was not found to be a factor in the children's repetition choices. A significant difference between boys and girls was obtained which had to be ascribed mainly to the grade school boys, who frequently elected to repeat the failed puzzle. The girls were more apt to prefer repeating successes, while at nursery school age there was as yet no marked difference between boys and girls. Observations of the children's free play behavior showed a greater passivity and open dependence in the older girls, and an assertiveness and independence in the grade school boys.

Compare: *Rosenzweig (1933b); *Rosenzweig & Mason (1934); *Bialer & Cromwell (1960); *Bialer (1961); *Butterfield (1963; 1965); and section 2.6.

GÖTZL ² studied the relation between time perspective and achievement motivation. His subjects were 8th and 9th grade school children (from Münster, Germany) who had to take an intelligence test; it was hinted that the results of the test would have very important consequences for them. The results of half the tasks were to be announced after 48 hours (near-result tasks), those

¹ Binomial test: $P < .01$ (both groups). However, in an abstract of the same or an identical experiment (Coopersmith 1957) the children with high self ratings and low teacher ratings were reported to have "repeated slightly more success than failure". This abstract is not mentioned in the 1960 paper.

² Unpublished study, reported by Heckhausen (1960).

of the other half only after eight weeks (distant-result tasks). The subjects could identify the two types of tasks by differently colored paper.

Recall was required after 24 hours. Positive correlations were obtained between hope of success and recall of distant-result tasks on the one hand, and between fear of failure and recall of near-result tasks on the other hand. The interpretation of these results read that for those subjects who are predominantly motivated by the hope of success, only the announcement of the results of the second half of the tasks means completion of the task-as-a-whole (tension release). On the other hand, for subjects who are predominantly motivated by the fear of failure, and whose time perspective is shorter, the announcement of the results of the first half of the tasks is felt to be so threatening that the near-result tasks acquire affective emphasis.

Compare: Moulton (1958); and section 2.5.

JUNKER remarked that Zeigarnik's instructions, that the tasks were to be completed as rapidly and correctly as possible, might give rise to one of the following possibilities. A subject might experience an uncompleted task as having been performed (1) rapidly enough and correctly; (2) not rapidly enough, but correctly; (3) incorrectly, but rapidly enough; (4) incorrectly and not rapidly enough. Attempts to vary the time variable, i.e. possibilities (1) and (2), in a Zeigarnik-like experiment, failed. For this reason the problem of selective recall was studied with regard to the variable correct-incorrect solution of the tasks.

The subjects in the various experiments were grammar school students in their last year (only good and very good students), freshmen in psychology ¹, and post-graduate students (from Frankfurt am Main). It turned out that many subjects later talked about the experiment, despite Junker's request not to do so. For this reason, and because of other interfering factors, the results of many subjects were discarded and the data of only relatively few (!) subjects were analyzed (p. 33). Junker used 16 problem solving tasks of the analogy type. Each task consisted of two parts. Half the tasks were interrupted after the subject had solved the first part, by making the remark: "No, the correct solution reads ..." (p. 31).

In the first experiment, which was performed under task-oriented instructions, all 7 subjects recalled predominantly uncompleted (and incorrect) tasks ². The problem then arose whether the same result might not be ob-

¹ Some of these subjects had to wait for three-and-a-half long hours (p. 43) before they were admitted to the experiment room!

² Wilcoxon matched-pairs signed-ranks test: $T_+ = 28$; $T_- = 0$; $n = 7$; $P = .016$.

tained if the completion–incompletion variable were eliminated, so that the tasks would only be distinguishable according to their correct–incorrect solution. In the experiments which were designed to test this hypothesis, the remark that was intended to qualify a solution as incorrect was given after the subject had completed both parts of the task. Except for a group of female students from a public grammar school, all the subjects recalled the tasks which they had solved incorrectly better than the correctly solved tasks. This result was obtained under conditions of both task and ego involvement, and the same result was found when recall was required a fortnight later.

The results were interpreted by postulating an enhancement effect of the unexpected performance. Incorrectly solved tasks were recalled better than correctly solved tasks when the subjects were disappointed that they had not lived up to their own achievement aspirations. The correct solutions, on the other hand, were only felt to be a usual achievement. With regard to the subjects who recalled predominantly correctly solved tasks, on the other hand, the interpretation read that these subjects had expected to experience many failures and were pleasantly surprised when their solutions were correct.

Compare: *Kendler (1949); *Bloom (1952); *Steininger (1957).

MILLER, SWANSON & BEARDSLEE¹ tried to relate selective recall to social class and child-rearing practices. It was theorized that belonging to the middle class was a pre-condition to the development of repression as the preferred mechanism of defense because, amongst other things, this facilitates social conformity behavior. Thus middle class children were expected to recall relatively more completed than uncompleted tasks. If one has been educated in a working-class environment, which – according to Miller, Swanson & Beardslee – probably means suffering greater hardships than is usual in a middle class environment, one may be more prone to resort to denial, i.e., to retreat into a world of fantasy as a way of escaping one's problems. Failures, thus not being experienced as failures, need not be repressed which might lead to a better recall of uncompleted than of completed tasks.

Furthermore, it was hypothesized that subjects whose parents had adhered to relatively benign educational techniques (like frequent rewards, psychological and mixed rather than corporal discipline, and explanations of requests for obedience) were inclined to repress their failures under stress, i.e.,

¹ The study is described in Miller & Swanson (1960): chapter 10, p. 231–255.

to recall predominantly completed tasks. On the other hand, it was said that subjects who had been brought up under a less benign parental regime (like occasional rewards, corporal discipline, and arbitrary requests for obedience) were inclined to deny their failures under stress. This – less mature – mechanism of defense might lead to a superiority of uncompleted tasks in recall, because denial precludes the experience of incompleteness as failure.

In a pre-experimental interview, 106 boys (7th–9th grade) were asked for their “dream job” and for the job they really expected to have “twenty years from now”. “Next the examiner said that he was going to administer an aptitude test that would show how realistic the boy was being in his plans and aspirations” (p. 237). Sixteen paper and pencil tasks (comparable to *Marrow’s 1938a), half of which were interrupted because “time was up”, were presented. “To make sure that all the subjects failed, the examiner first said that no one with the ability needed to make a success of himself would fail more than one of the sixteen tests” (p. 239). When the work on the tasks had been ended, and before recall was required, the subjects were asked to invent endings for a number of stories.

Of all the anticipated relations only social class seemed to be of influence on recall: the middle-class boys recalled significantly more completed than uncompleted tasks¹ while the obtained $RU > RC$ for the working-class boys was non-significant². Further breakdowns with regard to child-rearing practices within the working class did not reveal any significant relations³. Breakdowns within the middle class, however, demonstrated significant relations for all the previously stated parental methods but discipline.

Furthermore, within the middle class $RC > RU$ was found to be significantly associated with early weaning and severe toilet training. Miller, Swanson & Beardslee thought this relation difficult to interpret because, on the one hand, these parental techniques are relatively harsh, while, on the other hand, they are the methods preferred by middle-class parents.

Thus, on the whole, Miller *et al.*’s assumptions were found to apply to children reared in middle-class homes only and not to children living in working-class conditions⁴.

Compare: *Katz (1938); *Vogel (1965); and sections 2.4 and 5.4.3.

¹ Binomial test: $n = 44$; $x = 14$; $P = .02$.

² $n = 36$; $x = 15$; $P = .41$. Median $RU - RC$: 0.

³ The category $RU - RC = 0$ being rather large, for most of the breakdowns the median recall difference score is 0.

⁴ Perhaps it is relevant here to mention Cofer & Appley’s (1964) discussion on the way in which ego-involvement is usually induced (experiment = intelligence test). “These pro-

SPRADLIN¹ found that repetition of an interrupted task under conditions of ego involvement "was more likely in older and higher-M.A. mental retardates, while younger and lower-M.A. retardates tended to return to a completed task" (cited by *Miller 1961, p. 428). Cf. Butterfield (1965, p. 355).

Compare: *Rosenzweig (1933*b*; 1945); *Bialer & Cromwell (1960); *Crandall & Rabson (1960); *Bialer (1961); *McConnell (1961); *Stedman (1962); and section 2.6.

A study by TALLAND with Korsakov patients as subjects showed no consistent trends in selective recall, largely because these "patients forget their failures even more rapidly than the tasks themselves. When, following an unsuccessful attempt, they were asked whether they had done well or poorly in the trial, they almost invariably thought they had done pretty well" (p. 373).

Compare: *Krauss (1930).

1961

In a repetition-choice experiment with 45 mentally retarded children and 44 normal children (from Nashville) BIALER found that with increasing age (MA as well as CA) a tendency arose among the subjects (regardless of their retarded-normal classification) to choose to repeat the interrupted jigsaw puzzle rather than the completed one in a competitive situation.

Compare: *Rosenzweig (1933*b*; 1945); *Bialer & Cromwell (1960); *Crandall & Rabson (1960); *Spradlin (1960); *McConnell (1961); *Miller (1961); *Stedman (1962); *Butterfield (1963); Cromwell (1963); and section 2.6.

HILGARD & HOMMEL found that their 121 subjects (undergraduate students at Stanford University) participating voluntarily in a hypnotic experiment, tended to forget relatively more frequently those tasks in which they had failed (did not act hypnotized) than those in which they had succeeded. This

cedures can work only in a culture which prizes intellectual capability and certain traits of personality. The procedures probably proceed best with persons from the middle-class in the United States ..." (Cofer & Appley 1964, p. 784). Furthermore, the following quotation from Davis (1948, p. 68-69) may be of interest: "No matter how unreal and purposeless the problem may seem, the average child in a high socio-economic group will work hard to solve it, if his parents, his teacher, or other school officers expect him to try hard. The average slum child, however, will usually react negatively to any school test, and especially to a test whose problems have no relation to his experience".

¹ Original study not obtainable.

effect was obtained during the period when the subjects were under the suggestion that the events which took place under hypnosis would be forgotten both after waking and after amnesia had been relieved (second recall). "There is a strong presumption that some repressive activity accounts for the forgetting of the unsuccessful tasks, but the alternative cannot yet be ruled out that the differential results occur because of the enhancement of the successful tasks" (p. 215).

Compare: *Rosenthal (1944); *Brenman (1947); *Fuchs (1954); *O'Connell (1966).

One of the hypotheses which LOWE tested in an experiment with 65 student nurses read: "Subjects using the goal oriented mode of coping with anxiety show larger output . . . under stress than prior to the induction of stress, whereas subjects using the ego oriented mode of coping with anxiety show no such increase in output" (p. 303). The subjects' preferred mode of coping with anxiety was inferred from the relative emphasis of failures to successes in recall (an intelligence test with scrambled sentences was given). Subjects above the median on the recall measure were described as goal-oriented, and subjects below the median as ego-oriented ¹.

Lowe, analyzing output scores on the Minnesota Clerical Test, found a highly significant difference in increase in output under stress between the two groups of subjects. *If, however, the frequencies of the subjects who increased and decreased output, are analyzed instead, it appears that 53 of the 65 subjects increased output, which means a significant increase for both goal-oriented and ego-oriented subjects* ².

Compare: *Alper (1948; 1957); *Eriksen (1952a); *Zolik (1955); and section 2.5.

McCONNELL ³, in a repetition-choice experiment with institutionalized mental retardates, failed to find the developmental trend that older retardates tend to return more to the interrupted puzzle, while younger children tend to choose the completed task.

Compare: *Rosenzweig (1933b; 1945); *Bialer & Cromwell (1960); *Cran-

¹ $n = 29$ above median, $n = 36$ below median. Thus "the median" cannot mean the median recall difference score of the 65 nurses. Should it then be interpreted as: $p. 62). RU - RC = 0$ (or $RU/(RU + RC) = .05$)?

² $P = .000002$ (27:2, goal-oriented); $P = .01$ (26:10, ego-oriented).

³ Unpublished study, not obtainable. Main result cited by Cromwell (1963,

dall & Rabson (1960); *Spradlin (1960); *Bialer (1961); *Miller (1961); *Stedman (1962); and section 2.6.

In a repetition choice experiment under conditions of ego involvement with 26 adolescent mental retardates as subjects (from Nashville), MILLER found that almost all his subjects repeated the interrupted jigsaw puzzle when they were left alone by the experimenter for the period in which they had to make a choice. With another 26 subjects the choice situation was timed and run as an official test. Under these conditions the choices were almost evenly divided over the interrupted and the completed puzzles. Repetition of the interrupted task under conditions of time-control was related to a measure of rebelliousness.

Compare: *Rosenzweig (1933*b*; 1945); *Takuma (1957); *Bialer & Cromwell (1960); *Crandall & Rabson (1960); *Spradlin (1960); *Bialer (1961); *McConnell (1961); *Stedman (1962); *Sternlicht & Wexler (1966); and section 2.6.

The title of one of the chapters in SCHWARTZ & ROUSE's publication reads "A Zeigarnik effect and temporal factors". The author of the present study does not, however, see any connection between the reported experiments and the problem of task interruption as initiated by Zeigarnik.

1962

MCCLINTOCK ¹ studied 44 white children (randomly selected from a southern community in the U.S.A.) during their first three school months (age: 6-7 years old; I.Q. 72-151; all levels of socio-economic status). Six tasks were presented, of which two were endurance tasks, two were difficult but purposeful, and two were easy but purposeful. No general factor of tendency to continue was obtained. It was found to be represented by three unrelated factors: goal-oriented persistence, perseveration, and discomfort endurance. The results showed no relations between these three factors and age, sex, teacher ratings of school progress, and socio-economic status. The only association found was between perseveration and low intelligence.

Compare: *Pachauri (1936); Peterson (1942); *Rethlingshafer (1942).

One of the results of an experiment by MEHL, in which recall of the number of successes or failures in a two-person experimental game was required, was

¹ Only abstract available.

that the subjects (both the winners and the losers) tended to recall the number of successes and to forget the number of failures. The losers did not announce their own number of losses but instead said: *He* won four times and I once (p. 200). Subjects were 36 East-Berlin children of six to eight years of age.

STEDMAN¹ presented a puzzle task with which success and failure experiences were experimentally associated, to 48 mentally retarded subjects of both sexes, ranging in chronological age from 11 to 50, and in I.Q. from 46 to 79. A repetition choice experiment confirmed Stedman's prediction that the subjects would not return to either success associated (or completed) or to failure associated (or uncompleted) tasks to a significant degree.

Compare: *Rosenzweig (1945); *Bialer & Cromwell (1960); *Crandall & Rabson (1960); *Spradlin (1960); *Bialer (1961); *McConnell (1961); *Miller (1961); *Sternlicht & Wexler (1966); and section 2.6.

1963

BADDELEY presented 28 British naval ratings with anagrams of 12 common five-letter words. If a subject failed to solve an anagram within one minute, he was told the solution. The subjects solved a mean of 6.5 anagrams and recalled a mean of 4.4 solutions. Of the 28 subjects, 25 recalled relatively more unsolved than solved anagrams ($P < .001$). Ten of the 12 anagrams were recalled more frequently when the subjects had failed to solve them. Solving time was not found to be an important variable. Baddeley concludes that "it seems ... that interruption is the crucial factor, though how it facilitates recall is by no means clear either in the present situation or with the Zeigarnik effect in general" (p. 64).

BUTTERFIELD² studied the relation between selective recall and repetition choice under both skill and non-skill conditions. His subjects were 64 fourth- and 64 sixth-grade children, half of them male, half female. Each grade group was sub-divided into an internal locus of control group (the children who felt that they themselves controlled the outcome of events that affected them), and an external locus of control group (the children who felt that someone or something else controlled the outcome of events that affected them). Half the groups received skill (intelligence test) instructions, the other

¹ Only abstract available.

² Ph. D. thesis in mimeographed form. The data in this version and the data in the printed version (Butterfield 1965) were analyzed in different ways.

groups non-skill (task-oriented) instructions. The experimental tasks consisted of six jigsaw puzzles; the work on half the puzzles was interrupted. After the presentation of the puzzles, recall and repetition choice (one puzzle from each of the three pairs) were required.

Analyses of the recall difference scores of the eight breakdowns ¹ gave non-significant results for seven of them ².

With regard to the repetition choice Butterfield (1965, p. 360) asserted that the results "... support a developmental view of competence motivation", because "... under skill instructions the older children chose more incompleting tasks ... while there was no significant difference between younger and older children under nonskill instructions". *However, under skill instructions the results of one of the two fourth grade groups (the internal locus of control group) did not differ from those of their sixth grade counterpart* ³.

Butterfield (1965, p. 366) computed the correlations between various recall scores:

	under skill instructions	under non-skill instructions
RU - RC and (RU - RC)/(RU + RC)	.967	.970
RU - RC and RU/RC	.163	.933
RU - RC and repetition choice	.242	.002

No proof was given that repetition choice was significantly related to any recall variable. The results indicated that task recall and repetition choice are unrelated.

Compare: *Rosenzweig (1933b; 1945); *Rosenzweig & Mason (1934); *Brenman (1947); *Coopersmith (1960); *Crandall & Rabson (1960); *Bialer (1961); and section 2.6.

GREEN ⁴ experimented with 96 voluntary and non-voluntary undergraduate students (from California), who received either task-orienting or ego-orienting instructions. Under task orientation, the subjects recalled (slightly) more uncompleted tasks, while under ego orientation they recalled (slightly) more

¹ Raw data: *Butterfield (1963, p. 135-141). The recall difference scores of subjects no. 13, 36, 58, and 118 could not be calculated from the raw data because of misprints.

² The exception was the sixth grade internal locus of control group working under non-skill instructions: Wilcoxon matched-pairs signed-ranks test $T_+ = 8$; $T_- = 58$; $T_V = 50$; $n = 11$; $P = .02$. See table 36 for the other results.

³ In both groups 11 subjects chose to repeat more uncompleted puzzles, and 4 subjects chose more completed puzzles (score of one subject unknown because of misprint).

⁴ Reprinted in Steiner & Fishbein (1965), p. 20-27.

completed tasks. The recall scores of the volunteers were somewhat higher than those of the non-volunteers. "If ... volunteers are more likely to be interested in the tasks and less likely to be afraid of experimental and test situations than is the case among nonvolunteers, then volunteers in contrast to nonvolunteers will probably respond more readily to task orientation and less readily to ego orientation. Thus, the differences in recall among volunteering groups can be attributed to differences in degree of task involvement and ego involvement"¹. (p. 400).

Compare: *Atkinson (1953).

Applying Festinger's (1957) theory of cognitive dissonance to the interrupted task situation, RAND performed an experiment with 176 school-children (91 girls, 85 boys), 13 years old, from Porsgrunn (Norway), as subjects. The tasks were 12 arithmetic problems, which were recognizable by clear names. The intention was that the subjects, who worked in a group situation, should be able to solve only half the problems. Written recall was required. 23% of the total of 2112 arithmetic items were completed incorrectly which made them unclassifiable as either interrupted or completed. These items were excluded from the analysis.

On the basis of their scores on the Test Anxiety Scale for Children the subjects were divided into a high- and a low-anxiety group. It was hypothesized that high-anxiety girls, who combine a strong tendency to approach both dissonance-increasing and dissonance-decreasing information with a keen interest in interrupted tasks, recall relatively more interrupted than completed tasks; and that high-anxiety boys, who are characterized by the seeking of dissonance-reducing information and the avoidance of dissonance-increasing information recall relatively more completed than interrupted tasks. With respect to the low-anxiety groups no hypotheses were formulated.

No significant predominance of either completed or uncompleted items in recall was obtained for any of the four sub-groups.

Compare: *Clements (1959); and sections 2.5 and 6.1.7.

1964

HORWITZ, GLASS & NIYEKAWA set the problem of whether electromyographic measures distinguish between tasks that are experienced by the

¹ Schlachet (1965, p. 459), referring to the interrupted tasks as failures, ventured that perhaps "... ego- vs. task-orientation and volunteering in the Green study were inadvertently dissonance manipulations."

subject as successes, failures, interruptions, or completions, and thereby predict their differential recall. They postulated that "low-tension tasks that fall in tension should indicate psychological completions, while those that rise in tension should indicate psychological interruptions", and that "high-tension tasks that fall in tension should indicate psychological successes, while those that rise in tension should indicate psychological failures" (p. 82). As it was assumed that "interruptions should be better recalled than completions, and successes should be better recalled than failures" (p. 82), the following hypothesis was stated: "For low-tension tasks, recall is greater for tasks that rise than for those that fall in tension; for high-tension tasks, recall is greater for tasks that fall than for those that rise in tension" (p. 82).

Subjects were 17 female undergraduates at New York University, each of whom performed 12 mirror tracing tasks. All tasks were halted at a point three-quarters of the way through the tracing, in order to take electromyographic measures of the subjects' writing arms. Half the tasks were continued after the measures had been obtained. The subjects were informed in advance whether a particular tracing would be completed or not.

No significant difference between recall of interrupted and completed tasks was obtained ¹. When only the completed tasks were taken into consideration and breakdowns were made as regards high- and low-tension tasks that rise or fall in tension between the point of interruption and objective completion, the hypothesis was verified for the low-tension tasks ². For the high-tension tasks, the difference in recall was in the hypothesized direction, though not significantly so ³. Horwitz *et al.* concluded that the results of the experiment validate the use of muscular tension in measuring psychological states during task performance.

Compare: *McAllister (1952); *Smith (1953); *Forrest (1959).

The object of LELKENS's study was to investigate the relation between reaction to frustration and selective recall. She hypothesized that extra- and intro-punitives recall more uncompleted than completed tasks, while the reverse relation holds good for impunitives. 43 students of psychology (freshmen, Nijmegen-Holland) completed the Rosenzweig Picture-Frustration Study. For the interruption experiments, only those subjects who scored high on extrapunitive reactions (15 men, 2 women) and high impunitive scorers (10 men, 4 women) were retained, as the scores for intro-punitive reactions were

¹ Binomial test: $P > .25$.

² Fisher exact probability test: $P = .03$.

³ $P > .10$.

rather low. The experimental situation was fairly similar to Zeigarnik's. Although a number of the results showed a tendency in the predicted direction, neither of the two hypotheses could be verified by the data ¹, nor could a significant difference be found between the results of the extra- and impunitive scorers.

Compare: Rosenzweig (1934; 1938*a, b*); *Rosenzweig & Sarason (1942); and section 2.4.

MARTIN & DAVIDSON used twelve of *Marrow's (1938*a*) tasks in an experiment with 29 senior high school students as subjects. The median grade-point total of the classes from which the subjects were drawn was used to classify the subjects into achievers (above the median) and underachievers (below the median). The instructions were aimed at inducing either a relaxed or an achievement orientation. Except for the achievers under achievement orientation, the mean recall difference scores were negative ($RU < RC$). The scores of the achievers were higher ($P < .05$) than those of the underachievers. No significant difference was obtained between the two kinds of instructions. On the basis of these results, Martin & Davidson concluded that "there is no reason why Zeigarnik effect might not predict academic achievement level as well or better than need-achievement measures" (p. 316).

Compare: *Atkinson (1953); *Atkinson & Raphelson (1956); *Weiner (1966*a*); and section 2.5.

In an experiment by STERNLICHT ² (three completed and three interrupted tasks) with 90 college students as subjects, the Zeigarnik effect was obtained. After a time interval of four weeks the subjects recalled and resumed the interrupted tasks more frequently than the completed tasks. See *Sternlicht & Wanderer (1966) for a description of the experimental design.

Compare: *Sternlicht & Wexler (1966).

1965

The purpose of BECHTEL's ³ (unpublished) study was to determine the effects of a plan which operates in the working memory of the subject upon his

¹ Ger Lelkens was kind enough to provide the additional data necessary for the application of the statistical analysis designed by Hemelrijk (see section 4.3). Wilcoxon two-sample test: extrapunitives $W = 32$; $m = 11$; $n = 6$; $P = .10$; impunitives $W = 32$; $m = 4$; $n = 10$; $P = .64$. Combined: $z = 1.72$; $P = .09$. These results, referring to recall before the first hesitation period, do not differ much from total recall.

² Only abstract available.

³ Bechtel & Sroka (1966) gave most of the data and results of the study.

tendency to resume an interrupted task. The cognitive theory of Miller, Galanter & Pribram (1960) and their hypotheses concerning the recall and resumption of continuous activities (see section 2.8) formed the basis of the study.

Bechtel hypothesized that subjects who have a plan which operates in the working memory tend to resume an interrupted activity more frequently, and more quickly, than subjects who have no such plan. Subjects were 178 college freshmen and high school students of both sexes. A dish of 35 beads was presented to each of them.¹ The subjects of the experimental group, into whose working memory a plan had to be induced by the experimenter, were told to string 25 beads. This implied that they had to count the beads as they progressed, i.e. they had to keep a memory record. The subjects of the control group, on the other hand, were instructed to string all the beads. For these subjects the memory function was performed externally, by the dish of beads. When approximately the fifteenth bead had been strung an alternate task was presented.

The results showed that the subjects of the experimental group resumed the bead-stringing task significantly more frequently² than the subjects of the control group ($\chi^2 = 4.42$; $P < .05$). However, this result should be ascribed almost exclusively to the low resumption of the female subjects in the control group. The frequency of resumption of the males hardly differed in the two experimental conditions.

Bechtel's main result is not in agreement with Ovsiankina's (1928, p. 355–356) findings. On the one hand, the subjects whom Ovsiankina had instructed to string 30 beads (out of a box of 200) gave less resumption³ than the subjects whom she had instructed to string all the beads (of a box of 30). On the other hand, they resumed the bead-stringing activity about as frequently as the subjects who had received a box of 200 beads without any additional instructions.

Compare: section 2.8.

The aim of VOGEL's study⁴ was "to predict the occurrence of ostensibly 'defensive' behaviors in an experimental situation from a knowledge of the

¹ Dr. Bechtel was kind enough to provide additional information about the experimental design.

² They did not resume more quickly.

³ Although not to a significant extent: $P = .13$.

⁴ Only abstract available.

reinforcement received for relevant behaviors in similar situations in the past." Subjects were 62 boys and girls in the second and sixth grades. They received a success-failure task series followed by measures of selective recall and repetition. Individual interviews with each child and its mother made use of a role-playing task to assess the mother's characteristic reaction to the child's successes and failures. The main results were that children who had received inconsistent reinforcement for failure, recalled the largest number of failure tasks, whereas children who had received inconsistent reinforcement for success, repeated predominantly success tasks. High achievement motivation appeared to be associated with repetition of failure, whereas low *n* Achievement was associated with the repetition of successes.

Compare: *Miller, Swanson & Beardslee (1960).

WEINER (1965*b*) postulated "that in situations where greater approach than avoidance motivation is aroused, attainment of goals similar to a desired goal will lead to a decrease in the resultant motivation to approach the original goal. Thus goal attainment will have substitute value. However, where the stimulus situation elicits greater avoidance than approach motivation, attainment of goals similar to a desired goal will increase the tendency to strive for the original goal. In this situation goal attainment will have instigating rather than substitutive properties" (p. 166). The hypotheses deduced from these assumptions read that "in situations where achievement motivation is aroused, individuals high in *n* Ach will not spontaneously resume previously interrupted tasks following success experiences (goal attainment), but will exhibit resumption following interpolated failures. Conversely, individuals classified as low in *n* Ach will tend to resume previously interrupted tasks following interpolated success experiences, but not following interpolated failures" (p. 166).

Subjects were 25 male undergraduates at the University of Michigan. After working on a series of 20 simple puzzle tasks, half of which were left uncompleted, the subjects were required to trace over a series of ten geometrical designs without lifting the pencil from the paper or retracing a line. Some of the subjects received puzzle designs which were all soluble (success experience). Of the ten puzzle designs that were given to the other subjects, seven were insoluble (failure experience). In an intermission period following both success and failure, the subjects were allowed to have another look at the 20 original puzzles. The high *n* achievers more frequently resumed interrupted tasks following interpolated failure as opposed to interpolated success experiences, while subjects low in achievement motivation more frequently

resumed interrupted tasks following success rather than failure experiences, although not quite significantly so for either group.

Compare: *Nowlis (1941); and section 2.5.

YAMAUCHI studied the effect of completion/incompletion and the enjoyment/dislike of the various puzzle tasks on selective recall. 39 Japanese college students served as subjects in a stressful experimental situation; half the tasks were interrupted. After recall the subjects were required to evaluate the puzzles on a 3-point scale ranging from pleasant to unpleasant.

The completed tasks were recalled significantly better than the uncompleted puzzles ($P < .01$), and the tasks that had been evaluated as pleasant were recalled better than the unpleasant ones ($P < .01$). In general, the completed puzzles were liked better than the unfinished tasks.

Compare: *Dutta & Kanungo (1967).

1966

KANZER¹, who studied the effects of moderate amounts of alcohol on memory with regard to completed and interrupted tasks, reported that it was very difficult to administer alcohol to graduate students. "The only finding of note was that subjects who had been administered a moderate amount of alcohol recalled fewer incompleting tasks than subjects who had been administered either no alcohol or a very minimal amount of alcohol".

Compare: section 5.3.2.

MANDLER & WATSON compared "high" and "low" anxious subjects (32 in all) on their recall of the number of symbols in two forms of the Wechsler-Bellevue Digit Symbol Sub-test. One of the sub-tests was characterized as a standardized intelligence test; the other as a preliminary form of unknown validity. The subjects were instructed to perform each test five times. All ten trials were interrupted before completion. Half the subjects were allowed to decide for themselves in which order they would perform the ten trials. The others had to follow a fixed order. There was no difference in the recall of the number of symbols between the high and low anxious subjects, but the subjects who were allowed to decide on the order of the tests themselves recalled significantly more symbols ($P < .025$) than those who were not. There were no significant interaction effects between the two variables.

¹ Only abstract available.

O'CONNELL analyzed the post-hypnotic item recall of 486 undergraduate students (from the Boston area) who had been given initial standardized tests for hypnotic susceptibility. A significant tendency was obtained for passed items to be recalled relatively more frequently than failed items (i.e. tasks in which the subjects did not act hypnotized). Subjects low in hypnotic susceptibility showed this tendency more markedly than highly susceptible subjects.

Although O'Connell accepted that the tendency to repress failed items could be used as an interpretative device, he considered it to be of only slight importance. In interpreting the results more emphasis was placed on the enhancement of passed items, especially with regard to the subjects who were low in hypnotic susceptibility, and for whom passed items stood out because of their rather infrequent occurrence. The latter interpretation was discussed in relation to the Von Restorff effect.

Compare: *Rosenthal (1944); *Brenman (1947); *Fuchs (1954); *Hilgard & Hommel (1961).

STERNLICHT & WANDERER studied the influence of catharsis (in the form of cognitive behavior related to a previous frustration) on tension reduction. Tensions were induced via task interruption.

90 students (age 18–43) of a private Midwestern Liberal Arts college served as subjects. They were given six tasks to work on, three of which were interrupted. With 30 of the subjects (the experimental group) relevant cognitive behavior was then elicited by presenting them with 30 drawings, 6 of which represented the tasks they had just performed. The subjects were requested to name the drawings, after which they were shown an assembly of the 30 drawings for 15 seconds. After removal of the assembly recall of the drawings was required, and a number of sentences had to be constructed. Then the experimenter left for observation, leaving the subjects with the task material. The observation period for the 60 subjects in the control groups either immediately followed the work on the tasks, or followed an interval in which the subjects engaged in a routine activity.

The subjects of the experimental group recalled the interrupted-task pictures better than the completed-task pictures. The control groups resumed significantly more interrupted than completed tasks ¹; for the experimental group the difference in resumption between the two types of tasks was not significant ².

¹ $P < .0006$.

² $P = .79$.

Sternlicht & Wanderer concluded that catharsis in the form of a cognitive process, if related to the content of the previous frustration, can reduce tensions resulting from that frustration.

Compare: *Sternlicht (1964); *Sternlicht & Wexler (1966).

The purpose of STERNLICHT & WEXLER's study was to investigate whether mental retardates are able to utilize cognitive processes as a substitutive means of discharging frustration-created tensions. 90 institutionalized mentally retarded adolescents (age 12–20; I.Q. 50–69) acted as subjects. The theoretical background of the study and the experimental design were similar to those of *Sternlicht & Wanderer's (1966) study.

The results showed that the subjects of the control groups resumed significantly more interrupted than completed tasks ¹; for the experimental group the difference in resumption between the two types of tasks was not significant ². On the basis of these results Sternlicht & Wexler concluded that educatable mental retardates can successfully engage in the cathartic process.

Compare: *Takuma (1957); *Bialer & Cromwell (1960); *Miller (1961); *Stedman (1962); *Sternlicht (1964).

WEINER (1966a) used selective recall – which he considered “a valid behavioral criterion of aroused achievement motivation” (p. 694) – to study the motivational effects of single-sex and mixed-sex competitive conditions on achievement motivation. 33 male and 37 female students (from the Universities of Michigan and Minnesota) acted as subjects in this experiment. The subjects worked, two at a time, on 20 simple puzzle tasks, half of which were interrupted before completion for either both or only one of the subjects. The subjects had been told that the experiment was a study on the effect of competition on performance. After achievement motivation had been measured with the use of an objective scale, recall was required.

The group of subjects (taken as a whole) did not recall the interrupted tasks significantly better than the completed tasks ³. The male subjects, who were classified as high in achievement motivation, recalled relatively more uncompleted than completed tasks as compared to the males who were classified as low in achievement motivation. The male subjects who competed with females tended to recall relatively more unfinished than finished items as compared to males competing in single-sex pairs. For the female subjects

¹ $P < .002$.

² $P = .77$.

³ Binomial test: $P = .25$.

neither of the two relationships was (significantly) obtained. On the basis of these results Weiner suggested that role theorists should "attend to the enhancing effect which females have on male achievement strivings, rather than the inhibiting effect which males are presumed to have on female achievement strivings" (p. 695).

Compare: *Atkinson (1953); *Atkinson & Raphelson (1956); *Martin & Davidson (1964); and section 2.5.

1967

DUTTA & KANUNGO's purpose was "to find out if the intensity of affect can adequately explain memory for success and failure experiences" (p. 476). They hypothesized that ego-oriented instructions put the subject on the defensive, with the result that the pleasant feelings which accompany successes are experienced more intensely than the unpleasant feelings which accompany failures. This leads to a better retention of pleasant than of unpleasant tasks under conditions of ego orientation. Under conditions of task orientation, on the other hand, it was hypothesized that the subjects experience the unpleasantness of failure more intensely than the pleasantness of success, and that they therefore retain unpleasant tasks better than pleasant tasks.

Subjects were 60 graduate students and research workers (from Calcutta, India), who were instructed to identify the shape of a given object in each of twenty puzzle pictures (abstract designs) in which this shape was concealed very vaguely and ambiguously. The subjects were informed whether their solutions were right or wrong. "When the subject's solutions were reported to be wrong, the correct solutions were never pointed out to him in order to ensure lack of closure in the subject" (p. 478). The tasks were rated for pleasantness-unpleasantness on a 9-point scale. Half the subjects were required to recall the names of the hidden objects, while the other half were told to try and recognize the twenty puzzle pictures from a set of forty designs.

The hypotheses with regard to both intensity of feeling and retention (recognition and recall) were verified by the data. The intensity of affect was higher for the retained than for the non-retained items. Dutta & Kanungo concluded that the intensity of an affective experience determines its retention.

Compare: *Yamauchi (1965).

Statistical procedure

The question of how a statistical evaluation of the data of a Zeigarnik-like experiment should be made may seem simple. In reality, however, the problem is very complicated. This may be the reason why the diversity in approaches is not confined to the theoretical interpretations and the experimental designs, but is found in the statistical procedures as well. Various pitfalls await the person who attempts to analyze the quantitative data of his studies. Only after a close scrutiny of the experimental procedure and the data of some of the experiments with the aid of professional statisticians¹ were these pitfalls disclosed and could they be evaded for the greater part.

Stated in more general terms, the problem concerns the evaluation of the data of one group (and/or the comparison of two groups) of subjects, each of whom chooses an indefinite number of items from a finite dichotomous population of items, without replacement.

The problem consists of several parts: the computation of the scores, the choice of the test, or rather, of the class of test, and the control for systematic interfering variables and experimental errors.

4.1 Scores

Zeigarnik used the ratio score RU/RC ², because she wanted to rule out individual differences in memory (Zeigarnik 1927, p. 8). When averaging these ratios, however, the scores > 1 are much more heavily weighted than

¹ I am very grateful to Professor Dr. J. Hemelrijk for his advice that the data be analyzed in the way discussed in section 4.3. His offer to let part of the computations be carried out at the Mathematical Centre in Amsterdam (the results of which computations may be found by referring to the index), and the co-operation of the members of staff of the Statistical Department, especially P. van der Laan, is gratefully acknowledged. During the preliminary phases of the study, several aspects of the problem were clarified in discussions with C. A. G. Nass and J. C. Spitz.

² RU = number of uncompleted tasks recalled; RC = number of completed tasks recalled.

those < 1 (*Marrow 1938a, p. 24). Therefore the scores cannot be used when the calculation of the mean is required.

If, on the other hand, only the rank order of the scores is needed (as is the case with many parameterfree tests), the RU/RC scores will do just as well as the percentage scores $RU/(RU + RC)$ (used by, e.g., *Marrow 1938a, b; *Lewis 1944; *Mittag 1955) and $(RU - RC)/(RU + RC)$ (used by, e.g., *Rosenzweig 1943; *Zolik 1955). The difficulty with both these percentage scores is that the ranges of the theoretical distribution of the scores are unequal for $RU + RC \leq \frac{1}{2}(U + C)$ and $RU + RC > \frac{1}{2}(U + C)$,¹ as can be seen from table 1.

TABLE 1
Ranges of the distribution of the percentage scores
 $RU/(RU + RC)$ and $(RU - RC)/(RU + RC)$ when $U = 10$ and $C = 10$

RU + RC	ranges of	
	$RU/(RU + RC)$	$(RU - RC)/(RU + RC)$
≤ 10	0 - 1	-1 - +1
11	.09 - .91	-.82 - +.82
12	.17 - .83	-.67 - +.67
13	.23 - .77	-.54 - +.54
14	.29 - .71	-.43 - +.43
15	.33 - .67	-.33 - +.33
16	.38 - .62	-.25 - +.25
17	.41 - .59	-.18 - +.18
18	.44 - .56	-.11 - +.11
19	.47 - .53	-.05 - +.05
20	.50 - .50	0 - 0

Another measure is the recall difference score $RU - RC$, sometimes corrected for an unequal number of presentations of uncompleted and completed tasks: $RU/U - RC/C$ (used by, e.g., *Rosenzweig & Mason 1934; *Eriksen 1952a; *Caron & Wallach 1957). This measure is also used in this book.

In figure 1 the graphical representation of the recall possibilities in an experiment with 10 uncompleted and 10 completed tasks is given. This figure also demonstrates that recall difference scores and percentage scores lead to different ordinal scales²; furthermore, it shows that both models

¹ U = number of uncompleted tasks presented; C = number of completed tasks presented.

² When analyzing his experimental data, Butterfield (1965, p. 366) computed several of these measures and their intercorrelations (see chapter 3, section on *Butterfield 1963).

presuppose independence of RU and RC, which would mean the ideal situation of no cluster formation between the various tasks.

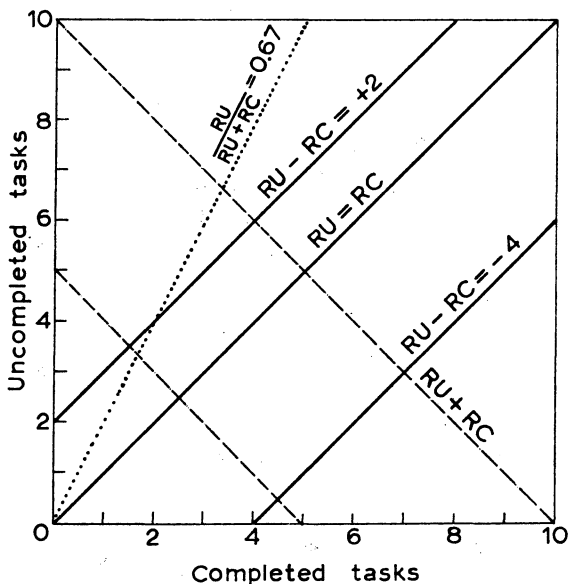


Figure 1. Representation of recall possibilities in an experiment with 10 uncompleted and 10 completed tasks.

If recall is represented by points within the square, then:

- (a) the diagonal through 0 represents $RU = RC$;
- (b) each line parallel to the diagonal ($RU = RC$) represents a constant $RU - RC$ value;
- (c) the diagonal perpendicular to the ($RU = RC$) diagonal represents the constant $RU + RC$;
- (d) lines parallel to this perpendicular represent the ranges imposed on the recall difference scores by $RU + RC$;
- (e) each line through 0 represents a constant percentage score.

4.2 Recall difference score

The following objection may be made to the use of the recall difference score. For many values of $RU + RC$ the theoretical range of the $RU - RC$ distribution is different. Or more explicitly: the range is minimal (0) for $RU + RC = 0$ and for $RU + RC = U + C$, and the range is maximal for $RU + RC = \frac{1}{2}(U + C)$. The distribution of the ranges is symmetrical around $\frac{1}{2}(U + C)$. The recall difference scores are thus not completely independent of $RU + RC$ and comparisons between scores belonging to different $RU + RC$ values

might result in artificial differences. As the subjects generally tend to recall about half the tasks presented, errors of this kind will not easily distort the results seriously.

Moreover, by utilizing parameterfree statistics, a possible detrimental effect of the recall difference scores will be reduced. Simple addition of the scores is not warranted because of the varying theoretical ranges of $RU + RC$. Therefore the tests that should be used are those which require only ordinal measurement.

4.3 *Control for task-memory effect*

The memory value of the various tasks proved to be a serious problem for a proper analysis of the data (see the results of the preliminary experiment, section 5.1.1).

As a control for this systematic interfering variable, Hemelrijk designed an analysis in which use was made of the two "kinds" of subjects in each experimental variation, the A-subjects and the B-subjects. The interruption series presented to the two classes of subjects were complementary: A-tasks are tasks interrupted for the A-subjects and completed by the B-subjects; B-tasks are tasks interrupted for the B-subjects and completed by the A-subjects. The A-subjects and the B-subjects were compared on their relative recall of A-tasks and B-tasks. New recall difference scores were computed: the number of A-tasks recalled (RA) minus the number of B-tasks recalled (RB). These scores are identical to $RU - RC$ for the A-subjects and to $RC - RU$ for the B-subjects.

If a comparison of the $RA - RB$ scores of the A-subjects and the B-subjects¹ leads to a rejection of the null hypothesis (H_0 : both samples are equally distributed), the difference will be due – under exclusion of a specific task-memory effect – to a differential recall of uncompleted and completed tasks. If the null hypothesis cannot be rejected, however, this means that no effect can be demonstrated of the completion/incompletion of a task on its being recalled or not.

¹ By means of the Wilcoxon two-sample test.

4.4 *Problems of errors in interruption series*

A further problem of analysis arises from experimental errors in the interruption series. Strictly speaking, this problem falls outside the scope of a chapter on statistical procedures. It has more to do with the methodological problems of the psychologist¹. It is nevertheless discussed here because of the consequences of experimental errors on the computations of the recall difference scores.

Although in most experimental designs the intention of the experimenter is to present the subjects with an equal number of tasks to be completed and tasks which are to remain uncompleted, the subjects do not always comply. Sometimes they finish the task hurriedly during the interruption and not unfrequently they are unable to complete even the most simple task.

The only way to analyze the data in a statistically correct way is to avoid confusion of the 2×2 design of the uncompleted-completed variable and the A-B variable. Therefore the analysis should be performed as if no errors had occurred². The effect of such neglected errors is a reduction of the power of the test used.

However, as a psychologist one ought not to neglect the subject's perception of the situation, and simply adhere to the originally planned – but not quite realized – design³ (see Criswell 1958; Mills 1962; *Rand 1963, p. 203; Van Bergen 1964). If the purpose of the study is to acquire a better understanding of some of the subjects' reactions, one ought to take the way in which the situation appears to the subject seriously⁴. A shift from uncompleted to completed, and vice versa, is not due to a "peculiar" perception of the situation, but is an objective fact for the subject as well as for the experimenter.

¹ Cf. Tukey (1960, p. 426) on the difference between statistical conclusions and those of the experimenter.

² The very characteristic of a model is that once it has been selected, "the researcher is not concerned at all about modifying the model itself on the basis of data obtained by means of it" (Marx 1963a, p. 14–15).

³ Cf. Back (1962, p. 37–39), on the difference between stochastic models, which are "attempts to explain the sort of human behavior that would occur if the human being were solely a physical object" (p. 38), and equilibrium theories which "offer the possibility of viewing the experimental subject as a person" (p. 39).

⁴ The more so if a Lewinian study is performed: "It is not important how the experimenter sees the situation, but what kind of situation exists for the rat or for the child, and one must in every case describe the structure of this whole situation" (Lewin 1933b, p. 328).

Moreover, in many instances the subjects do not even suspect that something went contrary to the experimenter's plans.

Therefore, besides the recall difference score proper, $(RU) - (RC)$, an adjusted score, $10(RU/U - RC/C)$ ¹, was computed, which takes into account the experimental conditions as they in fact exist². In each experiment the two sets of scores were scrutinized for possible serious discrepancies.

Furthermore, it might be well to consider that it depends on the hypothesis which is being tested whether a reduction of the power of the test will be regarded only as a harmless nuisance, or as a very unwelcome increase of the probability of a Type II error.

4.5 *Analysis of two-person experiment*

With regard to experiments in which two subjects start the work on a task together while only one of them completes the task (which means that it is left unfinished for the other), Nass (1960) suggested pair scores as the most adequate measure. With this method, 2 points are awarded for each task recalled as uncompleted only (by either of the two subjects), 0 points for each task recalled as completed only, and 1 point for each task either not recalled at all or mentioned by both subjects. The two-person experiment (section 5.1.1) was analyzed with this method. Unfortunately, because of the lack of basic experimental data, it was not possible to use this same method for the experiment by *Lewis (1944).

4.6 *Analysis of combination scores vs separate RU and RC scores*

The methods of analysis discussed in this chapter are examples of a combination of a subject's recall of uncompleted and completed tasks in one score. Certain experimenters, the most outspoken of whom were *Glixman (1948; 1949) and *Butterfield (1963; 1964), objected to this type of score because changes in it may be brought about by a change in the recall of the uncom-

¹ In case of the presentation of 22 tasks: $11(RU/U - RC/C)$.

² In the case of experimental errors a recalled task which is represented by RU in the one type of recall difference score may be represented by RC in the other, and vice versa. To illustrate this difference the symbols used to indicate the recall difference score proper are printed in italics.

pleted tasks, by a change in the recall of the completed tasks, or by both. True as this may be, I agree with Alper that a separate analysis of completed and uncompleted items fails to allow for the "psychological interdependence of completion and incompleteness which the interrupted task method imposes on" the subject (Alper 1952, p. 82). Therefore the analysis was confined to a comparison of the recall difference scores ¹.

¹ A level of significance of .05 has been chosen and the tests have been applied two-tailed. The tests used (also for the re-analyses of chapter 3) are: sign test and binomial test (Tables of the binomial probability distribution, 1952; Mosteller & Bush 1954); Wilcoxon matched-pairs signed-ranks test (Benard & Van Eeden 1956; Spitz 1965); Wilcoxon two-sample test (Wabeke & Van Eeden 1955; Auble 1953); likelihood-ratio test (Spitz 1961); Kendall's rank correlation τ (Van Eeden & Korswagen 1959); Kruskal-Wallis one-way analysis of variance (Siegel 1956); the Kolmogorov-Smirnov tests (Siegel 1956; Goodman 1954); Whitney's extension of the U -statistic (Mosteller & Bush 1954); Fisher exact probability test (Finney, Latscha, Bennett & Hsu 1963); 2×2 comparison of probabilities (Van Eeden 1953); combination of test results (Van Eeden 1953).

Personal experiments

5.1 *Preliminary studies*

5.1.1 *Two-person experiment (Koekebakker & Van Bergen)*

The first of these experiments was performed in 1957 within the framework of research training in social psychology at the University of Amsterdam ¹. It should be regarded as a preliminary, for the results of this study gave rise to the extensive review of the literature and the other experiments described in this chapter.

With the Lewinian motivation theory as starting-point, a small group experiment was designed, in which variations in selective recall were considered an indication for variations in task tension.

The problem under investigation was the effect of a-t-g (a concept related to group cohesiveness) on task tension. A-t-g, the independent variable, was defined as “the effect of the interaction of the motives which work in an individual to remain in or to leave the group” (Van Bergen & Koekebakker 1959, p. 83). It was manipulated by varying the personal attraction of the team members. Task tension was measured by means of the Zeigarnik phenomenon.

Design. Twenty different tasks were each begun on by two persons working together and finished by only one of them. This means that all tasks were – objectively – completed. In this respect the design resembles *Lewis’ (1944) co-worker experiment.

To avoid evoking feelings of failure in the subjects, the experiment was introduced as a study on fatigue in joint work. The experimenters ² therefore effected an interruption by saying to one of the subjects: “You may rest now”.

¹ For a description of the research training see Van Bergen & Spitz (1957, p. 71–74).

² The experimenters were: Ineke Bouman, Hanneke Scheepens, Dick ’t Hart, Mien Nienhuis, and Nel Voltelen. They all co-operated in the design and the analysis of the experiment.

Differences in the personal attraction of the subjects were manipulated – in the way common in group dynamics – by means of verbal instructions¹. On the basis of a quasi-personality schedule (with, inter alia, items from Allport's ascendance-submission test) half the subjects were told that they suited their partner perfectly, and the other half were told that a suitable matching of partners had not been feasible. In both high and low a-t-g conditions, the personal attraction of one of the partners of each pair was manipulated by verbal instructions from a male high-status person (professor in group psychology), while the personal attraction of the other partner was manipulated by instructions from the author (a female assistant).

After the last task had been performed, the subjects were separated and fatigue was supposedly measured by means of the Bourdon test (5 minutes). Then the subjects were asked to write down which tasks they had performed (2 minutes), and this was followed by questions regarding the affective value of the tasks and a check on the experimental manipulation.

Subjects. Subjects were 54 students (most of them female) of three schools of social work (a public, a Roman-Catholic, and a Calvinistic school) in Amsterdam. The partners in each of the 27 pairs did not know each other beforehand. The subjects were volunteers and had been recruited by the author, who had first given a short lecture on the value of the experimental method in psychology.

Tasks. Twenty tasks, presented in the same order in each case, were used. Of each pair, the subject in the Right-hand chair was interrupted in the work on the tasks to which an R is added (see table 4). The subject in the Left-hand chair was interrupted in the work on the other half of the tasks.

*Hypotheses*². The first hypothesis read that subjects with a high a-t-g, based on personal attraction, accept the partner's task completion as their own, which means that partner-completed tasks and personally-completed tasks are equally recalled. This is an operationalization of the more general hypothesis that people who like each other may finish each other's work without any ensuing feelings of frustration on the part of the person who had to leave off working.

¹ Problems of manipulation and measurement of a-t-g are treated in detail by Van Bergen & Koekebakker (1959; 1963).

² Cf. section 2.9.

The second hypothesis read that subjects with a low a-t-g do not accept their partner's task completion, which leaves these tasks subjectively unfinished, i.e., recall of the partner-completed tasks exceeds that of the personally-completed tasks.

Check on the experimental manipulation. The induction of the independent variable by means of verbal instructions may fail to be effective because of inattention, disbelief, or other reasons¹. It is, therefore, necessary to check whether the subject perceived the situation as the experimenter intended: one of the norms for verification².

At the end of the experiment, the subjects were asked how they had liked their partners, which had to be indicated on a 7-point scale designed by Hutte (1953)³. No significant difference between the personal attraction of the 28 subjects in the high a-t-g condition and the 26 subjects in the low a-t-g condition was obtained⁴. Moreover, the experimenters who observed the pairs at work classified one-third of them into the wrong a-t-g condition (the experimenters did not know beforehand whether high or low personal attraction had been induced). The independent variable had, therefore, not been induced properly, which means that the testing of the hypotheses became impossible⁵. Still, the data are not thrown away as – for testing purposes – would have been the proper thing to do. As the experiment should, however, be regarded as a preliminary, an exploration of the data – albeit without any proof value – seems feasible (De Groot 1956).

Problems of statistical analysis. The first hypothesis, which reads that under high a-t-g conditions the partner-completed and personally-completed tasks will be equally recalled, is psychologically relevant. However, it cannot be proved statistically, as it is identical to the null hypothesis.

Another problem deals with the uncertainty of whether the subject or the team ought to be chosen as the unit of measurement. As the work on the tasks was – partly at least – a common endeavor, it may be argued that the data of the two team members are not quite independent. However, one of the most relevant aspects of the situation was complementary for the two

¹ Festinger (1953, p. 157–160). Also: Anderson (1930, p. 368–369); Alper (1946a).

² De Groot (1961, p. 96–99); Jenkins (1933, p. 477).

³ English translation of the scale in Festinger & Hutte (1954).

⁴ Wilcoxon two sample test: $z = 1.45$; $P = .07$ one-tailed.

⁵ Van Bergen (1964). In this article the same data, added to those of one of the pre-studies ($n = 68$) have been analyzed.

team members: the task that remained unfinished by the one was completed by the other, and vice versa. This is an argument in favor of the choice of the subject as the unit of measurement. As the question remains unsettled, both types of analysis will be used.

Furthermore, errors in the interruption series constitute a problem for correct analysis (see section 4.4). In the two-person experiment, the experimenters occasionally had no chance to interrupt at all – the subjects were too quick – a few times the wrong subject was interrupted, and two subjects did not succeed in completing one of the tasks they had to finish. All this resulted in eight tasks erroneously completed and three tasks erroneously remaining uncompleted. Fortunately, no significant difference¹ between the $(RU) - (RC)$ scores and the adjusted scores was found. Therefore only slight discrepancies between the results of testing procedures based on either the one or the other set of scores may be expected.

Exploration of the main data. If the team is taken as the unit of measurement, pair scores, as suggested by Nass (1960), are the most adequate measure. These are composed of 2 points for each task recalled as partner-completed only (by either of the two team members), 0 points for each task recalled as personally-completed only, and 1 point for each task either not recalled at all or mentioned by both subjects. The theoretical range of the pair scores is from 0 (recall of personally-completed tasks only) to 40 (recall of partner-completed tasks only), while 20 indicates no difference in recall of the two types of completion.

Neither for the high nor for the low a-t-g condition was a significant preference found for the recall of either personally- or partner-completed tasks (see table 2). For the high a-t-g condition, however, this result cannot be interpreted as supporting the hypothesis, as the lack of difference between the two a-t-g conditions (for both the median is 21) shows that such a conclusion has no foundation.

If the subject is taken as the unit of measurement the same results are obtained (see table 3). The median recall difference score is 0² (+ 1 for the high and 0 for the low a-t-g condition). The medians are the same for both the adjusted recall difference scores and the $(RU) - (RC)$ scores.

¹ Wilcoxon matched-pairs signed-ranks test: $T_+ = 49$; $T_- = 17$; $T_v = 32$; $n = 11$; $P = .17$.

² For the 29 subjects in the various pre-tests of the experiment the median recall difference score was also 0.

TABLE 2

Pair scores two-person experiment
(Koekebakker & Van Bergen)

Pair scores*	Number of pairs	
	high a-t-g	low a-t-g
28	1	-
26	1	-
25	-	3
24	1	-
23	1	1
22	2	2
21	2	1
20	2	-
19	3	-
18	-	1
17	-	4
14	1	1
	<u>14</u>	<u>13</u>

$$T_+ = 58.5$$

$$T_- = 19.5$$

$$T_v = 39$$

$$P = .14$$

two-tailed

$$T_+ = 47$$

$$T_- = 44$$

$$T_v = 3$$

$$P = .47$$

one-tailed

(Wilcoxon matched-pairs signed-ranks test)

Wilcoxon two-sample test: comparison between high a-t-g and low a-t-g condition:
 $W = 154; P > .20$ (two-tailed).

As the main analysis did not show a tendency in the expected direction, other comparisons may be tried. First of all the condition that has systematically been varied, i.e. the Left-Right position, should be analyzed. A remarkable difference in recall difference scores was obtained between the subjects who sat on the Left-hand chair and those who sat on the Right-hand chair, i.e., between the members of one team. The subjects sitting on the Left side recalled more partner-completed tasks, while the subjects on the

* The pair scores reflect the actual completion/incompletion of the tasks. A presentation of the rank order of the pair scores according to the original design only requires shifting from score 25 to score 23 of one of the low a-t-g pairs. For testing purposes score 20 has been read as 0.

TABLE 3

Recall frequencies two-person experiment (Koekebakker & Van Bergen)

Condition	Subject no.	Experimenter	U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
High a-t-g Left JK	33	V			7	4	+ 3	+ 3
	36	Z			6	4	+ 2	+ 2
	37	X	11	9	6	8	- 3.44	- 2
	51	V			5	4	+ 1	+ 1
	60	V			5	3	+ 2	+ 2
	73	V			5	5	0	0
	75	Z			5	4	+ 1	+ 1
High a-t-g Left AvB	40	W			7	4	+ 3	+ 3
	44	V			6	5	+ 1	+ 1
	48	Z			5	3	+ 2	+ 2
	65	Y			5	3	+ 2	+ 2
	69	Z			7	2	+ 5	+ 5
	72	W			3	3	0	0
	83	W			5	4	+ 1	+ 1
High a-t-g Right JK	39	W			4	5	- 1	- 1
	43	V			3	3	0	0
	47	Z			5	6	- 1	- 1
	66	Y			5	5	0	0
	70	Z			4	1	+ 3	+ 3
	71	W			5	2	+ 3	+ 3
	84	W			5	7	- 2	- 2
High a-t-g Right AvB	34	V	9	11	6	5	+ 2.12	+ 1
	35	Z			6	2	+ 4	+ 4
	38	X	9	11	4(5)	8(7)	- 2.83	- 2
	52	V	8	12	4	6	0	- 2
	59	V			2	5	- 3	- 3
	74	V	9	11	3	3	+ 0.60	0
	76	Z			2	3	- 1	- 1
Low a-t-g Left JK	45	Y			3	5	- 2	- 2
	54	X			5	6	- 1	- 1
	56	W			4	4	0	0
	67	X			4	4	0	0
	77	X	7	7	4	3	+ 1.43	+ 1
	80	V			6	4	+ 2	+ 2
	81	Z			3	1	+ 2	+ 2

Table 3 (continued)

Condition	Subject no.	Experimenter	U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
	41	Y			7	3	+ 4	+ 4
Low a-t-g	49	Y	11	9	9(8)	0(1)	+ 8.18	+ 7
Left	57	Y	8	8	6	3	+ 3.75	+ 3
AvB	62	Y			4	4	0	0
	63	W			6	1	+ 5	+ 5
	86	V	9	11	6	2	+ 4.85	+ 4
	42	Y	9	11	3	4	- 0.31	- 1
Low a-t-g	50	Y			1	5	- 4	- 4
Right	58	Y	8	8	6	7	- 1.25	- 1
JK	61	Y			2	5	- 3	- 3
	64	W			6	6	0	0
	85	V			5	4	+ 1	+ 1
	46	Y			2	6	- 4	- 4
	53	X			4	5	- 1	- 1
Low a-t-g	55	W			4	7	- 3	- 3
Right	68	X			4	7	- 3	- 3
AvB	78	X	7	7	1	1	0	0
	79	V			2	7	- 5	- 5
	82	Z			4	4	0	0

U = number of partner-completed tasks presented; } only given if divergent from
 C = number of personally-completed tasks presented; } 10:10

RU = number of partner-completed tasks recalled;
 RC = number of personally-completed tasks recalled; } The frequencies reflect the actual completion/incompletion of the tasks. In parentheses: the frequencies under neglect of the interruption errors.

JK and AvB = initials of instructors who manipulated the subject's personal attraction.

Right recalled more personally-completed tasks¹. This might mean that the specific memory value of the separate tasks is a more powerful variable than the variation in completion/incompletion². In table 4 the recall frequencies of the tasks in the partner-completed and in the personally-completed conditions are given. The correlation for the twenty tasks is high: $\tau = +.71$.

It was thus necessary to take into account the influence of the specific tasks on recall. This has been done by analyzing the data according to the method originated by Hemelrijk (see section 4.3). The null hypothesis of an equal distribution of the scores over the two samples could not be rejected, neither for the total samples nor for the breakdowns, with regard to the high a-t-g and low a-t-g conditions³. This means that the effect of personal-completion/partner-completion of a task on its being recalled or not could not be demonstrated.

Incidental exploration of the data. Several other factors may be considered. First of all, a personal differential effect might exist, either between the persons of the instructors⁴ who tried to manipulate the personal attraction of the subjects, or between the experimenters who presented the tasks and who carried out the interruptions, or both. Breakdowns with regard to the person of the instructor and the person of the experimenter were therefore made. The general result of subjects sitting on the Left-hand chair recalling predominantly partner-completed tasks, was found to a lower degree with the high status male instructor than with the female instructor. There was, however, no difference whatsoever between the instructors with regard to the scores of the Right subjects.

¹ Wilcoxon two-sample test: $z = 3.65$; $n = m = 27$; $P = .0003$, two-tailed.

Wilcoxon matched-pairs signed-ranks test:

Left: $T_+ = 224$ $T_- = 29$ <hr style="width: 80%; margin: 0 auto;"/> $T_v = 195$ $n = 22$ $P < .01$ two-tailed	Right: $T_+ = 65$ $T_- = 166$ <hr style="width: 80%; margin: 0 auto;"/> $T_v = 101$ $n = 21$ $.05 < P < .10$
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The tests were performed on the adjusted scores.

² Cf. *Baltimore *et al.* (1953) for a similar problem.

³ Wilcoxon two-sample test, two-tailed. Total samples: $W = 854$; $n = m = 27$; $P = .28$. High a-t-g: $W = 270$; $n = m = 14$; $P = .09$. Low a-t-g: $W = 167$; $n = m = 13$; $P = .98$. (Computations carried out by the Mathematical Centre in Amsterdam).

⁴ Cf. Birney (1958) whose two experimenters (a faculty member and a student) obtained different results with their subjects. Also: McTeer (1953, p. 176).

TABLE 4

Recall frequencies of tasks: two-person experiment (Koekebakker & Van Bergen)

Order of present- ation	Task	U	C	RU	RC	$27\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
1.	sorting pins, paper clips, etc.			23	26	- 3	- 3
2.	R folding letters into envelopes			3	1	+ 2	+ 2
3.	R cutting out a paper chess-board			12	11	+ 1	+ 1
4.	telephone numbers			9	7	+ 2	+ 2
5.	drawing map of village			18	17	+ 1	+ 1
6.	R lottery-tickets	26	28	8	6	+ 2.54	+ 2
7.	R arranging bridge-cards			5(6)	11(10)	- 6	- 4
8.	jigsaw puzzle			22	18	+ 4	+ 4
9.	R sightseeing places in Amsterdam			11	11	0	0
10.	addition			5	8	- 3	- 3
11.	R deciphering illegible handwriting			2(1)	4(5)	- 2	- 4
12.	proof-reading			6	5	+ 1	+ 1
13.	drafting a week's menu			19	15	+ 4	+ 4
14.	R design table-cloth	25	29	10	8	+ 3.34	+ 2
15.	categorizing pictures	25	27	16	16	+ 1.27	0
16.	arranging cards alphabetically	25	25	7	4	+ 3.24	+ 3
17.	R enumerating Dutch authors	26	26	14	17	- 3.12	- 3
18.	R pasting sentence together out of newspaper letters	25	25	23	18	+ 5.40	+ 5
19.	drafting a radio program	25	25	18	12	+ 6.48	+ 6
20.	R list of contrasts	24	26	15	10	+ 6.50	+ 5

U = number of partner-completed tasks presented; } only given if divergent from
 C = number of personally-completed tasks presented; } 27:27

RU = number of partner-completed tasks recalled; } in parentheses: frequencies un-
 RC = number of personally-completed tasks recalled; } der neglect of the interrup-
 } tion errors.

R = tasks interrupted for subject sitting on the Right-hand chair.

The correlation between RU and RC (Kendall's $\tau = +.71$) has been computed for the frequencies reflecting the actual completion/incompletion of the tasks.

Between the five experimenters¹, no significant difference in the recall difference scores of their subjects was obtained². However, the subjects of experimenter X, who did only a few experiments because of scheduling difficulties, obtained lower scores than the subjects of the other experimenters³.

Another possible influence might lie in the religions professed by the subjects. On the basis of the Calvinistic value for hard work and abhorrence of laziness, one might hypothesize that the subjects of the Calvinistic school of social work would recall relatively more partner-completed tasks than the subjects of the Roman-Catholic and of the neutral school of social work. No such difference, however, was found.

Furthermore, the very peculiar finding made by *Abel (1941) was also obtained in this experiment: subjects with positive recall difference scores numbered the items on the recall sheet more frequently than subjects who recalled predominantly personally-completed tasks. However, an interpretation for this finding cannot easily be given.

With regard to the a-t-g conditions, it might be argued that during the cooperative work the inducement faded away. Therefore, separate scores were computed for the first ten tasks and for the second ten tasks. However, neither for the first ten tasks nor for the second ten tasks were differences found in recall difference scores between the two a-t-g conditions.

¹ The assigning of the experimenters to the pairs of subjects took place by matching the schedules of the subjects with the hours of the week which the experimenters had at their disposal. Although the importance of differences between the characteristics of the experimenters was recognized, at the time the belief in uniform stimulus situations by means of standardized instructions was still strong enough to let the agendas of the experimenters prevail over an even distribution of the experimenters over the various experimental conditions. Of the five experimenters only experimenter Y was a male. In table 3 the data are also given per experimenter (cf. McGuigan 1963, p. 422).

² Kruskal-Wallis analysis of variance by ranks: $H = 5.5$; $df = 4$; $P > .20$ (computed on the pair-scores).

³ The experimenters themselves, in a pre-study in which they were the subjects, had not given a clear-cut result either. In this classroom demonstration, with the two instructors as the experimenters, twelve tasks were used: 1. sentence construction (C); 2. square root (U); 3. cards in alphabetic order (U); 4. lottery-tickets (C); 5. cutting out of a St. Nicholas figure (U); 6. circling of letter i (C); 7. folding letters into envelopes (C); 8. addition (U); 9. sorting of pins, paper clips, etc. (C); 10. copying of music (U); 11. telephone numbers (U); 12. arranging bridge-cards (C). Recall was asked for in writing. The $RU - RC$ scores were: $3 - 4 = -1$ (experimenter V); $4 - 4 = 0$ (W); $5 - 5 = 0$ (Y); $5 - 4 = +1$ (Z); $5 - 3 = +2$ (a student who had dropped the course; unfortunately experimenter X could not partake in this experiment). The median recall difference score was 0. An experimenter modeling effect (Rosenthal 1963a) was not found.

The Left-Right effect can only be seen clearly in the scores for the first ten tasks. This is probably mainly due to the fact that the first ten tasks consisted to a larger extent than the second ten tasks of performance tasks and other tasks requiring spatial aptitude ¹. A score-split, taking into account the type of the task, demonstrated the Left-Right effect for performance tasks and spatial aptitude tasks only, and not for the other ten tasks. For neither of the two categories of tasks could an effect be demonstrated of personal-completion/partner-completion of a task on its being recalled or not.

With regard to the co-operative work situation, another distinction may be made: the distinction between tasks that only require a simple division of labor and tasks that involve exchange of ideas ². Separate recall difference scores for these two types of tasks again reveal the Left-Right effect. A comparison of the splinter-scores for division-of-labor tasks and exchange-of-ideas tasks does not show any difference in recall whatsoever (the scores were also examined for the four breakdowns Left-Right, High a-t-g – Low a-t-g).

At the end of the experiment, the subjects received a list of the tasks with the request to indicate which tasks they had liked very much and which tasks they had definitely disliked. The frequencies are given in table 5. Various analyses did not reveal an effect of the subject's liking (disliking) a task on its being recalled as personally-completed/partner-completed or not.

In the answers to the question whether one of the partners was definitely more skilled than the other on any of the tasks, the partner was given the honor 66 times, while the subjects thought themselves better 12 times. Moreover, in answering another question, the subjects stated 21 times that they would rather have used another solution to a task. Of these specially mentioned tasks, only 46% had been enumerated in the recall test: a percentage which did not differ much from the recall percentage of presented tasks (44%). No difference in skill attribution could be detected between personally-completed and partner-completed tasks.

Another question, asked at the end of the experiment, concerned the feelings of the subject at the moment of interruption. A 7-point scale was presented (with the items in random order): Relieved/Fairly good/All

¹ Performance tasks and other tasks requiring spatial aptitude are tasks number: 1, 2, 3, 5, 6, 7, 8, 14, 16, and 18. This kind of task-analysis has been suggested by Dr. Petronella Rijkssen.

² Tasks requiring division of labor only are numbers 1, 2, 4, 7, 10, 12, 16, and 20. Tasks involving exchange of ideas are numbers 3, 5, 13, 14, and 19. The remaining seven tasks are not clear examples of either of these two categories.

TABLE 5
 Frequencies of tasks liked and tasks disliked: two-person experiment
 (Koekebakker & Van Bergen)

	Task	Liked		Disliked	
		Left	Right	Left	Right
1.	sorting pins, paper clips, etc.	2	3	4	3
2. R	folding letters into envelopes	1	2	8	2
3. R	cutting out a chess-board	4	3	1	1
4.	telephone numbers	3	2	2	6
5.	drawing map of village	16	17	2	–
6. R	lottery-tickets	2	1	4	2
7. R	arranging bridge cards	7	3	1	1
8.	jigsaw puzzle	5	11	1	1
9. R	sightseeing places in Amsterdam	8	12	1	–
10.	addition	1	2	5	7
11. R	deciphering illegible handwriting	4	2	3	1
12.	proof-reading	3	6	6	1
13.	drafting a week's menu	9	13	2	1
14. R	design table-cloth	4	3	7	7
15.	categorizing pictures	4	3	–	1
16.	arranging cards alphabetically	–	4	1	3
17. R	enumerating Dutch authors	12	12	1	–
18. R	pasting sentence	4	6	3	2
19.	drafting a radio program	8	11	1	–
20. R	list of contrasts	5	4	1	1

R = tasks interrupted for subject sitting on the Right-hand chair.

right with me / Did not care much / Willing to go on / Irritated / Angry. Most of the 54 subjects, i.e. 33 subjects, were willing to go on, only 3 subjects felt somewhat irritated, and 17 subjects thought the interruption more or less all right, depending on the task. No differences were found between the four breakdowns. The answers perhaps reflect a stronger tendency to continue than – on second thoughts – might have been expected from the way in which we had disguised the interruption used: “You may rest now”¹. In general, four types of reactions to the interruptions could be observed: complete relaxation, eager or almost aggressive observation of the work on the task, turning away from the partner without looking at the task even once, and feeling guilty (verbally expressed) about leaving a tiresome or nasty task to the partner. At any rate, it cannot be said that a consistent orientation towards the interruptions was shown.

¹ Cf. *McAllister (1952), who also announced the interruptions as rest periods.

Concluding remarks. In the two-person experiment a differential recall between partner-completed (unfinished) tasks and personally-completed (finished) tasks could not be demonstrated. The median recall difference score was 0. This may perhaps have been due to the fact that all the tasks were eventually finished objectively: they were completed either by the subject or by the partner.

The only effect that was demonstrated was the disturbing influence of the differences in memory value of the various tasks. Various attempts to find an interpretation for this phenomenon, however, ended in a fizzle.

5.1.2 *Experiment with a homogeneous task series: jigsaw puzzles*

To avoid the confusing connection between recall of a task because of its being uncompleted (completed) and because of its specific characteristics, an experiment with a homogeneous task series was designed in 1960.

The plan was to start with individual experiments, followed by several series of two-person experiments – if the Zeigarnik effect had been obtained.

Tasks. To meet the criterion of homogeneity a series of jigsaw puzzles was chosen. These puzzles can be presented in a large variety and can be performed by one single person as well as by two people working together. Moreover, several other researchers (Rosenzweig in particular) had worked with jigsaw puzzles and had made no mention of severe difficulties.

Gaily-colored pictures (almost contour drawings, see figure 2) from four nursery books by Dick Bruna, were made into simple jigsaw puzzles ². To each of the subjects, 20 of the following 23 puzzles were presented in varying orders:

apple, two girls in a bath-tub, cutlery, flower, man, farm, tree, eggs, hay-stack, house, dog, Red Indians, church, chickens, cow, children, girl, pear and glass of milk, Punch and Judy show, pig, fish, butterfly, bird.

Design. The subjects were asked to do a series of puzzles without being given a special further instruction. For each subject a different order of the 20 tasks was used. The work on half the puzzles was interrupted.

Several experimental varieties were attempted: display of the picture of the puzzle for ten seconds; no display; use of a stopwatch by the experimenter

² I gratefully acknowledge the assistance of C. P. Venema of the Third Technical School in Amsterdam, who made the pictures into puzzles with the aid of a ribbon-saw.

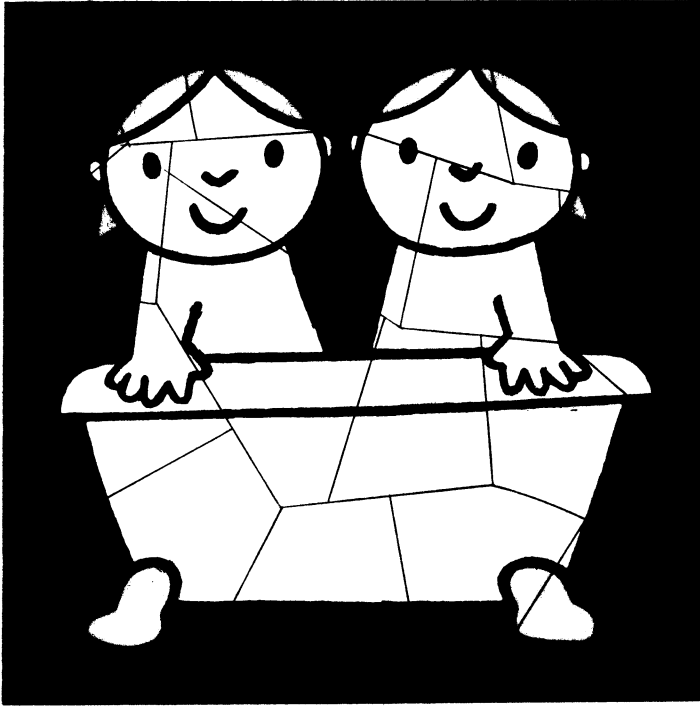


Fig. 2. One of the jigsaw puzzles used in the experiment with a homogeneous task series (reprinted by permission of Dick Bruna from "Fien en Pien").

(= the author); no stopwatch; individual experiments; two-person experiment (in which the subjects were both either interrupted or allowed to finish the task).

Subjects. Subjects were 12 students of and graduates in psychology of the University of Amsterdam. Members of the same profession were chosen because introspection was needed to enable one to choose from the several variations of the experimental design one which would be adequate for further study.

Hypothesis. It was expected that the subjects would recall more uncompleted than completed tasks.

Main results. For most of the subjects a hesitation period in recall could be observed (Zeigarnik 1927, p. 4-5). Separate analyses for recall before the

hesitation period and for total recall did not lead to a verification of the experimental hypothesis: the median recall difference scores were 0 and between 0 and +1 respectively (see table 6).

TABLE 6
Recall frequencies jigsaw puzzles

Experimental variation	Ss	All twenty tasks						First ten tasks	
		Before hesitation period			Total recall			Before hesitation period	Total recall
		RU	RC	RU-RC	RU	RC	RU-RC	RU-RC	RU-RC
with exposition with stopwatch	A	7	9	-2	8	10	-2	-1	-2
	B	4	3	+1	4	6	-2	0	-1
	C	4	4	0	5	4	+1	0	+1
without exposition with stopwatch	D	8	4	+4	8	4	+4	+3	+3
	E	6	5	+1	6	7	-1	0	-1
	F	7	7	0	8	7	+1	0	+1
without exposition without stopwatch	G	6	6	0	6	6	0	-1	-1
	H	5	9	-4	6	9	-3	-3	-2
	J	4	8	-4	5	9	-4	-2	-2
two-person experiment	K	7	5	+2	7	5	+2	+2	+2
	L	6	5	+1	6	5	+1	0	0
	M	5	5	0	7	6	+1	0	+2

RU = number of uncompleted tasks recalled;

RC = number of completed tasks recalled;

number of presentations: 10 uncompleted and 10 completed puzzles.

As several variations of the experimental design were used, and because of differences in the order of presentation of the puzzles, a possible task effect cannot be controlled, and the data will not be analyzed statistically. The medians are mentioned for illustrative purposes only.

Exploration of the data. Apart from the *fish* and the *bird* puzzles, which showed very low frequencies, all the puzzles were almost evenly recalled.

Two kinds of associations used in recall – though of rather little influence – were detected: associations based on coordination of content (e.g., apple-pear and glass of milk; cow-pig), and on alliteration (e.g., kerk-koe-kippen; hooiberg-huis-hond).

The behavior of the subjects varied with the variations in the experimental design. The reactions during the experiments in which no exposition of the picture took place were far more positive than the reactions during the experiments in which exposition did take place, because the element of anticipation – which puzzle it would be – was not removed. In the experiments in which no stopwatch was used the subjects behaved rather aggressively towards the experimenter because of the apparently whimsical character of the interruption.

The most outstanding observation was that all subjects sooner or later became satiated with doing jigsaw puzzles¹. This means that the very condition of the experiment (on task tensions) was undermined.

In the beginning of the experiment all the subjects – apart from a single exception – liked the puzzles and the pictures and felt frustrated by the interruption. However, after a while they all became so bored with doing one jigsaw puzzle after another that they actually welcomed the interruption. When exactly this change occurred did not become quite clear. At any rate it did not occur before halfway through the experiment. Therefore recall difference scores have been computed for the first ten tasks separately. It was hypothesized that the subjects would recall predominantly the uncompleted tasks of the first half of the experiment, at which stage they had still liked the puzzles. However, as can be seen from table 6, this was not the case: the median recall difference scores were 0 and between 0 and –1 respectively. No difference can be detected between recall of the first ten and that of the last ten tasks presented. This leads to the astounding conclusion that whether tensions to finish the puzzles had or had not been set up had no effect on the recall.

Concluding remarks. No difference between recall of uncompleted and completed tasks could be detected. The median recall difference score was 0.

The homogeneity of the 20 tasks resulted in feelings of satiation on the part of all the subjects. As in the later part of the experiment task tensions were no longer established², the very condition of the study was undermined. Therefore no more than 12 persons were asked to act as subjects. The “re-

¹ Cf. *Rosenzweig & Sarason (1942).

² This interpretation differs from the one advanced by Birenbaum (1930, p. 229–231). Birenbaum stated that in case of homogeneity of the tasks, one tension system is established for the experiment as a whole, instead of a number of separate tension systems, one for each individual task.

medy” of homogeneity proved to be worse than the disturbing influence of the differences in memory value of various dissimilar tasks.

5.2 *Replications*

The unexpected results of the two-person experiment and the study with the jigsaw puzzles gave rise to a renewed curiosity about Zeigarnik’s original conditions. Had not Cartwright (1959, p. 33) recently remarked that “when Zeigarnik’s original conditions have been exactly reproduced the same findings have been obtained”? Was it, therefore, correct to ascribe the absence of the Zeigarnik effect in the Dutch studies to deficiencies in the experimental designs – as had been expected – or should other factors have been taken into account as well?

These reflections finally gave rise to the idea of replicating Zeigarnik’s original experiment. Finally, for Duijker (1960, p. 43) had already exclaimed that a psychology without replications could hardly be called a science ¹. Why then the initial hesitations? Partly they may have been due to an overvaluation of inventivity among the younger Amsterdam psychologists ² and to the reception of letters from American colleagues which ended with “Best wishes for significant results”. This amazing wish is probably stimulated by the APA publication policy, by which studies with non-significant results tend to be deemed unworthy of further consideration³. However, the replication of an experiment is always based on at least a slight suspicion of the original (significant) results. This means that the expectation of rejecting the null hypothesis is held with less confidence than usual, and that the researcher is not living up to the wishes and the (presumable) expectations of his colleagues. Moreover, the interpretation of the results – in case of outstanding differences – is far from easy ⁴, the more so when a cross-cultural replication has been made ⁵.

The researcher who works on Lewinian studies of the Berlin period must,

¹ See also, e.g., Schlosberg (1951); Sidman (1960, p. 69–139). *Baltimore *et al.* (1953, p. 28) expressly stressed the necessity of verifying the Zeigarnik effect if it is to be used for demonstrating some other variable .

² According to Nickerson (1963), the same comment may be made with regard to the American situation.

³ Cf. Sterling (1959); Tullock (1959).

⁴ Cf. Rosenthal (1966, p. 34).

⁵ Cf. Rommetveit & Israel (1954); Schachter (1954); Ramuz-Nienhuis & Van Bergen (1960); Sears (1961); Frijda & Jahoda (1966).

furthermore, consider Lewin's (1927, p. 385, 417) remarks on the uselessness of replications. If the prevalence of uncompleted over completed tasks in recall is to be considered a general law, then Zeigarnik could have left 31 subjects (whose data may also be considered replications) out of her main study, because – according to Lewin – the data of one single case (subject) suffice. Moreover, one single case of counter-evidence is sufficient to refute a general law. What about Zeigarnik's three subjects who recalled evenly, and especially her three subjects who recalled more completed than uncompleted tasks? Therefore, there seemed to be no reason not to consider the Zeigarnik phenomenon a stochastic variable ¹.

When the decision to replicate a study has been made, difficulties may arise because of lack of sufficient details. In general, the data published require some additional information. However, partly as a result of non-response, or polite contentless secretary-responses, or the experimenter's distortions of memory, it is not always easy to obtain the essential information. It may therefore happen that a replication, intended as an exact repetition, becomes some kind of variation of the original design. This is indeed a great pity because, as a matter of course, differences in (type of) subjects, experimenter ², time, and place already have to be coped with. These circumstances make the problem of reproducibility salient again. Is it at all possible to replicate in psychology? And if it is, should an attempt be made to copy the experimental procedure exactly or would it be more purposeful to try to obtain the relevant conditions that are believed to underlie the effect under study ³?

I think that the best answer to this problem is to do both. Start with the exact copy and continue with a refined or "adjusted" design (see also Van Bergen 1963a).

¹ Cf. Margineanu (1935).

² Already mentioned by Postman & Jarrett (1952, p. 253) as a source of difficulties in replication studies. The part played by the experimenter is treated in more detail in section 5.3.

³ The solution to the latter problem is even more difficult than obtaining equivalent measuring instruments in cross-national attitude research. Equivalence of attitude scales, which is not achieved by simply translating the scale items (Duijker 1955), may – at least in certain cases – be achieved by replicating the construction process of the scales (Brouwer & Van Bergen 1960, p. 54–55).

5.2.1 Replication of Zeigarnik's experiment I

Design. Zeigarnik's main experiment (1927, p. 7–12) was replicated in 1961 in Amsterdam by the author as the experimenter.

The experiment was started by giving the following general instruction: "I shall give you a series of tasks which you are to complete as rapidly and correctly as possible" (Zeigarnik 1927, p. 4). The interruption of half of the tasks was effectuated by presenting the material for the next task while saying: "Now do this, please" (Zeigarnik 1927, p. 20). Immediately after the last task the experimenter asked what tasks the subject had worked upon during the experiment.

Tasks. 22 tasks were used, half of which were interrupted. The tasks which remained uncompleted by half the subjects were presented as completed tasks to the other half and vice versa. In this way two interruption series, A and B, were used (see table 8 for the list of tasks and the interruption series).

It was possible to deduce the nature and material of the 22 tasks fairly accurately from Zeigarnik (1927), Rupp (1925), and Birenbaum (1930). Only two tasks had to be changed a little. In the task in which *the names of a German town and a German author* were required, Dutch was substituted for German. What was meant by the task called "*chair-mending from a match-box*" remained a complete mystery and therefore *mat weaving* was substituted.

Subjects. Subjects were 37 acquaintances of the experimenter, many of whom were graduates or students in (social) psychology. These subjects were chosen in order to approximate the relation that existed between Zeigarnik and her subjects: unconstrained and one of good-fellowship. The experiments were performed in the experimenter's home, to create a free and easy situation.

Three subjects recognized the experiment while performing the tasks. Their data were discarded from the analysis, but – for illustrative purposes – are mentioned separately in table 7. The data of four other subjects on whom recognition dawned only at the time of instruction to recall, were not discarded from the analysis. Their data are marked with an asterisk.

Each of the two interruption series was presented to 10 male and 7 female subjects.

Hypothesis. It was expected that the subjects would recall more uncompleted than completed tasks, and that the results of the Dutch replication would not differ from those of Zeigarnik's original study.

Problems of replication. As has been stated, it is, in general, not very easy to replicate the conditions of a study exactly. Even if the experimental design has been described in detail the replicator sometimes feels puzzled. Therefore it is no wonder that several problems were met with in the attempt to repeat Zeigarnik's first experiment.

First of all, it was in general very difficult for the experimenter to recognize the right moment for interruption, i.e., the moment when the subject was most engrossed in his work. Notwithstanding Zeigarnik's detailed description, the question whether this moment is when the subject is still in the middle of his work (Zeigarnik 1927, p. 20–21) or closer towards the end of it (p. 56) has been settled rather ambiguously. In addition to this, it was sometimes, e.g. with the *flag at angles*, almost a matter of a conjuring-trick to interrupt at all between the beginning of the work and its completion (analogous difficulties are mentioned by *Schlote (1930) p. 14–15).

Secondly, with three of the tasks specific difficulties arose. In spite of an extra explanation many subjects gave their initials instead of their *monogram* with the consequence that this task was completed in the U-condition nine times. The problem with the *crotcheting* task was that none of the men had ever done it before, so that a fully-fledged learning process had to be inserted. What about the Germans in 1924? Zeigarnik only states that most of the boys (in the experiments with children) were not able to perform this task (p. 77). Were the subjects of her main experiment women only or was crotcheting men's daily work during those days in Berlin? Furthermore, the Dutch subjects did not seem to know "their Vondel" as well as the German subjects probably knew their poets¹. Half the subjects did not know any *poem* by heart ("Will you, please, write down a poem you like very much?"). In order to bring also this task to a happy conclusion the experimenter then added to the instruction, "or a nursery-rhyme or a St. Nicholas rhyme" (of these categories everybody in Holland at least knows one example). However, this did not quite lessen the shock which some of the subjects received when they realized that they knew no poem by heart at all. And with reference to the original instruction, several subjects protested by saying, "But this is not a poem that I like very much, on the contrary!"

¹ However, one of *Schlote's (1930, p. 9) subjects hardly knew any poem by heart either.

Problems of statistical analysis. Not all the tasks were completed or remained unfinished in accordance with the experimental design. As we have seen the *monogram* was completed in the U-condition nine times. Moreover, eight times it happened that a U-task was hurriedly finished during the interruption, and seven times a C-task was not completed, either because of the subject's inability or because of his refusal to go on with the work.

The idea of eliminating the results of these subjects from the analysis was discarded ¹, as their behavior (and probably feelings) was no different from that of many of the other subjects – only a bit more extreme in the consequences. Moreover, the purpose of the experiment is to study a specific kind of behavior of “normal” human beings (from which category the subjects had been drawn) and not the behavior of supermen or robots, who act exactly as the experimenter wishes ².

To cope with the problems posed by the behavior of these subjects and by some of the tasks, three recall difference scores were computed. Firstly, the recall data were adjusted to the U-C reversals, which gave the 11 (RU/U – RC/C) score. Secondly, the proper score for statistical analysis was computed, the (RU) – (RC) score. However, as the U-C reversals were more or less concentrated in some of the tasks, a third recall difference score was formed by eliminating the worst tasks in this respect.

Fortunately, no significant difference was found between the first two sets of scores ³. A possible difference between the second and the third set of scores can only be evaluated by comparing the results of the main testing procedure (see the second footnote of the next sub-section).

Main result. The hypothesis that the subjects would recall more uncompleted than completed tasks was not verified by the data. The median recall difference score was 0 for recall measured before the hesitation period (see table 7).

As this result was influenced by differences in recall between the subjects

¹ For the dangers of rejecting the results of subjects see, e.g., Chapanis & Chapanis (1964); Van Bergen (1964).

² This last statement will probably not be subscribed to by Lyons (1964, p. 105), who stated that “the experimenter keeps looking for the perfect servant...”. See also Back, Hood & Brehm (1964, p. 181).

³ Wilcoxon matched-pairs signed-ranks test: $T_+ = 141$; $T_- = 90$; $T_v = 51$; $n = 21$; $P > .35$.

TABLE 7
Recall frequencies replication Zeigarnik

Condition Sex	Subject	U	C	RU	RC	$11\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
A ♂	A 1			7	5	+ 2	+ 2
	A 2	9	13	3(4)	8(7)	- 3.12	- 3
	A 3			4	7	- 3	- 3
	A 4	10	12	2	8	- 5.14	- 6
	A 5	10	12	5	7	- 0.91	- 2
	A 6	9	13	2(4)	7(5)	- 3.60	- 1
	A 7	9	13	6(7)	8(7)	+ 0.56	0
	A 8			3	4	- 1	- 1
	A 9			3(2)	6(7)	- 3	- 5
	A10			5	6	- 1	- 1
A ♀	A11	9	13	5	6	+ 1.02	- 1
	A12			5	5	0	0
	A13	10	12	2(3)	9(8)	- 6.05	- 5
	A14			7	10	- 3	- 3
	A15	10	12	5(6)	6(5)	0	+ 1
	A16	10	12	3(4)	8(7)	- 4.04	- 3
	A17	9	13	6	3	+ 4.80	+ 3
B ♂	B 1	12	10	9(7)	5(7)	+ 2.75	0
	B 2	12	10	5(4)	3(4)	+ 1.29	0
	B 3*	10	12	6	4	+ 2.94	+ 2
	B 4*	10	12	6	4	+ 2.94	+ 2
	B 5			9	4	+ 5	+ 5
	B 6			6	0	+ 6	+ 6
	B 7			6	3	+ 3	+ 3
	B 8*	10	12	5	6	0	- 1
	B 9			5	5	0	0
	B10*	10	12	6(7)	6(5)	+ 1.10	+ 2
B ♀	B11	10	12	8(9)	5(4)	+ 4.21	+ 5
	B12	10	12	7(8)	8(7)	+ 0.36	+ 1
	B13	10	12	5(6)	5(4)	+ 0.91	+ 2
	B14	10	12	6(7)	9(8)	- 1.65	- 1
	B15			7	7	0	0
	B16			3	7	- 4	- 4
	B17			6	8	- 2	- 2
Recogn.							
A	A18	9	13	2(4)	4(2)	- 0.95	+ 2
A ♂	A19			7	7	0	0
B	B18	9	13	5(6)	7(6)	+ 0.07	0

TABLE 7 (continued)

Condition Sex	Subject	U	C	RU	RC	$11\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU)-(RC)$
	A20	10	12	3	9	- 4.95	- 6
Extra	A21	10	12	0(1)	7(6)	- 6.40	- 5
A ♂	A22			3	8	- 5	- 5

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 11:11

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of
 the tasks. In parentheses: the fre-
 quencies under neglect of the in-
 terruption errors.

Recogn. = recognition of the Zeigarnik experiment while performing the tasks;

* = recognition only at the time of recall;

Extra = slight variation in some of the tasks.

of the two interruption series, A and B¹, the only fair test of the hypothesis was to compare the A-subjects with the B-subjects on their relative recall of A-tasks and B-tasks. However, the null hypothesis could not be rejected², which means that no effect could be demonstrated of the completion/incompletion of a task on its being recalled or not.

Comparison between the original experiment and the replication. Zeigarnik's 32 subjects recalled many more uncompleted tasks as compared with completed ones than the 34 Dutch subjects³. Unfortunately, Zeigarnik does not indicate which subjects were presented with interruption series A and which subjects with interruption series B. Therefore a more relevant comparison cannot be made. This may seem a more serious drawback than it actually is. Only three of her subjects recalled more completed than uncompleted tasks

¹ Analysis based on adjusted scores. Wilcoxon two-sample test: $W = 138$; $n = m = 17$; $P < .01$. The correlation between the recall frequency of the tasks in the uncompleted and in the completed condition is fairly high: $\tau = +.63$ ($n = 22$). For Zeigarnik's original study this correlation is $\tau = +.11$.

² Wilcoxon two-sample test: $W = 326$; $n = m = 17$; $P = .53$. An attempt to increase the power of the testing procedure by eliminating the tasks with the most U-C reversals reduced the P -value to .29 ($W = 351$), which is still non-significant. (Computations carried out by the Mathematical Centre in Amsterdam).

³ Wilcoxon two-sample test based on 11 $(RU/U - RC/C)$ scores: $z = 3.84$; $P = .0001$.

TABLE 8

Recall frequencies of tasks (Zeigarnik replication)

task	replication						Zeigarnik (1927)					
	U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$	U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	RU - RC
1. monogram	8	26	2(7)	7(2)	- 0.20	+ 5			8	9	- 0.62	- 1
2. A pentagram	15	19	2	5	- 1.31	- 3			12	9	+ 1.88	+ 3
3. thread winding			6	3	+ 1.76	+ 3			7	7	0	0
4. A beads			9	10	- 0.59	- 1			12	12	0	0
5. A poem	18	16	12(11)	14(15)	- 2.08	- 4			14	4	+ 6.25	+ 10
6. spiral			8	10	- 1.18	- 2			10	5	+ 3.13	+ 5
7. paper-folding	16	18	5	6	- 0.21	- 1			8	5	+ 1.88	+ 3
8. A crosses in ellipse	16	18	7	3	+ 2.70	+ 4			13	8	+ 3.12	+ 5
9. A matches	15	19	2(3)	6(5)	- 1.84	- 2			9	10	- 0.63	- 1
10. box			14	13	+ 0.59	+ 1	17	15	16	6	+ 5.41	+ 10
11. triangles			14	14	0	0			8	6	+ 1.25	+ 2
12. A counting backwards	14	20	3	6	+ 0.57	- 3			5	2	+ 1.87	+ 3
13. drawing a vase			4	8	- 2.35	- 4	17	15	14	3	+ 6.26	+ 11
14. A flag at angles	15	19	5	4	+ 1.22	+ 1			7	3	+ 2.50	+ 4
15. A honeycomb pattern	19	15	10(8)	8(10)	- 0.08	- 2	17	15	8	6	+ 0.70	+ 2
16. multiplication			7	8	- 0.59	- 1	15	17	5	7	- 0.78	- 2
17. mat weaving (chair)	19	15	13(12)	12(13)	- 1.16	- 1			11	7	+ 2.50	+ 4
18. A straightening wire			3	3	0	0			8	2	+ 3.75	+ 6
19. A pattern of carpet	13	21	9(13)	17(13)	- 1.13	0			13	7	+ 3.75	+ 6
20. crotchet	18	16	16(15)	14(15)	+ 0.14	0			7	6	+ 0.62	+ 1
21. A riddle	14	20	12(15)	16(13)	+ 0.57	+ 2	17	15	15	4	+ 6.17	+ 11
22. printing			15	15	0	0			9	8	+ 0.62	+ 1

U = number of uncompleted tasks presented; } only given if divergent from 17:17 (replication) or
 C = number of completed tasks presented; } from 16:16 (Zeigarnik)

RU = number of uncompleted tasks recalled; } Actual completion/incompletion of the tasks. In parentheses:
 RC = number of completed tasks recalled; } the frequencies under neglect of the interruption errors.

A = tasks interrupted for A-subjects

and another three subjects recalled evenly, which means that even if all these six scores belonged to one interruption series only, ten positive recall difference scores in this same interruption series would still remain.

A comparison of the recall difference scores computed for the 22 tasks also shows a significant difference between the recall data of the original study and that of the replication (see table 8)¹. The recall frequencies per task did not show correlations between the results of the Amsterdam and the Berlin subjects that were significantly different from zero².

Zeigarnik's observation that the first and second tasks recalled tend to be ones that were uncompleted (Zeigarnik 1927, p. 11-12) was not substantiated by the Dutch results (see table 9). A difference was found between the two

TABLE 9

The frequency of being a U-task and a C-task of the first and second task recalled (replication Zeigarnik)

	first task recalled		second task recalled	
	U-task	C-task	U-task	C-task
interruption series A	3	14	6	11
interruption series B	14	3	8	9
	17	17	14	20

interruption series for the first task recalled. Most subjects in series A recalled a completed task, most subjects in series B an uncompleted one³. For the second task no clear-cut tendency can be observed at all.

From her subjects' behavior Zeigarnik inferred three principal attitudes towards the work on the tasks. The subjects worked because of a sense of duty towards the experimenter, out of sheer ambition⁴, or because they were stimulated by the material and the work itself (Zeigarnik 1927, p. 17).

In the Dutch experiments two more attitudes could be deduced from behavior. Though as a rule the experimenter was simply obeyed when the interruption was made (the subjects behaving as "good" subjects)⁵, now

¹ Wilcoxon matched-pairs signed-ranks test. Comparison of adjusted scores: $T_v = 222$; $P < .01$. Comparison of $(RU) - (RC)$ scores: $T_v = 199$; $P < .01$.

² Correlations computed on the adjusted scores ($n = 22$): recall of uncompleted tasks only (RU): $\tau = +.12$; recall of completed tasks only (RC): $\tau = +.01$; recall of both (RU + RC): $\tau = +.16$.

³ Fisher exact probability test: $P < .004$.

⁴ Cf. section 6.1.6.

⁵ Cf. Criswell (1958); Orne (1962).

and again the subjects did not want to hand in their uncompleted work any longer and tried to outwit the experimenter ¹ by hurriedly finishing the task during the interruption. This feeling is reflected very nicely in the *poem* (task 5) handed in by one of the subjects :

“There was a smiling young lady from Riga
Who went for a ride on a tiger.
They came back from the ride,
The young lady inside
And the smile on the face of the tiger.”

Another type of behavior, probably also not observed by Zeigarnik, was refusal to go on with the work ². In addition to flat refusal, feelings of boredom were expressed many times, and once even the name of Karsten (known for her satiation experiments) was mentioned! Not unfrequently the subjects set out with enthusiasm, which dwindled, however, before they were halfway through the task ³.

The wide divergency in the attitudes towards the work may have been caused partly by the very general and ambiguous experimental instructions, “I shall give you a series of tasks which you are to complete as rapidly and correctly as possible”. This instruction leaves the subjects without sufficient orientation as to the purpose of the experiment and leaves them free to conjecture about it (Festinger 1953). The more divergent their guesses about the true purpose of the study are, the less uniform their interpretation of how a subject ought to behave will be.

Further exploration of the data. The recall data analyzed by Zeigarnik were the items that had been mentioned prior to a hesitation period in the recall. She did not find a difference between these data and total recall, i.e., all the items mentioned by the subjects (Zeigarnik 1927, p. 13). To check this finding, the total recall data of the replication were analyzed as well. When all the items that were recalled within a period of three minutes were taken into account, again no effect could be demonstrated of the completion/incompletion of a task on its being recalled or not ⁴.

¹ “... below the surface there may be a battle of wits, engendered by the realisation on the part of the subjects that deception may be practised by the experimenter” (Frijda & Jahoda 1966, p. 119). Cf. Kelman (1967).

² Refusal was also mentioned by *Dancker (1950).

³ Also observed by *Rösler (1955).

⁴ Wilcoxon two-sample test: $W = 344$; $n = m = 17$; $P = .35$ (tasks with the most U-C reversals eliminated). (Computations carried out by the Mathematical Centre in Amsterdam).

The time of day at which the experiment was performed did not seem to have an influence on the recall data.

As in the two-person experiment, recall of performance tasks and other tasks requiring spatial aptitude¹ was analyzed separately from recall of the other tasks. The difference in recall between the two interruption series was found to be due only to the performance – spatial aptitude tasks. For neither of the two categories of tasks could an effect be demonstrated of incompleteness/completeness of a task on its being recalled or not. An extensive analysis of the performances on each separate task and of the verbal commentary that went with it did not lead to any further insight into the problem of selective recall.

Some of the tasks – though intended (by Zeigarnik) to be easy enough to be completed by everybody – unexpectedly formed a problem for some of the subjects. E.g., in one of the tasks, the continuation of a *honeycomb pattern*, many small and several larger mistakes (even up to complete chaos) were made. The performance of the Dutch subjects on this task can be compared with that of Rupp's (1923) subjects, i.e., Germans of Zeigarnik's time, and with *Dancker's (1950) East-German subjects. When the analysis was made according to Rupp's category system (ranging from a correct reproduction of the pattern to chaos) it was found that the performance of the

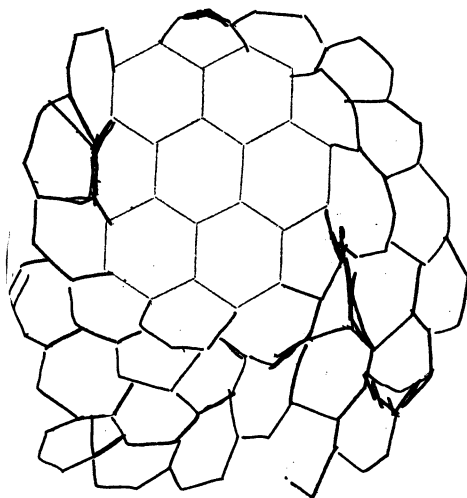


Fig. 3. Example of the continuation of the honeycomb pattern.

¹ Performance tasks and other tasks requiring spatial aptitude are tasks number: 2, 6, 7, 9, 10, 11, 14, 15, 17, 19, and 20.



Fig. 4. Drawing of a vase of flowers (atypical example).



Fig. 5. Drawing of a vase of flowers (typical example).

Dutch subjects was much worse than that of Rupp's 22 university subjects (Rupp 1923, p. 268). Many of the Dutch subjects' *honeycomb patterns* (see figure 3) resembled those of *Dancker's (1950) dystrophics more closely than those of Dancker's healthy subjects. The same applies to the drawing of a *vase of flowers*. Only two Dutch subjects drew vases resembling figure 4, the general type of drawing made by Dancker's healthy subjects. An ex-

ample of a typical drawing made by the Dutch subjects is given in figure 5; it is very similar to those made by the East-German dystrophics.

A certain cluster effect in recall was detected. The clusters comprised of the last two, three or four tasks were due to the efforts of some of the subjects to enumerate the tasks backwards¹. The *spiral* and *box* tasks were frequently recalled together, probably because both involved the cutting of paper. For less obvious reasons, *triangles* and *crotcheting* formed another cluster. Succession in rank order of presentation had only very slight association effects.

Several times the subjects did not like being interrupted at all. This irritation may have been due to either the *work* that was interrupted or to the interruption itself (authoritative position of the experimenter). 44 times in all, explicit protests were made in one way or another. Of the tasks during which this occurred, however, only 21 (= 48%) were recalled, a percentage not very different from the 50% recall of all the interrupted tasks. This is rather an amazing finding because protests demonstrate a tendency to continue which ought to be highly correlated with recall.

The reversal of the tendency to continue namely, feelings of satiation, also occurred². These were, of course, most frequently expressed in connection with tasks that were lengthy and rather tedious. It was found that more tasks of this kind had to be completed in series A than in series B. This is also reflected in the total time needed for the experiment³. To check this factor, minor changes in the tasks were introduced⁴ in order to render the progress of the experiment much smoother. The modified series A was performed by three extra men, whose mean time was very much smaller indeed: 57 minutes. However, like the other A-males they recalled a preponderance of completed tasks (see table 7: Extra A ♂). This seems to point towards the same astounding finding of the experiment with the jigsaw puzzles: whether the subjects wanted to finish a task or whether they came to loath the work on it, does not seem to make any difference to its being recalled or not.

¹ Cf. Zeigarnik (1927, p. 31).

² Phenomena of satiation were also mentioned by *Dancker (1950) with respect to her healthy subjects.

³ The means are: ♂ A 96 min, ♂ B 77 min, ♀ A 69 min, and ♀ B 54 min.

⁴ E.g., for the construction of a cardboard *box* staples were offered instead of glue, and the *crotchet* was replaced with the making of *knots in a piece of string*.

Concluding remarks. In the replication of Zeigarnik's main experiment, no difference between recall of uncompleted and completed tasks could be detected. The median recall difference score was 0. The result of the replication is thus widely divergent from that of Zeigarnik's original study in Berlin.

Previous to this replication, three other exact replications had been performed. There was first of all *Schlote's (1930) study in Göttingen. Although Schlote worked with four subjects¹ only, there is a significant difference between his results and those of Zeigarnik². Between Schlote's and the Dutch data no significant difference could be detected³. The second replication was performed by *Dancker (1950) with East Germans as subjects. Her results did not differ significantly from Zeigarnik's. The third replication, also an East-German one, was *Rösler's (1955) study with school children and pre-school children as subjects. He too obtained highly significant Zeigarnik effects.

A cultural explanation for the striking disparity between Zeigarnik's and the Dutch results therefore seems to be the obvious one. However, *Schlote's (1930) results, obtained only a few years after Zeigarnik's in the same country – however few the subjects were on whose data they were based – somewhat detract from the likelihood of an exclusively cultural explanation.

5.2.2 *Replication of Marrow's experiment I (first experimenter)*

After the flop of the Zeigarnik replication – if the non-verification of someone else's experimental results may be called a flop!⁴ – the necessity of another replication was very urgently felt. It was felt that the results of the second original study to be replicated should be as clear-cut as those of Zeigarnik's, i.e., with the vast majority of the subjects recalling predominantly uncompleted tasks. Moreover, to obtain more data on the relevance of a cultural factor, it was desirable that a replication be made of an experiment in which subjects of another nationality than the German had been used. It was Marrow's study with New York students that met both these requirements.

¹ The RU – RC data are: $4 - 2 = +2$; $6 - 5 = +1$; $7 - 7 = 0$; and $4 - 5 = -1$.

² Wilcoxon two-sample test: $W = 43$; $n = 32$; $m = 4$; $P < .05$.

³ $W = 120$; $n = 34$; $m = 4$; $P > .10$ (adjusted scores).

⁴ E.g., Hanson (1958) in a study on this topic only found a verification percentage of 36 (for a total of 99 tests).

Design. Marrow's first experiment (*Marrow 1938a) was replicated in 1961 in Amsterdam by the author as the experimenter.

On their arrival at the institute¹ the subjects were made to feel at ease. Then the experimenter gave them the following verbal instructions:

"I am going to give you a series of pencil-and-paper tests. These tests will be given to you one at a time. At the signal "*begin*", start working as rapidly and as accurately as you can. Both of these factors are of equal value in your final score. Before each test I will read the instructions to you. These instructions are repeated at the top of each sheet so that you can refer to them again if necessary. Please do not ask any questions during the experimental period. There are definite things called for in every test. Be sure to notice exactly what these are and then try to accomplish them as quickly and as correctly as you can. If you are ready now, we will begin". (*Marrow 1938a, p. 16).

The interruption of half of the tasks was effectuated by saying to the subject: "We will do the next one now". After the 20th task the subject was told: "In the next test you are asked to recall as many of the tasks as you can of those you have done so far" (*Marrow 1938a, p. 19). Then a series of additional questions was asked.

Tasks. Twenty paper-and-pencil tasks were used, half of which were interrupted. There were three serial orders (A, B, C) of task presentation. Within each of the serial orders, the tasks which remained uncompleted by half the subjects were those which the other half of the subjects were allowed to complete, and vice versa. Thus, within each of the serial orders two interruption series, a and b, were used. This resulted in six presentation series Aa and Ab, Ba and Bb, Ca and Cb.

Two slight changes in Marrow's presentation series were made. For series Ba 9 uncompleted and 11 completed tasks are indicated, and for series Bb 11 U-tasks and 9 C-tasks (*Marrow 1938a, table 1, p. 18). The task *follow directions* was chosen to make equal the number of U- and C-tasks: in the replication it was presented as a U-task in series Ba, and as a C-task in series Bb. Another change was made because in series C the ratio of the U-tasks and C-tasks in the first ten tasks presented was different from the ratio of U-tasks and C-tasks in the last ten tasks presented. In order to obtain a 5 : 5 ratio (which is less frustrating for the subjects than a long series of U-tasks, one after another) the U- and C-presentation of the task *cities* and the task *counting backwards* were reversed in the replication.

It was possible to deduce the nature of the tasks fairly well from *Marrow (1938a, p. 13-15). Only three tasks had to be changed a little. Instead of *ten*

¹ This experiment and the ones that follow were performed in university institutes.

American cities beginning with B, C, or D, ten Dutch cities (or villages) beginning with A, B, or D (C being an unusual letter in Dutch) were required. In the task requiring that 25 words be formed from the letters *p-a-i-l-s-t-e*, the letters *k-a-s-t-p-a-p-i-e-r* were presented instead for reasons of adjustment to the Dutch language. In the task requiring that *twelve points of interest in New York City* be enumerated, Amsterdam was substituted for New York.

Subjects. Subjects were 30 students (23 male and 7 female) of the University of Amsterdam and of the Free University in Amsterdam. They were first and second year students from all the faculties and are probably more or less comparable to Marrow's students of elementary psychology. Like the New York subjects the Dutch ones were all volunteers. They were paid *f* 2.50 for their co-operation. The experimenter recruited them at the student restaurant where she personally asked the younger students to take part in her experiment. Almost all the students invited agreed, except a few who had to pass an examination within a fortnight, and a few very tense boys who thought the affair too weird.

Hypothesis. It was hypothesized that the subjects would recall more uncompleted than completed tasks, and that the results of the Dutch replication would not differ from those of Marrow's experiment I.

Problems of replication. It was difficult for the experimenter to decide which role behavior she should display because of a discrepancy in Marrow's description of the experimental procedure (see section 5.3). As in the other experiments she behaved in a friendly and impersonal way, as an experimenter should.

As one of his reasons for requiring verbal recall, Marrow mentioned that it "permitted the subject to specify the same task twice if he unknowingly did so" (p. 20). However, he does not say whether such tasks were also counted twice. In the replication a double recall of one task was counted only once.

Problems of statistical analysis. In this experiment, as in the others, some U-C reversals occurred. Two tasks were completed through an error made by the experimenter, and twelve times it happened that a subject did not succeed in finishing. Most frequently this was the case with *points of interest in Amsterdam*; with *rearranging letters*, which only meant completing some very simple anagrams of everyday fruit and vegetables; and with *object*

naming. In this last task it happened that some of the subjects could not think of any one film star, politician, or scientist! (the subjects were students!).

To cope with these difficulties two recall difference scores were computed: the $(RU) - (RC)$ score and the adjusted score. Fortunately, no significant difference was found between these two sets of scores ¹.

Because of the three serial orders, the proper statistical analysis, which compares the data under exclusion of a specific task memory effect, was hardly possible because there remained only five subjects in each sub-group. An overall analysis therefore seemed the most suitable.

Main result. As Marrow set no time limit on the recall, the data were analyzed for recall before the hesitation period (for comparison with the other experiments) and for total recall (Marrow's measure).

For the adjusted scores the median recall difference scores were between -1 and -1.32 (before the hesitation period), and between -0.51 and -0.61 (total recall). For the $(RU) - (RC)$ scores the median recall difference scores were -1 (both sets of scores) (see table 10). This means that the subjects recalled relatively more completed than uncompleted tasks, a result which is contrary to the hypothesis. For none of the four sets of scores was the predominance of the negative scores significant, though it was sometimes very nearly so ². How near-significant will be seen when the data are tabulated not per subject but per task (see table 11). The tasks in the completed condition were recalled significantly better than those in the uncompleted condition, and this applies to all four sets of scores ³.

Comparison between the original experiment and the replication. Marrow's 30 subjects recalled many more uncompleted tasks in comparison with completed ones than the 30 Dutch subjects, who tended to recall in the reverse direction ⁴.

¹ Wilcoxon matched-pairs signed-ranks test. Before the hesitation period: $T_v = 7$; $P = .77$. Total recall: $T_v = 1$; $P = 1.00$ ($n = 10$).

² Wilcoxon matched-pairs signed-ranks test. Adjusted scores: $T_- = 267$; $T_+ = 111$; $T_v = 156$; $n = 27$; $P > .05$ (before hesitation period); $T_v = 152$; $n = 27$; $P > .05$ (total recall). For the $(RU) - (RC)$ scores: $T_- = 253.5$; $T_+ = 97.5$; $T_v = 156$; $n = 26$; $P > .05$ (before hesitation period); $T_v = 140$; $n = 27$; $P > .05$ (total recall).

³ Wilcoxon matched-pairs signed-ranks test. Adjusted scores: $T_- = 112.5$; $T_+ = 23.5$; $T_v = 89$; $n = 16$; $P = .02$ (before hesitation period); $T_- = 133$; $T_+ = 38$; $T_v = 95$; $n = 18$; $P = .04$ (total recall). For the $(RU) - (RC)$ scores: $T_- = 87$; $T_+ = 18$; $T_v = 69$; $n = 14$; $P = .03$ (before hesitation period); $T_- = 143$; $T_+ = 47$; $T_v = 96$; $n = 19$; $P = .055$ (total recall).

⁴ Wilcoxon two-sample test: $P < .00006$.

TABLE 10

Recall frequencies replication Marrow I (first experimenter)

Condition	Subject number	before hesitation period						total recall			
		U	C	RU	RC	$10\left(\frac{RU}{U}-\frac{RC}{C}\right)$	$(RU)-(RC)$	RU	RC	$10\left(\frac{RU}{U}-\frac{RC}{C}\right)$	$(RU)-(RC)$
Aa	50			4	3	+ 1	+ 1	9	5	+ 4	+ 4
	16			3	2	+ 1	+ 1	4	4	0	0
	21			4	6	- 2	- 2	4	7	- 3	- 3
	24	11	9	7(6)	3(4)	+ 3.03	+ 2	10(9)	5(6)	+ 3.54	+ 3
	34			4	4	0	0	7	6	+ 1	+ 1
Ab	1			1	6	- 5	- 5	4	6	- 2	- 2
	10			3	5	- 2	- 2	5	8	- 3	- 3
	37			5	8	- 3	- 3	5	8	- 3	- 3
	28			4	3	+ 1	+ 1	4	4	0	0
	31			4	8	- 4	- 4	9	9	0	0
Ba	2	9	11	5	6	+ 0.10	- 1	6	8	- 0.60	- 2
	38			8	3	+ 5	+ 5	8	5	+ 3	+ 3
	20			6	5	+ 1	+ 1	8	10	- 2	- 2
	26			1	4	- 3	- 3	1	4	- 3	- 3
	32			3	3	0	0	5	6	- 1	- 1
Bb	8	12	8	5(4)	6(7)	- 3.33	- 3	6(5)	6(7)	- 2.50	- 2
	15			4	7	- 3	- 3	4	8	- 4	- 4
	22	12	8	5(4)	5(6)	- 2.08	- 2	7(6)	8(9)	- 4.17	- 3
	23	11	9	8(7)	4(5)	+ 2.83	+ 2	9(8)	8(9)	- 0.71	- 1
	29			5	6	- 1	- 1	5	8	- 3	- 3

TABLE 10 (continued)

Condition	Subject number	before hesitation period						total recall			
		U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
Ca	3	9	11	4(5)	5(4)	- 0.11	+ 1	7(8)	6(5)	+ 2.33	+ 3
	9			2	2	0	0	8	6	+ 2	+ 2
	17	11	9	3	4	- 1.71	- 1	8	7	- 0.51	+ 1
	25			8	5	+ 3	+ 3	9	6	+ 3	+ 3
	30	13	7	2	2	- 1.32	0	4	2	+ 0.22	+ 2
Cb	7			2	5	- 3	- 3	2	5	- 3	- 3
	14			2	5	- 3	- 3	3	7	- 4	- 4
	19			4	3	+ 1	+ 1	4	3	+ 1	+ 1
	27	11	9	3(2)	4(5)	- 1.71	- 3	5(4)	7(8)	- 3.23	- 4
	33	11	9	4(3)	7(8)	- 4.14	- 5	7(6)	9(10)	- 3.64	- 4

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 10:10

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of the tasks. In parentheses:
 the frequencies under neglect of the interruption errors.

TABLE 11

Recall frequencies of tasks replication Marrow I (first experimenter)

task	replication										Marrow I (1938)		
	before hesitation period						total recall				total recall		
	U	C	RU	RC	$15\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$	RU	RC	$15\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$	RU	RC	RU-RC
1. scattered numbers			9	9	0	0	11	9	+ 2	+ 2	14	11	+ 3
2. addition			11	12	- 1	- 1	11	14	- 3	- 3	11	8	+ 3
3. circle drawing			7	10	- 3	- 3	8	13	- 5	- 5	12	5	+ 7
4. counting backwards			4	5	- 1	- 1	5	7	- 2	- 2	9	3	+ 6
5. sentence building			6	5	+ 1	+ 1	12	8	+ 4	+ 4	8	7	+ 1
6. limerick			4	6	- 2	- 2	7	8	- 1	- 1	9	7	+ 2
7. authors and titles			7	7	0	0	12	10	+ 2	+ 2	5	6	- 1
8. rearranging letters	18	12	6(4)	8(10)	- 5	- 6	12(10)	10(12)	- 2.50	- 2	15	8	+ 7
9. free association			9	9	0	0	9	12	- 3	- 3	13	9	+ 4
10. numbering alphabet			6	5	+ 1	+ 1	7	9	- 2	- 2	11	7	+ 4
11. newspaper description	17	13	6	7	- 2.79	- 1	7	10	- 5.36	- 3	8	5	+ 3
12. cities	14	16	4(5)	6(5)	- 1.34	0	7(8)	8(7)	0	+ 1	11	6	+ 5
13. object naming	19	11	9(6)	9(12)	- 5.17	- 6	14(11)	11(14)	- 3.93	- 3	11	9	+ 2
14. word construction			2	6	- 4	- 4	3	7	- 4	- 4	8	4	+ 4
15. reversed spelling			9	7	+ 2	+ 2	12	9	+ 3	+ 3	7	5	+ 2
16. points of interest	18	12	4(3)	6(7)	- 4.17	- 4	7(6)	7(8)	- 2.91	- 2	14	8	+ 6
17. following directions	14	16	8	8	+ 1.07	0	10	12	- 0.52	- 2	6	4	+ 2
18. opposites			2	5	- 3	- 3	6	9	- 3	- 3	8	5	+ 3
19. handwriting disguise			3	2	+ 1	+ 1	7	8	- 1	- 1	5	4	+ 1
20. sentence arrangement			7	7	0	0	10	10	0	0	13	8	+ 5

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 15:15
 RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of the tasks. In parentheses:
 the frequencies under neglect of the interruption errors.

Between Marrow's six presentation series no differences in selective recall could be detected. The five subjects who recalled evenly or who had a negative score were distributed over almost all of the six series (*Marrow 1938a, p. 26).

A comparison of the recall difference scores computed for the 20 tasks shows the same outstanding difference between the recall data of the original study and of the replication (see table 11).

Of Marrow's subjects 26 "attributed the interruption to some inadequacy on their part, such as 'being too careful and hence too slow', or 'not very good at this type of test', etc. The other four subjects felt that the interruption meant that they had displayed mastery of the particular task, or that they were not expected to finish it anyway" (*Marrow 1938a, p. 20). The explanation for the interruption given by the Dutch subjects was less concentrated in the "failure" category. Thirteen of the subjects attributed the interruption to some inadequacy on their part, six subjects stated objectively or rather aggressively that the time allowed had been too short to finish the task, eight subjects mentioned both reasons, differentiated for the various tasks, and three subjects could not think of any reason at all for the interruption.

Exploration of the data. Several times, or more precisely: 36 times, the subjects explicitly did not accept the interruption. Either they protested loudly or the experimenter had to snatch the paper away from the subject. Of the tasks during which this occurred, 18 (= 50%) and 25 (= 69%) were recalled respectively, percentages which are quite a bit higher than the 39% and 57% respectively for all the interrupted tasks. This finding is thus in accordance with the Lewin/Zeigarnik theory.

For further explorations see sections 5.3.3 and 5.7.

5.2.3. *Replication of Marrow's experiment II*

An effort was made to replicate Marrow's second experiment (*Marrow 1938b) with six subjects (male) in Amsterdam.

With the exception of the instructions, all the experimental conditions (tasks, subjects, experimenter) were the same as those of the replication of Marrow I (see section 5.2.2).

The different instructions were used in an attempt to reverse the attitude of the subjects towards the interruption. Interruption was to connote that the task had been successfully performed (subjectively completed), while ob-

jective completion was to imply that the performance had not been good enough (subjectively uncompleted). To achieve this the following sentences were added to the instructions of Marrow I:

"On such tasks as you indicate to me by your manner of handling and by the speed with which you work that you have sufficient mastery of the task, it will not be necessary for you to finish that task. The total time devoted to the entire series is of great importance in determining your final score, and so the more tasks you perform satisfactorily the less work you will have to do, and similarly the less time you will require". (*Marrow 1938b, p. 38).

Hypothesis. It was hypothesized that the subjects would recall more completed than uncompleted tasks, and that the results of the Dutch replication would not differ from those of Marrow II.

Results. During the work on the tasks three of the six subjects completely forgot the additional instructions, even to the extent that they did not want to hand in their work and tried to finish some of the tasks. The attitude taken towards the interruption by two other subjects could not be discovered, so only one of the subjects adhered to the instructions given. The most likely explanation for these findings is that the experimental situation evokes a rather strong association (interruption – too slow, or insufficient time – failure due either to oneself or to experimenter) which can hardly be undone by verbal instructions only. This is the reason why the originally intended

TABLE 12
Recall frequencies replication Marrow II (first experimenter)

Con- dition	Subject number	before hesitation period						total recall			
		U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
Aa	5			4	4	0	0	5	6	-1	-1
Ab	36			5	7	-2	-2	5	7	-2	-2
Ba	12			1	3	-2	-2	6	6	0	0
Bb	6	11	9	2	6	-4.85	-4	4	6	-3.03	-2
Ca	35	11	9	4(3)	2(3)	+1.42	0	7(6)	6(7)	-0.31	-1
Cb	11	11	9	4(3)	4(5)	-0.81	-2	8(7)	8(9)	-1.62	-2

U = number of uncompleted tasks presented; }
C = number of completed tasks presented; } only given if divergent from 10:10

RU = number of uncompleted tasks recalled; }
RC = number of completed tasks recalled; } Actual completion/incompletion of the tasks. In parentheses: the frequencies under neglect of the interruption errors.

number of 30 subjects was cut down to six. If the experimental conditions cannot be realized further accumulation of data becomes meaningless.

For illustrative purposes only, the recall data, which tend towards the expected negative direction, are given in table 12.

5.3 *Relation experimenter–subject*

In view of the non-verification of three different studies (Zeigarnik, Marrow I, and Marrow II) – it may even be justifiable to speak of *four* non-verified studies, if the experiment with the jigsaw puzzles is regarded as a kind of replication of *Rosenzweig's (1943) experiment under informal conditions – some further reflection on the experimental conditions does not seem out of place.

The two-person experiment was performed with five different experimenters; but in the other four studies the author was the experimenter. Did she perhaps bias the results ¹? But how?

In clinical psychology, studies have been made which demonstrated that the experimenter's personality characteristics and/or his behavior can influence the test results ², and in experiments on interviewer effect it was found that the interviewer's own attitude towards the topic of the interview and the interviewer's expectations as to how the respondent will reply may form sources of bias (see Hyman *et al.* 1954). Still, in 1961, it seemed rather far-fetched to transfer these findings to experimental psychology, and even Brunswik's (1956, p. 131) demand that "examiners should also be sampled" (representative design) attracted hardly any attention. As late as 1960, e.g., Mulder complained that the relation between the observer and the person observed was a highly neglected one. At around that time, however, Rosenthal *et al.* had already begun work on a series of studies on experimenter effect ³.

Biasing influences in the studies on selective recall reported in this chapter may have been the experimenter's expectations with regard to the value, and especially to the sign, of the recall difference scores, and the interest she had in the outcome of the studies, which were to be used for her doctor's thesis. In an attempt to avoid the expectation bias, the experimenter tried

¹ "We do not take even our own observations quite seriously, or accept them as scientific observations, until we have repeated and tested them" (Popper 1959, p. 45).

² Cf. the reviews by Masling (1960); Van de Loo (1962).

³ Cf. the reviews by Rosenthal (1963*b*; 1964*a, b*; 1966); Kintz *et al.* (1965).

to think of other matters during the recall period in order to exclude the possibility of giving unconscious signals ¹ and of assessing the scores during recall. Furthermore, she did not look at the data in the course of a study, except when the subject wanted to know his score, which occurred only rarely.

There are two points which detract from the likelihood of the experimenter's expectations having a strong effect. In several cases she made a rough estimate of a subject's recall difference score, because Zeigarnik (1927, p. 79) had said that a fairly experienced experimenter could predict quite accurately how his acquaintances would score. But the frequency of the author's correct estimates should be ascribed to chance. Furthermore, the expectations as to the outcome of the studies in general changed during the course of experimentation. The first experiments were performed with the conviction that a Zeigarnik effect would be obtained. When this effect had failed to appear a number of times, doubt arose: no hypothesis was held with any conviction. The last experiments (still to be described) were carried out with the implicit expectation that no effect whatsoever would be obtained. Still, the results of the first, middle, and last period do not differ greatly.

Although the experimenter was, therefore, not considered as a serious source of error, it seemed wiser to control possible "suggestion-errors" (Rosenzweig 1933c). Therefore another experimenter was hired to replicate Marrow's first study once more. This new experimenter knew of Zeigarnik's original study but was not informed about the results obtained thus far by the author.

In the mean time the author's behavior towards the subjects was discussed. In all the experiments she had behaved in the ordinarily friendly and "im-personal" way typical of an experimenter. The behavior had formed a problem in the Marrow replication because of a discrepancy in Marrow's description of the experimental procedure. On the one hand, the subject was to be treated informally and to be made to feel at ease. On the other hand, the instructions, the interruption sentence, and the instructions for recall were formulated in a rather – not to say very – authoritative manner. It was therefore possible to conduct the experiment in a friendly way but it would at the same time not be too difficult to change it into an autocratic affair. Considering that Marrow, who in later life became President of the Board of the Harwood Manufacturing Corporation, might have been a

¹ Linschoten (1964, p. 163) characterized the psychologist as a born Von Osten ...

much more autocratic experimenter than the author¹, the failure to replicate the results was – for the time being – ascribed to a possible difference in experimenter-subject relationship. Therefore a second replication of Marrow I was decided on, and a less friendly role was prescribed for the author as experimenter.

Two more replications of Marrow I were thus performed: one with a second experimenter who behaved in an impersonal but friendly way, and one with the first experimenter whose behavior may be characterized as autocratic.

5.3.1 *Replication of Marrow's experiment I (second experimenter)*

Except for the different experimenter, Thea Harms, all experimental conditions (instructions, tasks, subjects) were the same as those of the replication of Marrow I made by the first experimenter (see section 5.2.2). 25 Amsterdam students (male) served as subjects; the data of one of them – a student of psychology – was discarded because he recognized the Zeigarnik-like design.

Hypothesis. No hypothesis was formulated. Were we to expect results comparable to Marrow's original study or to the author's replication?

Problems of statistical analysis. Fortunately, the six U-C reversals did not lead to a significant difference between the adjusted scores and the (RU) – (RC) scores².

Main result. The median recall difference score of the 24 subjects was 0 for recall before the hesitation period. For total recall, the median recall difference score was between –0.1 and –1 for the adjusted scores and –1 for the (RU) – (RC) scores (see table 13). This means that there was no difference whatsoever between the recall of uncompleted and completed tasks³.

¹ Later, when the author had become acquainted with Marrow's (1957) book on "Making management human" this harsh (stereotyped) image was exchanged for a milder one.

² Wilcoxon matched-pairs signed-ranks test: $T_v = 5$; $n = 5$; $P = .62$.

³ Wilcoxon matched-pairs signed-ranks test. Adjusted scores: $T_- = 114$; $T_+ = 96$; $T_v = 18$; $n = 20$; $P = .76$ (before hesitation period); $T_- = 14$; $n = 22$; $P > .80$ (total recall). For the (RU) – (RC) scores: $T_- = 126.5$; $T_+ = 83.5$; $T_v = 43$; $n = 20$; $P > .43$ (before hesitation period); $T_v = 41$; $n = 21$; $P > .44$ (total recall).

TABLE 13

Recall frequencies replication Marrow I (second experimenter)

Con- dition	Subject number	before hesitation period				total recall					
		U	C	RU	RC	$10\left(\frac{RU}{U}-\frac{RC}{C}\right)$	$(RU)-(RC)$	RU	RC	$10\left(\frac{RU}{U}-\frac{RC}{C}\right)$	$(RU)-(RC)$
Aa	T 1			2	8	- 6	- 6	9	10	- 1	- 1
	T 7			6	6	0	0	9	6	+ 3	+ 3
	T13			3	1	+ 2	+ 2	7	4	+ 3	+ 3
	T19	11	9	3(2)	5(6)	+ 2.82	- 4	5(4)	6(7)	- 2.12	- 3
Ab	T 2			4	3	+ 1	+ 1	7	5	+ 2	+ 2
	T 8			3	2	+ 1	+ 1	6(5)	7(8)	- 1	- 3
	T14			5	2	+ 3	+ 3	6	5	+ 1	+ 1
	T20			5	6	- 1	- 1	7	7	0	0
Ba	T 3			8	8	0	0	8	9	- 1	- 1
	T 9			4	0	+ 4	+ 4	6	4	+ 2	+ 2
	T15			6	3	+ 3	+ 3	7	8	- 1	- 1
	T25			3	2	+ 1	+ 1	5	5	0	0
Bb	T 4			4	7	- 3	- 3	7	8	- 1	- 1
	T10			2	6	- 4	- 4	5	8	- 3	- 3
	T16			2	2	0	0	6	7	- 1	- 1
	T22			1	5	- 4	- 4	1	7	- 6	- 6
Ca	T 5	11	9	4(3)	3(4)	+ 0.31	- 1	8(7)	6(7)	+ 0.60	0
	T11			5	2	+ 3	+ 3	5	6	- 1	- 1
	T17			5	2	+ 3	+ 3	8	4	+ 4	+ 4
	T23			4	4	0	0	7	4	+ 3	+ 3
Cb	T 6	11	9	2(1)	3(4)	- 1.51	- 3	6(5)	5(6)	- 0.10	- 1
	T12			1	4	- 3	- 3	4	6	- 2	- 2
	T18			3	5	- 2	- 2	3	6	- 3	- 3
	T24	11	9	5(4)	4(5)	- 0.11	- 1	6(5)	5(6)	- 0.10	- 1

U = number of uncompleted tasks presented;
 C = number of completed tasks presented;

} only given if divergent from 10:10

RU = number of uncompleted tasks recalled;
 RC = number of completed tasks recalled;

} Actual completion/incompletion of the tasks. In parentheses: the frequencies under neglect of the interruption errors.

Comparison with original experiment and first replication. Marrow's 30 subjects recalled many more uncompleted tasks in comparison with completed ones than the second experimenter's 24 Amsterdam subjects¹. Between the two Dutch replications no difference in recall difference scores could be detected².

The distribution of reasons suggested by the subjects for the interruption was comparable to that in the first replication. The explanations were about equally distributed among the three categories: not enough time, not good at this type of test or too slow, and both reasons. Between these explanations – or attitudes towards the work on the tasks – and the sign of the recall difference scores, no relation was found.

Further exploration of the data. See sections 5.3.3 and 5.7.

5.3.2. *Replication of Marrow's experiment I (autocratic behavior of experimenter)*

Another replication of Marrow's first experiment was performed by the author³, who now behaved in a more autocratic and less friendly (even rather nasty) way. This was effectuated by generally formal behavior and by a very abrupt interruption manner. The experimenter said, in a starchy voice, "Just hand it in", and at the very same moment snatched the paper away from the subject.

Subjects. Subjects were 13 male students of the University of Amsterdam and of the Free University. The results of one of them had to be discarded because he was slightly drunk⁴, so there remained two subjects in each of the six presentation series.

Hypothesis. It was hypothesized that the subjects would recall more uncompleted than completed tasks, and that the results of the Dutch "autocratic" replication would not differ from those of *Marrow's (1938a) experiment I.

¹ Wilcoxon two-sample test: $z = 4.05$; $P < .00006$.

² $z = .54$; $P = .59$, computed for $(RU) - (RC)$ scores before the hesitation period only.

³ See section 5.2.2.

⁴ With this subject the experimental procedure became more or less the reverse of a Zeigarnik study: the experimenter gently – though in vain – tried to make the subject finish the C-tasks.

Problems of statistical analysis. Six times U-C reversals occurred, because six of the subjects were not able to finish one of the tasks. E.g., one of the (student!) subjects did not think that he had read as many as ten books (for the *authors and titles* task). This means that the differences between the $10(RU/U - RC/C)$ scores and the $(RU) - (RC)$ scores were all in the same direction, which led to a significant difference between the two sets of scores¹. In case of discrepancies in the results, these would therefore have to be interpreted with the utmost care.

TABLE 14

Recall frequencies replication Marrow I (autocratic behavior of experimenter)

Con- dition	Subject number	U	C	before hesitation period				total recall			
				RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
Aa	K44	11	9	5(4)	2(3)	+ 2.33	+ 1	8(7)	5(6)	+ 1.72	+ 1
	K46			3	2	+ 1	+ 1	3	2	+ 1	+ 1
Ab	K41	11	9	5(4)	2(3)	+ 2.33	+ 1	7(6)	4(5)	+ 1.92	+ 1
	K51			3	5	- 2	- 2	8	9	- 1	- 1
Ba	K40	11	9	4(3)	3(4)	+ 0.31	- 1	4(3)	3(4)	+ 0.31	- 1
	K49			4	2	+ 2	+ 2	5	4	+ 1	+ 1
Bb	K43	11	9	4	4	- 0.80	0	6(5)	8(9)	- 3.44	- 4
	K47	11	9	4(3)	5(6)	- 1.91	- 3	7(6)	9(10)	- 3.64	- 4
Ca	K45			5	4	+ 1	+ 1	8	9	- 1	- 1
	K52			3	3	0	0	6	10	- 4	- 4
Cb	K42			1	4	- 3	- 3	3	4	- 1	- 1
	K48	11	9	2(1)	3(4)	- 1.51	- 3	5(4)	7(8)	- 3.23	- 4

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 10:10

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of the tasks. In parentheses: the frequencies under neglect of the interruption errors.

¹ Wilcoxon matched-pairs signed ranks test. Before hesitation period: $T_v = 19$; $P = .06$. Total recall: $T_v = 21$; $P = .03$. $n = 6$.

Main result. For the adjusted scores the median recall difference scores were between 0 and +0.31 (before the hesitation period), and 0 (total recall). For the $(RU) - (RC)$ scores the median recall difference scores were -1 (both sets of scores) (see table 14). This means that there was no difference whatsoever between the recall of uncompleted and completed tasks ¹.

Comparison with original experiment and other replications. Marrow's 30 subjects recalled many more uncompleted tasks in comparison with completed ones than the twelve Amsterdam subjects who were treated in an autocratic way ². Between the three Dutch replications no difference in recall difference scores could be detected ³.

The subjects' overt behavior was different from that in the other experiments. After a few abrupt interruptions many of the subjects put a protecting arm on and around their sheet of paper. This made snatching away the tasks even more awkward. Several subjects rather angrily threw their ballpoints down on their desks and one of them even threw his at the experimenter. Though most of the subjects tried to keep smiling, a few gave the impression that they wanted to leave swearing, which was not denied on later questioning. In general, they were less talkative than in the other experiments.

Further exploration of the data. See sections 5.3.3 and 5.7.

5.3.3 Combination of the three Marrow I replications

Main result. Between the three replications of Marrow's first experiment no systematic differences in recall difference scores were found. It was therefore possible to analyze the combined data of 66 subjects (see sections 5.2.2, 5.3.1, and 5.3.2).

The increased number of subjects made it possible to control a possible interruption series effect, which – in the Marrow experiments – must be

¹ Wilcoxon matched-pairs signed-ranks test. Adjusted scores: $T_+ = 34.5$; $T_- = 31.5$; $T_v = 3$; $n = 11$; $P > .90$ (before hesitation period); $T_v = 30$; $n = 12$; $P = .27$ (total recall). For the $(RU) - (RC)$ scores: $T_+ = 18.5$; $T_- = 36.5$; $T_v = 18$; $n = 10$; $P > .38$ (before hesitation period); $T_v = 42$; $n = 12$; $P = .11$ (total recall).

² Wilcoxon two-sample test: $z = 3.87$; $P = .0001$.

³ Wilcoxon two-sample test, $(RU) - (RC)$ scores before the hesitation period only. The author's two replications: $z = .52$; $P = .60$. Second experimenter vs first experimenter with autocratic behavior: $W = 288$; $P > .90$.

computed separately for each of the three serial orders of task presentation. A comparison of the selective recall of a-tasks and b-tasks of the 11 a-subjects and the 11 b-subjects only led to a rejection of the null hypothesis in the C-series ((RU) – (RC) scores before the hesitation period) ¹. The rejection was in favor of the completed items.

A similar comparison, based upon the (RU) – (RC) scores for total recall, led to a rejection of the null hypothesis in the B-series ². This rejection was also in favor of the completed items.

A combination of the test results – i.e., a comparison of the recall data of 33 a-subjects and 33 b-subjects – led to a rejection of the hypothesis of no difference, both for recall before the hesitation period and for total recall ³. This means that the combined results of the three Marrow I replications show – under exclusion of a specific task memory effect – a significantly better recall of the completed than of the uncompleted items.

This result was not, however, accompanied by recall of a majority of completed items for the first and second task recalled. Neither for the first task recalled ($RU = 37$; $RC = 29$) nor for the second task recalled ($RU = 36$; $RC = 30$) could a preference for either uncompleted or completed tasks be observed ($P > .25$).

Comparison with original study. When the (RU) – (RC) scores of Marrow's 5 subjects and the 11 Dutch subjects for each of the six separate interruption series were compared, large differences were obtained for four of the series. The series Aa and Ca did not show a significant difference ⁴.

As might have been expected, the combination of the test results of the six series led to an enormous difference between the results of *Marrow's (1938a) study and the combined results of the three replications ⁵.

¹ A-series: $W = 94$ (–), $P = .39$; B-series: $W = 91$ (–), $P = .34$; C-series: $W = 55$ (–), $P = .024$. (Computations carried out by the Mathematical Centre in Amsterdam).

² A-series: $W = 131$ (+), $P = .76$; B-series: $W = 21$ (–), $P = .001$; C-series: $W = 81$ (–), $P = .19$. (Computations carried out by the Mathematical Centre in Amsterdam).

³ $P = .0168$ respectively $P = .0124$. (Computations carried out by the Mathematical Centre in Amsterdam).

⁴ Aa: $W = 76$, $P = .25$; Ab: $W = 100$, $P = .012$; Ba: $W = 101$, $P = .010$; Bb: $W = 103$, $P = .007$; Ca: $W = 62$, $P = .73$; Cb: $W = 108$, $P = .003$. (Computations carried out by the Mathematical Centre in Amsterdam).

⁵ $P = .000\ 000\ 24$. (Computations carried out by the Mathematical Centre in Amsterdam).

Further exploration of the data. Additional exploration of the data is given for the three Marrow I replications combined.

When the experiment was over, the subjects were presented with a list of the 20 tasks (listed in a different order from the three serial orders used). They were asked which of the tasks they had and which they had not finished. Of the 1320 tasks presented, 99 were wrongly remembered as having been completed and 65 were wrongly remembered as having been interrupted (12% of all the tasks). The slight inclination to believe that more tasks had been completed than had actually been the case must be ascribed mainly to the subjects of the first experimenter's replication. When for these subjects the recall difference scores were computed according to the subjects' report of completion/incompletion, no difference was found between the subjective and the "objective" scores for the data before the hesitation period: the median recall difference score was -1 . For total recall, however, the subjective scores did make a difference, in the negative direction: the median recall difference score was between -2 and -3 .

At the end of the experiment the subjects were asked to state for each task whether they had liked it, disliked it or felt rather indifferent towards it. For each of the three categories, recall of the tasks did not differ markedly from recall of all the tasks. The same applied to the breakdown with regard to the interrupted tasks. For the completed tasks, however, there seemed to be a tendency for the disliked tasks and also for the tasks to which the subjects felt indifferent to be somewhat better recalled than might have been expected from the recall of all the completed tasks¹ (see table 15 for the data of the first experimenter's replication). This is a finding that contradicts the task tension theory, for the relatively best recalled tasks were not the liked ones that remained uncompleted, but the disliked (and also "indifferent") ones that the (poor) subjects had to finish!

Another – also very peculiar – finding is partly in accordance with Zeigarnik's results. She found that the interesting tasks were recalled equally well in the uncompleted and in the completed condition and that the whole effect of the superior recall of the uncompleted tasks was due to the tasks towards which the subjects felt indifferent (Zeigarnik 1927, p. 45). For the Dutch replication of Marrow I a similar result with respect to the completed tasks was obtained: there was no difference between RU and RC for the

¹ This finding is only applicable to the results of the first experimenter's replication and the "autocratic" experiment. The frequencies, consisting of several ratings per subject, were not independent; therefore a test of the independency hypothesis was not applied.

TABLE 15

Frequencies of tasks liked and tasks disliked: replication Marrow I
(first experimenter)

	Before hesitation period			Total recall		
	Liked	Indifferent	Disliked	Liked	Indifferent	Disliked
RU	63(40%)	32(37%)	23(42%)	95(60%)	48(55%)	29(53%)
U not recalled	94	55	32	62	39	26
RC	70(43%)	54(53%)	20(56%)	97(59%)	73(72%)	26(72%)
C not recalled	94	47	16	67	28	10
total	321	188	91	321	188	91

	Before hesitation period	Total recall
Recall of all interrupted tasks	118/300 = 39%	172/300 = 57%
Recall of all completed tasks	144/300 = 48%	196/300 = 60%
Recall of all tasks	262/600 = 44%	368/600 = 61%

liked tasks (nor for the disliked tasks), and the predominance of the completed tasks in recall was due entirely to the indifferent tasks!

Another requirement at the end of the experiment was to rate the quality of one's own performance on each task on a ten-point scale. Performances on tasks in the completed condition¹ were rated somewhat higher than performances on the same tasks in the unfinished condition². Within each of the two conditions there was no significant difference between the performance ratings for tasks recalled and tasks not recalled. Neither the subjects who felt very confident about their performance (the extremely high ratings) nor those who rated their work very low showed any preference in their recall for either unfinished or finished tasks.

In general, the tasks required more time in the completed than in the uncompleted condition (means $2\frac{3}{4}$ minutes and 2 minutes respectively). Within the uncompleted condition there was no difference in time required for the tasks recalled and for the tasks not recalled. Within the completed condition, however, significantly more time was spent on the tasks recalled than on the tasks not recalled, but only in the first experimenter's replication³.

The effect of position within the series upon the frequency of recall of a task did not show a primacy effect. As in Marrow's original study, a recency

¹ Mean 7.0, 7.3, and 7.0 respectively for the three replications.

² Mean 6.3, 6.4, and 6.2 respectively.

³ Sign test: $x = 9$; $n = 30$; $P = .04$.

effect and a slight retroactive inhibition of subsequent tasks upon earlier tasks was found in the combined Dutch replications¹. Contrary to Marrow's findings, however, this effect was only slightly applicable to the uncompleted tasks and was not applicable to the completed tasks (see table 16).

TABLE 16
Recall as connected with serial position
(combined replications of Marrow I)

serial position	frequency of presentation	RU	%RU	RC	%RC	RT	%RT
1	66	13	.39	9	.27	22	.33
2- 5	264	38	.29	35	.26	73	.28
6-10	330	55	.33	72	.44	127	.38
11-15	330	54	.33	76	.46	130	.39
16-19	264	58	.44	52	.39	110	.42
20	66	29	.88	24	.73	53	.80

Conclusion. Contrary to the hypothesized relation, the subjects of the combined Marrow I replications recalled significantly more completed than uncompleted items. Various exploratory analyses did not lead to an adequate interpretation of this result.

5.4 *Sharpening of experimental conditions*

Several efforts have been made to copy exactly the experimental procedure and conditions of the studies in which a clear-cut Zeigarnik effect had been found (see sections 5.2.1, 5.2.2, 5.3.1, and 5.3.2). The expected result was, however, not obtained: the uncompleted tasks were not recalled better than the completed ones.

Perhaps it was a mistake to try to replicate exactly. Perhaps an exact replication is impossible when the original studies have been performed in a different country and decades ago, i.e., in 1924 and some time before 1938.

It was decided to create experimental situations much more favorable for obtaining a Zeigarnik effect than those of the original studies. In this way the probability of a neglected variable working in the negative direction

¹ However, in the data of the first experimenter's replication no retroactive inhibition was observed.

would be abolished, or at any rate severely diminished. Three experiments belonging to this category were performed.

5.4.1. *Experiment with only three unfinished tasks*

While observing the subjects during the experimental sessions, the impression was obtained that many of them became accustomed to the interruptions after a while and even came to expect others. After all, half the tasks were interrupted, and it is quite worthwhile to try to become accustomed to something of such frequent occurrence.

To prevent the subjects from becoming used to the interruptions and to accentuate the interruptions at the same time, an experiment was designed with only three interrupted tasks. Marrow's twenty tasks were chosen for this purpose. The frequency of recall per task obtained in previous experiments was needed in order to make an adequate choice for the three tasks that were to be interrupted.

In order not to "prove" the hypothesis by means of the design, the three tasks that had been least recalled in the three Marrow I replications were chosen¹: *opposites*, *Dutch cities*, and *counting backwards*. Within a series of completed tasks these interrupted items stand out so much that they should be recalled easily², despite their low recall value.

Instructions and serial orders were similar to the Marrow I replications.

Subjects were 15 Amsterdam students (3 of them female), belonging to the same population and approached in the same way as in the Marrow replications (see section 5.2.2).

Thea Harms (the second experimenter) was the experimenter, except with the subjects H 33, H 28, and H 37 (seen by the author).

Hypothesis. It was hypothesized that the 3 uncompleted tasks would be recalled relatively more often than the 17 completed tasks.

Problems of statistical analysis. The type of statistical analysis applied thus far was not applicable to the data of this experiment. The probability of recall of uncompleted items was different from the probability of recall of completed items. The method of the 2×2 comparison of probabilities was used³. Its use is permitted in this case because of the differentiation of the

¹ See sections 5.2.2, 5.3.1, and 5.3.2.

² Compare Von Restorff (1933); *De Monchaux (1951).

³ Advised by P. van der Laan (Mathematical Centre in Amsterdam).

tasks into a category of items of low recall value and a category of items of high and medium recall value. The 15 independent tests (for each subject) were combined ¹.

Main results. Not one of the 15 subjects recalled all three of the uncompleted tasks before the hesitation period, and only two of them did so during total recall (see table 17).

TABLE 17

Recall frequencies experiment with only three unfinished tasks

condition	subject number	before hesitation period		total recall	
		RU	RC	RU	RC
A	T26	0	9	0	12
	T27	1	5	1	11
	H33	1	5	2	10
	T35	1	6	2	11
	T38	1	5	1	10
B	H28	1	9	1	12
	T29	1	8	1	13
	T32	1	6	2	9
	T36	2	6	3	12
	T39	1	8	2	10
C	T30	0	3	3	9
	T31	0	7	2	15
	T34	1	6	2	7
	H37	0	7	0	13
	T40	1	6	2	9

The test results showed that the null hypothesis, which states that there is no difference in recall between uncompleted and completed items, could not be discarded ². This result applied both to recall before the hesitation period and to total recall.

It might be argued that the experimental hypothesis had not been given a fair chance because of the choice of interrupted tasks with an extremely low recall value. It might, furthermore, be speculated that the three items – although they did not lead to rejection of the null hypothesis – were

¹ See Van Eeden (1953).

² Both for recall before the hesitation period and for total recall: $z = .36$; $P = .72$.

recalled much more frequently than in the three replications of Marrow I. This argument can be refuted, as recall of the three tasks before the hesitation period was no different in this experiment from recall of the same tasks in the three replications. Total recall increased, on the one hand, for *counting backwards* and *opposites*, and, on the other hand, decreased somewhat for *Dutch cities* (see table 18). The fact that these three tasks were the only ones out of a total of 20 tasks that remained uncompleted did not help to increase the recall of the unfinished items ¹.

TABLE 18

Frequency of recall of three unfinished tasks (experiment with only three unfinished tasks)

task	before hesitation period				total recall			
	experiment with three unfinished tasks		three replications Marrow I		experiment with three unfinished tasks		three replications Marrow I	
		%		%		%		%
opposites	3	.20	11	.17	8	.53	28	.42
Dutch cities	4	.27	18	.27	6	.40	31	.47
counting backwards	5	.33	20	.30	10	.67	32	.48

Further exploration of the data. The ordinal position of the isolated tasks in the task series was not found to have had an effect on the frequency with which these tasks were recalled ².

Conclusion. The hypothesis that the 3 uncompleted tasks would be recalled relatively more frequently than the 17 completed tasks must be dropped.

5.4.2 *Experiment with tasks with a clear-cut end*

Zeigarnik (1927, p. 48-56) showed that the predominance of the uncompleted tasks in recall depended partly upon the type of task. The recall scores were much higher for tasks with a definite conclusion than for tasks which are best characterized as continuous activities ³. It was therefore de-

¹ Perhaps the result should partly be ascribed to the fact that in a Zeigarnik experiment the names of the tasks are learned incidentally. Wallace (1965, p. 417), in a review of the Von Restorff phenomenon, concludes that "it is only under quite specific circumstances (isolation by differences in materials) that the Von Restorff effect appears for incidental learners".

² Cf. Green (1956); Deutsch & Sternlicht (1967).

³ *Endhandlungen vs fortlaufende Handlungen.*

cided to design an experiment using tasks with a clear-cut end only. The conclusion had to be dictated by the work on the task itself, and not by some point arbitrarily set by the experimenter. E.g., does a subject really get a feeling of having completed the task when he has jotted down the authors and titles of *ten* books he has read, simply because the experimenter said *ten* (why not just eight or even twelve?)?

In the literature it is fairly frequently stressed that a task-oriented attitude should be induced in the subjects in order to obtain a Zeigarnik effect. An ego-oriented attitude on the part of the subject (e.g., my I.Q. is being measured) – sometimes accompanied by feelings of stress – is said to diminish the Zeigarnik effect and even to reverse it. Any feeling of being tested, therefore, had to be avoided.

With these two requirements in mind an experiment was designed, and performed in 1961 with the author as the experimenter.

Subjects. Subjects were 40 students (half male, half female) of the University of Amsterdam and of the Free University in Amsterdam. They were first and second year students from all the faculties. They were recruited and paid in the same way as were the subjects for the Marrow replications (see section 5.2.2).

Design. Twenty different tasks were presented, half of which were interrupted. The interruption was effectuated by presenting the material and the instructions for the next task, and collecting the material for the old – unfinished – task. The tasks which remained uncompleted by half the subjects were completed by the other half and vice versa. In this way two interruption series, A and B, were used.

When the subject had entered the room, the following instructions – aimed at bringing about an exclusively task-oriented attitude – were given.

“Presently, after the experiment is over, I shall tell you what it was all about. I prefer not to do that now. But on the other hand, it is not nice for you if you have no idea of what the experiment is about at all and therefore I shall tell you something about it. I am working on a long series of experiments, all of which differ from the others in some small respect. Now with the last experiment that I performed I obtained very queer results, and it might be that these queer results were only produced by the material I used, i.e., the utensils with which must be worked. I have therefore selected a different kind of material and I shall give you other things to do than were given to the subjects in the last experiment. The reason I only want first and second year students is because of replication purposes: the other experiment was performed with first and second year students. If I had asked another group of subjects, I should not know – if different results were obtained – whether to

ascribe the results to the different group of subjects or to the different kind of material. I expect that the latter will be the case, as I said. So this is a study of the material in which the group of subjects forms the constant factor. Well, let's begin then. I only want to ask you to work as rapidly and correctly as possible. Otherwise it would not be a fair test of the material".

After the completion (or interruption) of the twentieth task, the subject was required to recite the alphabet backwards. This was done to counter the tendency to recall backwards. After two minutes he was stopped and the recall instruction was given. Recall of the alphabet task was not included in the results. The recall instructions read:

"Would you, please, tell me what tasks you have done during the experiment? You need not give them in any special order, just recite them as they come to mind".

Tasks. The following 20 tasks were used ("A" means: tasks interrupted for subjects in the A-series):

1. Jigsaw puzzle.
2. A Unwrapping of rattling parcel (in which a piece of chocolate).
3. A Building of one meaningful sentence, using the words "canal", "clock", "flowers", and "week".
4. Counting the money in a box and writing down the total amount (15 Dutch florins).
5. A Paper-folding after an example.
6. Blowing up a plastic toy elephant (see figure 6).
7. Drawing a continuous line connecting scattered numbers (result: drawing of an armchair).
8. Cutting, folding, and stapling a box from thin cardboard.
9. A Composing a limerick with a given first line ("Er was eens een dame in Eelde").
10. A Looking up in the timetable the time of departure from Amsterdam Central Station of a train due in Olst at 2 p.m.
11. Screwing a hook onto a piece of wood.
12. A Writing the word "Oudemanhuispoort" with the left hand (left-handed subjects had to use the right hand).
13. Serial arrangement of seven photos in order to form a story.
14. A Multiplying of 5457 and 6337.
15. Writing a picture postcard (of the Wester Tower in Amsterdam) to Aunt Loes to tell her that one will not be able to stay with her.
16. A Assembling parts of a toy car (kept together with one screw only).
17. A Making a five-point star with a folding pocket-rule.
18. Drawing a cow.
19. Covering a book.
20. A Peeling a big potato.

Hypothesis. It was expected that the subjects would recall relatively more uncompleted than completed tasks.

Problems of statistical analysis. In all 18 U-C reversals occurred. Nine times it happened that a subject hurriedly finished a task during the interruption or was exceptionally quick because, e.g., he knew part of the timetable by heart (which made it impossible for the experimenter to interrupt at all). Nine times it happened that a subject did not succeed in finishing a task. This occurred four times with the task *train Amsterdam–Olst*. Many subjects confessed to never having looked in a timetable before. They always traveled in their parents' car, hitch-hiked, or if they did go by train, they just went to the station and waited for the next train ¹! And what is even worse, several of the (student) subjects thought neither of looking for a map nor of looking for an index of stations, and sometimes – by sheer luck – found the correct hour of departure by thumbing through the timetable.

Unfortunately, a significant difference was found between the adjusted scores, $10(RU/U - RC/C)$, and the $(RU) - (RC)$ scores ², the latter being somewhat smaller. In case of discrepancies in the results these would have to be interpreted with the utmost care.

Main results. The median recall difference score, computed for all 40 subjects, was 0 (see table 19). This statistic is the same for both sets of scores, for recall before the hesitation period and for total recall (the latter data will not be analyzed any further).

A comparison of the A-subjects with the B-subjects on their relative recall of A-tasks and B-tasks did not lead to rejection of the null hypothesis ³. Thus no effect could be demonstrated of the completion/incompletion of a task on its being recalled or not. This result applied to the data of all subjects as well as to the separate analysis of the data of the men and women.

Further exploration of the data. Recall frequencies tabulated per task (see table 20) demonstrated a high correlation between recall of a task in the uncompleted and in the completed condition: $\tau = +.72$ (based on adjusted scores).

A minor finding which is difficult to explain is the practically complete

¹ In Holland trains come and go with such frequency that – except for a few rare cases during the weekend – one never has to wait longer than one hour. However, more time may be lost by catching a train which makes many stops or by taking a bad connection.

² Wilcoxon matched-pairs signed-ranks test: $T_v = 89$; $n = 15$; $P = .01$.

³ Wilcoxon two-sample test: $W = 417$; $n = m = 20$; $P = .82$. For the male subjects: $W = 130$; $n = m = 10$; $P = .26$; for the female subjects: $W = 79$; $n = m = 10$; $P = .44$. (Computations carried out by the Mathematical Centre in Amsterdam).

absence of recall (only named once) of the *toy elephant* task. The animal was quite a sight with its loud colors and other provoking attributes (see figure 6), and made quite a noise as well with its bell and the squeaks pro-

TABLE 19
Recall frequencies experiment with tasks with a clear-cut end

Condition Sex	Number Subject	U	C	before hesitation period			
				RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU)-(RC)$
A ♂	58			4	3	+ 1	+ 1
	61			4	7	- 3	- 3
	63			3	6	- 3	- 3
	68	11	9	5(4)	5(6)	- 1	- 2
	69			4	4	0	0
	72	9	11	2	4	- 1.42	- 2
	75			3	1	+ 2	+ 2
	76	8	11	3	5	- 0.80	- 2
	82			4	2	+ 2	+ 2
	83	11	9	4(3)	5(6)	- 1.91	- 3
A ♀	57			7	5	+ 2	+ 2
	65			5	2	+ 3	+ 3
	74			6	4	+ 2	+ 2
	80			6	4	+ 2	+ 2
	84			5	6	- 1	- 1
	88			3	3	0	0
	89			5(4)	2(3)	+ 3	+ 1
	91			2	4	- 2	- 2
	93	8	12	3(4)	5(4)	- 0.42	0
	95			4	7	- 3	- 3
B ♂	60			3	3	0	0
	62	9	11	3	3	+ 0.50	0
	64			4	3	+ 1	+ 1
	67			4	3	+ 1	+ 1
	70			3	3	0	0
	71			4	4	0	0
	77			5(4)	3(4)	+ 2	0
	79	9	11	3	3	+ 0.50	0
	81			4	5	- 1	- 1
	87			4	4	0	0

Table 19 (continued)

Condition Sex	Subject number	U	C	before hesitation period			
				RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU)-(RC)$
B ♀	59	11	9	5(4)	3(4)	+ 1.22	0
	66	11	9	4(3)	2(3)	+ 1.42	0
	73	9	11	3	4	- 0.31	- 1
	78	11	9	5	3	+ 1.22	+ 2
	85			3	3	0	0
	86			4	3	+ 1	+ 1
	90	11	9	6(5)	6(7)	- 1.22	- 2
	92	11	9	4	4	- 0.81	0
	94			5	4	+ 1	+ 1
	96			3	3	0	0

U = number of uncompleted tasks presented; } only given if divergent from 10:10
 C = number of completed tasks presented; }

RU = number of uncompleted tasks recalled; } Actual completion/incompletion of
 RC = number of completed tasks recalled; } the tasks. In parentheses: the frequen-
 cies under neglect of the interrup-
 tion errors.



Fig. 6. Plastic toy elephant: the material for one of the tasks used in the experiment with tasks with a clear-cut end, and in the experiment with children.

TABLE 20

Recall frequencies of tasks (experiment with tasks with a clear-cut end)

task	U	C	before hesitation period			
			RU	RC	$20\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
1. jigsaw puzzle			17	17	0	0
2. A unwrapping of parcel			6	5	+ 1	+ 1
3. A sentence building	19	21	8	8	+ 0.80	0
4. counting money			2	2	0	0
5. A paper-folding	19	21	3(4)	2(1)	+ 1.25	+ 3
6. toy elephant			1	-	+ 1	+ 1
7. scattered numbers			-	7	- 7	- 7
8. box	21	19	16(15)	14(15)	+ 0.48	0
9. A limerick	21	19	19(18)	14(15)	+ 3.38	+ 3
10. A timetable	22	18	7(5)	2(4)	+ 4.14	+ 1
11. hook	21	19	14(13)	13(14)	- 0.34	- 1
12. A left-handed writing			3	1	+ 2	+ 2
13. photos	18	22	8	6	+ 3.42	+ 2
14. A multiplication			3	2	+ 1	+ 1
15. card to Aunt Loes	19	21	7	13	- 5.02	- 6
16. A toy car			10	14	- 4	- 4
17. A star			5(4)	3(4)	+ 2	0
18. cow			10	6	+ 4	+ 4
19. book covering			4	5	- 1	- 1
20. A potato peeling*	19	20	19	19	+ 1	0

* One of the potatoes, although it looked all right from the outside, proved to be rotten. This made the distinction completion/incompletion irrelevant.

U = number of uncompleted tasks **presented**; }
 C = number of completed tasks **presented**; } only given if divergent from 20:20

RU = number of uncompleted tasks **recalled**; }
 RC = number of completed tasks **recalled**; } Actual completion/incompletion of
 the tasks. In parentheses: the frequencies under neglect of the interruption errors.

duced in blowing it up. Destruction of the work – which happens, of course, when one is interrupted while blowing something up – is not sufficient explanation for the low recall of the task. Zeigarnik (1927, p. 47-48) found only a relatively low RU for destroyed tasks, not an extremely low RC as well.

A certain cluster effect in recall was detected. One of the clusters was formed by the first and the last task. The *car* and *hook* tasks were frequently

recalled together, probably because both involved screwing. Likewise, the *limerick*, *sentence*, and *postcard to Aunt Loes* tasks formed a cluster (writing involved). Probably because it was a picture postcard that was sent to Aunt Loes, this task was frequently recalled together with the *photo* task. For less obvious reasons the *jigsaw puzzle* and *box making* tasks formed another cluster (these were not the only Kindergarten tasks!), and so did the *limerick* and the *potato peeling* tasks. In some of the limericks it was said that the lady from Eelde “aardappels teelde” (grew potatoes). However, this rhyme was not used by any of the subjects who recalled the two tasks together.

During the chat which followed the experiment, when the later explanation was given, several subjects said that they had been irritated by the interruptions, while others said that they had not minded at all. It was also remarked that not being able to finish had not mattered very much if they already knew what the solution would be. So long as the task still remained a problem, the interruption was irritating to these subjects.

One of the subjects said that he had the impression that the rapid succession of tasks was a handicap to remembering them. At every interruption he had wanted to continue and at any rate stay with the task mentally. But then he had said to himself every time: “Do stop it. Forget all about it and continue your work”.

Conclusion. An experiment that proceeded in a pleasant manner, using only tasks with a definite conclusion, and in which a task-oriented attitude had been induced in the subjects, did not bring the long abided Zeigarnik effect into the Dutch lab.

5.4.3. *Experiment with children*

After performing her experiment with children, Zeigarnik (1927, p. 79–82) concluded that children (more than adults) wish to resume unfinished tasks because their needs tend to press on in a rather unbridled manner. She interpreted the recall data of the children as having a larger average positive value than those of the adults. However, when the data are analyzed properly no significant difference between the two sets of scores can be found (see section 1.1.3). Nevertheless it seemed worthwhile to attach importance to Zeigarnik’s observations and also to perform an experiment with children (in 1962 in Amsterdam with the author as the experimenter).

Subjects. Subjects were 40 fifth grade primary school children (20 boys and 20 girls) from ten municipal schools, approximately evenly distributed over the higher, middle and lower socio-economic districts of Amsterdam¹. 16 of the children were 10 years old, 19 of them were 11, and 5 were 12. From each school two boys and two girls were chosen, and distributed over the interruption series A and B. With the exception of a single school the children were chosen at random by the experimenter who asked for, e.g., the third child in the second row.

Tasks. Most of the twenty tasks of the experiment with tasks with a clear-cut end (see section 5.4.2) were used with the children. A few of them had to be changed because they were either too difficult or too dangerous for the children. The *limerick* task was changed into “*a rhyme you know by heart*”; looking up the *telephone number of the Amsterdam Zoo* was substituted for the *train Amsterdam–Olst* task; instead of *photos*, simple *pictures* were presented; and – because the author did not want to have to give first aid four times a day – *getting a key onto a key-ring* was substituted for the *potato peeling* task.

As in the other experiments, two interruption series, A and B, were used.

Design. The same instructions as have been used for the experiment with tasks with a clear-cut end (see section 5.4.2) were given, but in a much simpler way. The same idea – to relieve tension, to detract from the apparent intelligence test situation, in short, to induce a task-oriented attitude – was at the root of these instructions. This, however, did not work at all with the kids. They were far too pleased at having been “selected” from the whole class to take in the idea that the tasks were more important than they themselves. Moreover – although they perhaps no longer think that the whole world revolves around them – eleven-year-old children are more ego-centered than adults, which made the attempt to induce a task-oriented attitude by means of verbal instructions rather futile. On the other hand, most children become much more absorbed in small tasks than adults. Thus the desired attitude was still arrived at, even in a more natural way. Only

¹ The author wishes to acknowledge gratefully the co-operation of A. de Roos, alderman of Amsterdam, of B. G. Palland, education inspector, and of W. C. A. Amo, Miss M. B. A. Engelchor, J. R. de Groot, E. E. Haras, B. Hogeweg, W. C. de Pagter, J. van Reijen, W. Tromp, J. W. F. Usi, and Miss J. A. Vinger, heads of the schools, who gave their consent and rendered assistance in the actual execution of the experiment.

very rarely was a child so tense that it asked the experimenter's approval for almost every little thing it did (or did not) accomplish.

When the experiment was over, the sheets with task instructions and interruption series were shown to the child and the purpose of the experiment explained. The requirement not to talk about anything that had happened for the rest of the day and especially not about the tasks they had performed was met by all of the subjects. It was completely understood by them that the memory test (the work of the experimenter) and the fun of the subjects after them would be ruined if they talked that they did not. They deserve an enormous compliment for their secrecy, for back in the classroom they were immediately overwhelmed with questions from all the other kids.

Hypothesis. It was hypothesized that the children would recall relatively more uncompleted than completed tasks.

Problems of statistical analysis. In all only 7 U-C reversals occurred, which fortunately did not lead to a significant difference between the adjusted scores and the (RU) – (RC) scores ¹.

Main results. The median recall difference score was –1, both for the adjusted scores and for the (RU) – (RC) scores (see table 21). For total recall the median was even lower: –2 (the latter scores will not be analyzed any further).

A comparison of the A-subjects and the B-subjects on their relative recall of A-tasks and B-tasks led to rejection of the null hypothesis, which means that completed tasks were recalled significantly better than unfinished tasks. A separate analysis of the data of the boys and girls led to non-significant respectively near-significant results ². At any rate the results were contrary to the experimental hypothesis.

Further exploration of the data. There was some relation between recall of a task in the uncompleted condition and in the completed condition (see table 22), although the correlation was not very high: $\tau = +.56$ (based on the adjusted scores).

¹ Wilcoxon matched-pairs signed-ranks test: $T_v = 6$; $n = 7$; $P = .69$.

² Wilcoxon two-sample test: $W = 584$; $m = n = 20$; $P = .012$. For the boys: $W = 135$; $m = n = 10$; $P = .19$; and for the girls: $W = 148$; $m = n = 10$; $P = .07$. (Computations carried out by the Mathematical Centre in Amsterdam).

The *toy elephant* that occupied the last place in recall in the experiment with tasks with a clear-cut end (see section 5.4.2) moved forward to the tenth place in the experiment with the children.

A peculiar fact was that of the 31 children who wrote an address on the picture postcard of the Wester Tower in Amsterdam in order to tell Aunt

TABLE 21
Recall frequencies experiment with children

Condition Sex	Subject number	U	C	before hesitation period			
				RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
A ♂	S 1			2	4	- 2	- 2
	S 5	9	11	1	4	- 2.53	- 3
	S 9			3	5	- 2	- 2
	S13			2	5	- 3	- 3
	S17			1	5	- 4	- 4
	S21			2	5	- 3	- 3
	S25			4	3	+ 1	+ 1
	S29			1	4	- 3	- 3
	S33			3	4	- 1	- 1
	S37	9	11	2	4	- 1.42	- 2
A ♀	S 2	9	11	2	3	- 0.51	- 1
	S 6			2	6	- 4	- 4
	S10			5	5	0	0
	S14			4	5	- 1	- 1
	S18			1	6	- 5	- 5
	S22			3	4	- 1	- 1
	S26	9	11	3	4	- 0.31	- 1
	S30			2	4	- 2	- 2
	S34			6	4	+ 2	+ 2
	S38			2	4	- 2	- 2
B ♂	S 3	11	9	3	3	- 0.60	0
	S 7			3	6	- 3	- 3
	S11			3	3	0	0
	S15			4	2	+ 2	+ 2
	S19			1	5	- 4	- 4
	S23	9	11	7(8)	3(2)	+ 5.05	+ 6
	S27			3	5	- 2	- 2
	S31	9	11	5(6)	3(2)	+ 2.82	+ 4
	S35			2	3	- 1	- 1
	S39			5	2	+ 3	+ 3

Table 21 (continued)

Condition Sex	Subject number	U	C	before hesitation period			
				RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
B ♀	S 4			3	2	+ 1	+ 1
	S 8			3	6	- 3	- 3
	S12			5	4	+ 1	+ 1
	S16			4	6	- 2	- 2
	S20			2	4	- 2	- 2
	S24			5	7	- 2	- 2
	S28			3	4	- 1	- 1
	S32			6	4	+ 2	+ 2
	S36			5	5	0	0
	S40			4	2	+ 2	+ 2

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 10:10

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of
 the tasks. In parentheses: the frequen-
 cies under neglect of the inter-
 ruption errors.

Loes that they were not able to stay with her, 19 mentioned the name of a street just around the corner of their school (and their home). Only three children indulged in a visit outside Amsterdam.

The recall data differed somewhat according to the different social status of the schools from which the children came. The recall difference scores of the children from the middle-class schools were relatively the highest (median 0). The medians of the children from the higher- and lower-class schools were -1 respectively -3.

During a little chat, before the explanation of the experiment was given, the subjects were, amongst other things, asked, whether they had liked doing the experiment in the way it had just been done, with some of the tasks completed and some not, or whether they would rather have finished everything. 21 children said they preferred completing the things they had started, 9 children had liked doing the experiment as they had just done it, and 6 children said that their wish to finish depended on the task (4 subjects did not answer the question). The recall difference scores of the three groups of subjects did not differ significantly. Nevertheless it was possible to make some remarkable observations. Of the six children who had distinguished

TABLE 22

Recall frequencies of tasks (experiment with children)

task	U	C	before hesitation period			
			RU	RC	$20\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
1. jigsaw puzzle			15	16	- 1	- 1
2. A unwrapping of parcel			6	14	- 8	- 8
3. A sentence building	21	19	6	11	- 5.88	- 5
4. counting money			4	2	+ 2	+ 2
5. A paper-folding			2	3	- 1	- 1
6. toy elephant	19	21	2(3)	10(9)	- 7.41	- 6
7. scattered numbers			3	6	- 3	- 3
8. box			10	16	- 6	- 6
9. A rhyme			13	15	- 2	- 2
10. A telephone number			1	0	+ 1	+ 1
11. hook			16	14	+ 2	+ 2
12. A left-handed writing	19	21	1	4	- 2.76	- 3
13. pictures			7	4	+ 3	+ 3
14. A multiplication			8	7	+ 1	+ 1
15. card to Aunt Loes	19	21	4(5)	7(6)	- 2.45	- 1
16. A toy car			7	12	- 5	- 5
17. A star	18	22	1	7	- 5.25	- 6
18. cow			11	10	+ 1	+ 1
19. book covering			4	5	- 1	- 1
20. A key	19	21	6	4	+ 2.51	+ 2

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 20:20

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of
 the tasks. In parentheses: the frequen-
 cies under neglect of the interrup-
 tion errors.

between tasks they had wanted and tasks they had not wanted to finish, four came from the same (higher-class) school. Of the nine children who had rather disinterestedly (or in some cases perhaps politely?) replied that everything had been all right just as it had been, four were from one school as well (middle-class). With the exception of one girl, all the children of the lower-class schools belonged to the "finish everything" category. Whether all of the 21 children of this category had really longed to finish everything they had started remains an open question. Quite possibly several of them, in answer to the question, just recited the norm as it had been taught them

without a real desire of their own to finish. One of the children gave a further explanation: “I don’t like unfinished work, because later you still have to do it”. And another little girl herself gave the experimenter reason for doubting whether she had wanted to complete everything when she replied “Oh no!” to the question whether she was anxious to know what was in the *parcel*, accompanied by the offer of letting her open it, even although the experiment was over. She was one of the five kids (out of 20) who did not care in the least about the parcel anymore.

Conclusion. Contrary to the expectation, the children recalled significantly more completed than uncompleted tasks.

5.5 Control of task effect

5.5.1 Equalization-of-tasks experiment

In several of the experiments performed thus far, the correlation between recall of a task in the uncompleted and in the completed condition had been found to be rather high. An attempt to eliminate this effect by using a homogeneous task series (such as jigsaw puzzles) did not work at all (see section 5.1.2).

An effort was made to equalize a series of heterogeneous tasks by means of an outside criterion. In an experiment performed in 1963 with the author as the experimenter, the subjects were told that work on the tasks would be judged and paid for accordingly. However, for each task an almost equal standard amount of money was awarded¹. It was hoped that in this way the interfering effect of task memory would be abolished.

Subjects. Subjects were 18 students and two instructors (male) of the Institute of Technology in Eindhoven. They were personally invited to participate when met by the author in one of the halls of the Department of Social Relations. All of the students knew the author as one of the staff members of the department and some of them still had to pass a small (and rather unimportant) examination with her. Most of the students had – apart from their interest in technical science, in which they were majoring – a keen interest in business administration. The experiment was announced as a study on work classification. No mention of any payment was made.

¹ The basic idea for this experiment was suggested by Wim Brinkman.

Design. The experimenter gave the subjects the following instructions:

“I am trying to develop a system of judging which includes aspects of work classification and of merit rating, i.e., a system which takes into account both the degree of difficulty of the work and the way in which the work is performed. Whether the system is any good, I don’t know yet. That is why I designed an experiment. You will be given quite a number of different tasks, all of which will be judged on a certain scale. This means that the difficulty of the task and your way of handling the material will be expressed by marks. When the experiment is over I shall explain the construction of the scale and I shall also tell you what special observations I made. If I were to tell you all this now, you would work accordingly and then the whole experiment – which is intended as test of the scale – would be worthless. However, there are a few things you might as well know now. The range of the scale is from 1 to 40. The lowest score that you can obtain – for each separate task – is 1, and the highest possible score is 40. My hypothesis is that, if a homogeneous group of subjects is worked with – e.g., students of technical science – the total score of all the subjects will be about equal but the variance will be enormous. I expect to find big differences between the scores for the various tasks, and I expect to find that these scores will also vary from subject to subject: one subject may score high on the one task and low on the other; another subject, low on the one task and high on the other. But the mean score should be about the same for all of you. For other groups, e.g. operators, or teachers, I would expect a different average score with the same large variance. I am very anxious to know whether these hypotheses will be verified or not. In order to involve you in this problem I shall give you your score every time. Of course, I could just tell you the score but I thought it might be nicer to let you earn your wage task by task instead of paying you the usual subject salary all at once. Therefore I shall pay you what you score in money. For each separate task you will get an amount that may vary between 1 and 40 cents. Well, for the rest I think it is self-evident that you will work on the tasks correctly and rapidly, as it is an experiment on the judgment of tasks and work. Shall we start?”


After the instructions had been given the experimenter procured an impressive looking and completely mystifying double scale, a stopwatch and four boxes with small change.

The interruption was effectuated by presenting the material and the instructions for the next task. Recall was asked for immediately after the last task was over.

The following wages, in cents, were paid for the twenty tasks: 28, 27, 22, 25, 23, 28, 24, 26, 28, 25, 23, 27, 24, 25, 22, 26, 24, 23, 28, and 22. For each of the two interruption series, A and B, the same order of scoring was used. The subjects earned 5 guilders, which is twice the usual subject wage. It was reflected that an amount of 10 or 12 cents would have almost no meaning for students and that the payment per task should therefore not be less than about 25 cents.

The story about the enormous variances had been told to induce in the

subjects the feeling of equal pay for each task (which was intended to lead to an equalizing of the tasks).

Tasks. Most of the tasks of the experiment with tasks with a clear-cut end were used (see section 5.4.2). Four of them, however, had to be changed. The task *counting money* could not be used in an experiment in which money played such an important part. It was replaced by: *counting coffee stamps* and choosing the appropriate object from a list of free gifts made up by the coffee firm. The train *timetable* task was discarded because so many problems had been encountered with it. It was replaced by the task: try to find the student restaurant in the *Rue Mabillon in Paris*. A booklet with maps of the various "arrondissements" was provided. The *toy elephant* task was removed from the series because it had been so very much neglected in recall by the Amsterdam students. Instead, the subjects were required to construct the symbol of the Institute of Technology in Eindhoven  with some ingenious building material. Because of the cluster formation *car-hook*, the *car* task was eliminated. Instead a *plug* had to be attached to flex. Moreover, the order of presentation and the order of the interruptions had to be changed a little (see table 24).

Two interruption series, A and B, were used.

Hypothesis. It was hypothesized that relatively more uncompleted than completed tasks would be recalled.

Check on the experimental manipulation. After recall had been given the subjects were asked to express their feelings about and opinion of the judging system. 17 of them mentioned the small difference between the scores or the low variance. Two subjects did not talk about the scoring system and could not even be brought to answer leading questions. Only one subject had the impression that the scores varied to quite an extent.

Most of the subjects therefore perceived the manipulation of equal pay in the way the experimenter had intended. This does not mean that they liked it. Several of the subjects complained about it spontaneously, because they would have preferred to have been given some extreme scores as well. Some thought the low variance a defect of the scale, others sought the fault within themselves and sighed about their mediocrity.

Problems of statistical analysis. Only one subject did not succeed in finishing one of the tasks and was too quick with another task to allow the ex-

perimeter to interrupt him. This can hardly be called a problem for the analysis.

TABLE 23
Recall frequencies equalization-of-tasks experiment

Condition	Subject number	before hesitation period			
		RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
A	E 1	5	5	0	0
	E 2	2	2	0	0
	E 3	3	6	-3	-3
	E 4	2	6	-4	-4
	E 5	2	3	-1	-1
	E 6	4	3	+1	+1
	E 7	3	6	-3	-3
	E 8	6	6	0	0
	E 9	2	6	-4	-4
	E10	2	6	-4	-4
B	E11	6	4	+2	+2
	E12	4	4	0	0
	E13	7	4	+3	+3
	E14	6	2	+4	+4
	E15	3	3	0	0
	E16	4	2	+2	+2
	E17	6	5	+1	+1
	E18	7	6	+1	+1
	E19	7	3	+4	+4
	E20	4(3)	2(3)	+2	0

RU = number of uncompleted tasks recalled; } Actual completion/incompletion of
 RC = number of completed tasks recalled; } tasks. In parentheses: the frequencies
 under neglect of the interruption
 errors.

Main results. The median recall difference score, computed for all 20 subjects, was 0 (see table 23). This statistic was the same for both sets of scores – for recall before the hesitation period and for total recall (the latter data will not be analyzed any further).

A comparison of the A-subjects and the B-subjects on their relative recall of A-tasks and B-tasks did not lead to rejection of the null hypothesis¹,

¹ Wilcoxon two-sample test: $W = 101$; $n = m = 10$; $P = 1.00$. (Computations carried out by the Mathematical Centre in Amsterdam).

which means that no effect could be demonstrated of the completion/incompletion of a task on its being recalled or not.

Further exploration of the data. One of the principle questions with regard to this experiment is whether the manipulation of equal pay per task did indeed lead to diminution of the task memory effect. It had been expected that the correlation between recall of a task in the uncompleted condition and in the completed condition should be nearer 0 than +.72 (the latter correlation was obtained in the experiment with tasks with a clear-cut end; see section 5.4.2). However, the correlation obtained does not in the least resemble 0 (see table 24): $\tau = +.62$ ($P < .001$; based on $(RU) - (RC)$)

TABLE 24
Recall frequencies of tasks (equalization-of-tasks experiment)

task	U	C	RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
1. jigsaw puzzle			9	9	0	0
2. A unwrapping of parcel			2	2	0	0
3. A sentence building			3	4	-1	-1
4. counting coffee stamps			1	1	0	0
5. A paper-folding			1	2	-1	-1
6. photos	9	11	4	3	+1.71	+1
7. scattered numbers			5	4	+1	+1
8. A box			7	7	0	0
9. limerick			9	8	+1	+1
10. A street in Paris			2	1	+1	+1
11. A hook			5	6	-1	-1
12. A left-handed writing			-	1	-1	-1
13. cow			5	1	+4	+4
14. A symbol Inst. Technol.	11	9	1(-)	1(2)	-0.20	-2
15. card to Aunt Loes			5	5	0	0
16. plug			4	6	-2	-2
17. A multiplication			1	5	-4	-4
18. book covering			1	3	-2	-2
19. potato peeling			10	9	+1	+1
20. A alphabet in reverse			10	6	+4	+4

$\left. \begin{array}{l} U = \text{number of uncompleted tasks presented;} \\ C = \text{number of completed tasks presented;} \end{array} \right\}$ only given if divergent from 10:10

$\left. \begin{array}{l} RU = \text{number of uncompleted tasks recalled;} \\ RC = \text{number of completed tasks recalled;} \end{array} \right\}$ Actual completion/incompletion of the tasks. In parentheses: the frequencies under neglect of the interruption errors.

scores). The interpretation of this statistic is that the manipulation of equal pay – although perceived in the desired manner – did not bring about an equalization of the task memory effect¹. The results seem to have been changed very little by the fake instructions and the payment system.

There were four main reactions towards the little piles of coins that formed the expression of the scores. Some of the subjects made a frequency distribution; others made a time distribution to enable them to follow their progress; a third group of subjects just left the coins where the experimenter had put them; and only a few subjects pushed the whole lot onto a heap.

Several of the subjects said that they would rather have finished everything. With the others, who said that they did not mind, a discrepancy was often noted between their frustrated behavior at the moment of interruption and the remarks made at the end of the experiment. Some of the “I did not mind” statements sounded like rationalizations and others like an attempt to console the experimenter – as if the subject wanted to say: You need not worry, I really did not feel disturbed; the experiment went just fine. All this – of course – was expressed between recall and the explanation of the true purpose of the study.

It was a surprise for a stranger in the world of technical science to notice the difference in attitude towards the material between students in the various branches of technical science. E.g., students who were majoring in electrical engineering, when they received the *hook* task, sometimes rather haughtily advised the experimenter to take the work to a mechanical engineer; while on the other hand, some of those who were majoring in mechanics did not think it their proper work to fix plugs onto flex and would rather have hired an electrical engineer to do it.

Conclusion. An effort to diminish the task memory effect failed. The main result of the experiment was a median recall difference score of 0.

5.5.2 *Success—failure experiment*

After the failure to equalize the tasks with respect to value and ease of memorizing, an effort was made to make the valences of the uncompleted and completed tasks as different as possible. By means of an outside criterion (apart from the interruption) the completed tasks were to be experienced as successes and the interrupted tasks as failures.

¹ Cf. the hypothesis formulated by Goldin (1964, p. 376) that selective recall is not related to evaluation of performance.

The purpose of the experiment was two-fold. First of all, it was an attempt to obtain a clear-cut preference in recall for either the uncompleted or the completed items. And secondly, it was meant as a control of the (absence of the) effect of the payment system of the equalization-of-tasks experiment (see section 5.5.1).

Design. The only part of the experimental instructions that was changed was the part that concerned the experimenter's hypotheses:

"My hypothesis is that the scores obtained with this system will be normally distributed. Whether the variance will be large or small, I don't dare to say: that would be rather too specific. But what I really do expect to find is the normal distribution. Did you follow the course in statistics? (Depending on the subject's answer, a shorter or longer explanation followed, with the emphasis on:) That means many scores in the middle, and only a few extreme scores".

For each completed task a high score was awarded, for each unfinished task a low score. The subjects of the A-series received in cents the following wages or scores: 33, 9, 11, 36, 7, 35, 33, 7, 31, 10, 12, 8, 29, 7, 36, 29, 12, 36, 34, and 10. For the subjects of the B-series the order was as follows: 9, 33, 36, 11, 35, 7, 10, 33, 7, 31, 36, 29, 8, 29, 12, 12, 36, 7, 10, and 34¹.

Scores lower than 7 and higher than 36 were not awarded because of the problems that would arise if the performance was objectively pretty good or fairly bad respectively.

Subjects. Subjects were 16 students and one staff member (male) of the Institute of Technology in Eindhoven.

Hypothesis. It was hypothesized that the series of recall difference scores would differ significantly from 0, in either direction.

Check on the experimental manipulation. During the experiments itself and, more explicitly, after recall, the subjects expressed their amazement at the scoring system. They did not understand it at all because so many discrepancies were experienced between the score (either very high or very low) and their subjective evaluation of the performance as bad or good or just mediocre. Therefore it cannot be said that a univocal experience of either success or failure was induced by the manipulation.

¹ Cf. Doris & Sarason (1955, p. 337) who suggested that the pattern of success and failure is a crucial factor in determining a person's attitude towards his failures.

Problems of statistical analysis. One of the subjects did not succeed in making anything even faintly resembling a limerick, and three subjects each finished one task that should have remained uncompleted. They either simply refused to hand the work in, or – unexpectedly – made a fake ending. Differences between the set of scores adjusted to these reversals and the $(RU) - (RC)$ scores are almost negligible.

Main results. The median recall difference score was 0 for the $(RU) - (RC)$ scores before the hesitation period (see table 25) and for total recall of both sets of scores. For the adjusted scores before the hesitation period the median recall difference score was +0.31. The data for total recall will not be analyzed any further.

TABLE 25
Recall frequencies success – failure experiment

Condition	Subject number	U	C	before hesitation period			
				RU	RC	$10\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
A	E21			3	8	- 5	- 5
	E22			3	8	- 5	- 5
	E23			3	6	- 3	- 3
	E24	11	9	4(3)	3(4)	+ 0.31	- 1
	E25			4	6	- 2	- 2
	E26			4	6	- 2	- 2
	E27			2	7	- 5	- 5
	E28	9	11	2	5	- 2.33	- 3
	E29			7	3	+ 4	+ 4
	E30			6	3	+ 3	+ 3
B	E31			5	5	0	0
	E32			5	3	+ 2	+ 2
	E33	9	11	6	3	+ 3.94	+ 3
	E34			7	6	+ 1	+ 1
	E35			4	3	+ 1	+ 1
	E36			5	1	+ 4	+ 4
	E37	9	11	5	2	+ 3.73	+ 3

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 10:10

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of the tasks. In parentheses: the frequencies under neglect of the interruption errors.

TABLE 26

Recall frequencies of tasks (success - failure experiment)*

task	U	C	RU	RC	$8\left(\frac{RU}{U} - \frac{RC}{C}\right)$	$(RU) - (RC)$
1. jigsaw puzzle			8	7	+1	+1
2. A unwrapping of parcel			3	3	0	0
3. A sentence building			2	2	0	0
4. counting coffee stamps			-	-	0	0
5. A paper-folding			-	-	0	0
6. photos			4	3	+1	+1
7. scattered numbers			4	2	+2	+2
8. A box			5	5	0	0
9. limerick			8(7)	7(8)	+1	-1
10. A street in Paris			1	1	0	0
11. A hook			6	5	+1	+1
12. A left-handed writing	7	9	-	-	0	0
13. cow			4	5	-1	-1
14. A symbol Inst. Technol.			-	2	-2	-2
15. card to Aunt Loes			4	7	-3	-3
16. plug			5	6	-1	-1
17. A multiplication			-	3	-3	-3
18. book covering			3	4	-1	-1
19. potato peeling			6	8	-2	-2
20. A alphabet in reverse			7	6	+1	+1

U = number of uncompleted tasks presented; }
 C = number of completed tasks presented; } only given if divergent from 8:8

RU = number of uncompleted tasks recalled; }
 RC = number of completed tasks recalled; } Actual completion/incompletion of
 the tasks. In parentheses: the frequen-
 cies under neglect of the inter-
 ruption errors.

A comparison of the A-subjects with the B-subjects on their selective recall of A-tasks and B-tasks did not lead to rejection of the null hypothesis¹, which means that no effect could be demonstrated of the completion/incompletion of a task on its being recalled or not.

¹ Wilcoxon two-sample test: $W = 94$; $m = 8$; $n = 9$; $P = .30$. (Computations carried out by the Mathematical Centre in Amsterdam).

* To obtain an equal number of U and C presentations - for comparison purposes - the data of subject E37 have been omitted.

Further exploration of the data. Despite the failure to induce success and failure experiences univocally, one of the principle questions in this experiment remains whether the unequal payment (scoring) for the uncompleted and completed condition led to differences between these two conditions in the recall of each separate task. It did not. The median recall difference score (computed for the 20 tasks) was 0 and the correlation (based on $(RU) - (RC)$ scores) was $\tau = +.74$ (see table 26; for comparison purposes the last subject, E37, was omitted from the table). This means that the awarding of scores and/or payment for the separate tasks does not have any demonstrable effect on selective recall.

It might be argued that if something really *is* at stake – with the concomitant feelings of success or failure – recall will certainly be influenced. This possibility was explored with two additional subjects (students in technical science) who had to pass part of their examination in operations research in Zeigarnik-like fashion¹. However, even in this situation, recall difference scores of 0 and -1 were obtained!

Conclusion. An effort to equate completion with success and incompleteness with failure did not lead to significant differences between RU and RC. The median recall difference score was 0.

5.6 *Observations made outside the laboratory*

5.6.1 *Experiences in a transfer service*

Although they are completely different from the experimental data, some experiences gained in the Dutch Postal Cheque and Clearing Service are worth mentioning.

A peculiarity in this office was that there were no fixed closing hours. Orders that arrived by post in the morning had to be cleared off the same day. It is of course interesting to know how this daily forced completion of work was experienced by the workers. Therefore, while studying the experience of tempo in this office in 1961, together with 't Hart², the author asked a few additional questions.

¹ The author is very grateful to Professor W. Monhemius and A. Kees for taking the initiative in carrying out a few examinations in this way.

² Professor H.W. Ouwelen³ graciously gave permission for the publication of these data.

Added to the questionnaire was:

If it were half past five and half-an-hour's work still had to be done, and the decision were yours, what would you do:

leave it ("to-morrow is another day")

finish it ("what's done is done")¹.

Of the 32 workers studied (15–30 years old, of both sexes) 29 answered that they would finish their work. However, when asked for their closing hours preferences (fixed or varying) 21 of these 29 subjects answered: fixed hours. This, of course, implicitly means that the work would have to be left uncompleted part of the time.

During an interview, the same subjects were asked whether they tended to leave sharp, or whether they just finished their work at coffee-, lunch-, and tea-time. A significant trend was not discernable as 4 subjects said that they always finished their work, 9 stated that they always left sharp, and 18 subjects were classified in one of the middle categories. Sometimes a social reason was given for finishing: the desire to tell others in the canteen how much had already been completed.

The women only ($n = 14$) were asked to express their opinion on the daily completion of the work. One clearly positive answer was obtained (exciting to know whether the balance-sheet fits) and one answer was pointedly negative (a nuisance with regard to dates). Most subjects said they were used to it and preferred not to continue with old work the following morning.

However scanty these data may be, a trend seems to be discernable. The question which related to a general rule of conduct was answered by most of the subjects with: finish the work². But when actual behavior (although in slightly different situations) was asked for, univocality with regard to finishing the work disappeared.

5.7 Exploration of the data of the experiments

In none of the studies presented in this chapter was a Zeigarnik effect obtained. In many experiments the median recall difference scores were zero (see table 27). The children recalled significantly more completed than uncompleted tasks and a similar result was obtained for the combined three Marrow I replications.

¹ In Dutch: laten liggen ("morgen is er weer een dag"); afmaken ("klaar is Kees").

² Cf. section 6.2.4.

TABLE 27
Median recall difference scores: personal experiments

	Number	Before hesitation period		Total recall	
		Adjusted scores	(RU)–(RC)	Adjusted scores	(RU)–(RC)
a. Two-person experiment	54			0	0
a'. id. pre-studies	29			0	0
a''. id. experimenters	5			0	0
b. Jigsaw puzzles	12	0	0	+1 > Mdn > 0	+1 > Mdn > 0
c. Replication Zeigarnik	34	0	0	+0.50 > Mdn > +0.33	0
d. Replication Marrow I (first experimenter)	30	-1 > Mdn > -1.32	-1	-0.51 > Mdn > -0.61	-1
e. Replication Marrow II*	6	-0.81 > Mdn > -2*	-2*	-1 > Mdn > -1.62*	-1 > Mdn > -2*
f. Replication Marrow I (second experimenter)	24	0	0	-0.1 > Mdn > -1	-1
g. Replication Marrow I (autocratic behavior <i>E</i>)	12	+0.31 > Mdn > 0	-1	0	-1
h. U:C = 3:17	15				
i. Tasks with clear-cut end	40	0	0	0	0
j. Children	40	-1	-1	-2	-2
k. Equalization-of-tasks	20	0	0	0	0
l. Success-failure	17	+0.31	0	0	0

* Marrow's second experiment was designed with the aim of obtaining negative recall difference scores.

Many subjects recalled approximately the same number of uncompleted and completed tasks. It is not unreasonable to consider recall difference scores of +1 and -1 as "equal recall", as the subjects who enumerated an odd number of tasks could not possibly have obtained a recall difference score of zero. This would mean that 46% respectively 43% of the 323 subjects¹ recalled an equal number of completed and interrupted items² (i.e. their recall difference scores were 0, +1, or -1); see table 27A.

TABLE 27A

Number of subjects with "equal" recall difference scores (+1, 0, or -1):
personal experiments

	Number	Before hesitation period	
		Adjusted scores	(RU)-(RC)
a. Two-person experiment	54	23	25
a'. id. pre-studies	29	16	16
a". id. experimenters	5	4	4
b. Jigsaw puzzles	12	7	7
c. Replication Zeigarnik	34	11	14
d. Replication Marrow I (first experimenter)	30	11	13
e. Replication Marrow II	6	2	2
f. Replication Marrow I (second experimenter)	24	10	10
g. Replication Marrow I (autocratic behavior <i>E</i>)	12	5	7
h. U:C = 3:17	15		
i. Tasks with clear-cut end	40	22	24
j. Children	40	14	14
k. Equalization-of-tasks	20	9	10
l. Success-failure	17	4	4

On the basis of these results, a clear-cut answer to the problem of selective recall cannot be given. In an effort to explain the negative results of the experiments, the data were studied for various possible relationships. The results of the explorations which applied specifically to each individual

¹ Percentages based on (RU) - (RC) scores and adjusted scores respectively, before the hesitation period. The subjects of all the experiments except the one with only three unfinished tasks (see table 27A) were included.

² Cf. Rand (1960, p. 181) who concluded his review of the literature on selective recall by stating: let us therefore emphasize that most people normally remember an equal number of completed and interrupted tasks or, at any rate, approximately an equal number.

experiment have already been presented in the appropriate sections. The variables that were explored in connection with more than one experiment will be discussed here.

In the experiments in which a comparison between male and female subjects could be made ¹, the analysis of the scores did not indicate a difference in selective recall between the results of the two sexes.

The factor of religion, already mentioned in the two-person experiment (section 5.1.1), was again studied in Marrow's replication (first experimenter) and in the experiment with tasks with a clear-cut end. The subjects in these studies were students of the University of Amsterdam (no particular religion) and the Free University in Amsterdam (Calvinistic). However, no difference was found between the recall difference scores of the two groups.

The effect of position within the series upon the frequency of recall of a task shows a rather varied picture when various experiments are analyzed. In five experiments ² a primacy effect was obtained, whereas in another four studies ³ no such effect was observed. The last task was very frequently recalled in seven of the experiments ⁴, whereas no recency effect could be detected in the two-person experiment, nor with the children. A slight retroactive inhibition of subsequent tasks upon earlier tasks was found in two of the Marrow I replications ⁵. On the other hand, in five other experiments ⁶ no retroactive inhibition was found.

Zeigarnik's observation that the subjects tend to recall an uncompleted task in the first and second place was checked in seven experiments ⁷. However, in none of them was this phenomenon verified, neither for the tasks that were recalled in the first place, nor for those recalled in the second place. Thus not even the strictest part of the Zeigarnik effect was demonstrated in the experiments reported in this chapter.

¹ Experiment with jigsaw puzzles, Zeigarnik replication, Marrow replication (first experimenter), experiment with tasks with a clear-cut end, experiment with children.

² Two-person experiment, experiment with tasks with a clear-cut end, experiment with children, equalization-of-tasks experiment, and success-failure experiment.

³ Zeigarnik replication, the three replications of Marrow I.

⁴ Zeigarnik replication, the three replications of Marrow I, experiment with tasks with a clear-cut end, equalization-of-tasks experiment, success-failure experiment.

⁵ Second experimenter and autocratic behavior replication.

⁶ Two-person experiment, Zeigarnik replication, Marrow replication (first experimenter), experiment with tasks with a clear-cut end, experiment with children.

⁷ Zeigarnik replication, the three Marrow I replications, experiment with tasks with a clear-cut end, experiment with children, equalization-of-tasks experiment.

Evaluation

6.1 *Evaluation of experimental results*

In the preceding chapter the author's experiments were presented. Most of the studies were designed with the object of obtaining a Zeigarnik effect, in which, however, all of them failed.

On the one hand, it may be suggested that the experiments were performed incompetently¹; on the other hand, the results may be seen as an indication that the theory which was tested in the experiments is false². It would be somewhat rash, however, to draw the latter conclusion solely on the basis of the experiments described in chapter 5, for in the course of years certain investigators have obtained a Zeigarnik effect.

Before proceeding with the evaluation of the experimental results the methodological problems of such an evaluation will be discussed.

6.1.1 *Methodological problems of evaluation*

A summary of the results on selective recall is given in table 36 (direction of selective recall: $RU > RC$ or $RU < RC$, number of subjects, and P -values)³. Given the enormous amount of – more or less contradictory – experimental results, the question arises by which criteria they are to be evaluated. In general, this is a rather neglected problem; at any rate no adequate solution has as yet been given.

De Groot (1961, p. 27–28) drew attention to the evaluation problem by introducing the idea of “a forum”. A forum, he said, should be made up of

¹ “... where other investigators have repeated our experiments in a competent manner, our results have stood up very well on the whole” (Lewin 1940, p. 8).

² “... insufficiencies and difficulties of experimentation are not a matter technical improvements can cope with. They are usually, at least in young sciences, indications that the theory itself is false...” (Lewin 1926a, p. 298; 1951a, p. 80).

³ Table 36 is inserted at the end of this chapter. Not all the studies on task interruption, but only those on selective recall, are tabulated.

the experts of the sub-branch of the science in question. They hold the ultimate responsibility of accepting or rejecting theories and hypotheses. However, not even De Groot gave any suggestions as to the criteria ¹ by which the cumulative results of a single problem area (a typical "forum-problem") should be evaluated.

The data of the studies presented in chapter 3 have been statistically (re-) analyzed (see table 36). This procedure would normally lead to the statistical evaluation of the probabilities, because these should be regarded as a sample of all possible experiments on selective recall ².

Unfortunately such an analysis cannot be applied to the data of table 36. The experimental conditions of the various studies were far too miscellaneous to warrant a comparison of the unclassified results. Moreover, even if the results were classified into meaningful categories (see sections 6.1.3–6.1.7), statistical analyses would still not be feasible. "At best" a seemingly exact (and probably distorted) picture of research on task interruption would be obtained.

The problems involved are the following. Firstly, a number of studies may as well be classified in either the one or the other of two categories, which are each other's opposite with regard to the prediction of a $RU > RC$ or a $RU < RC$ result (see, e.g., section 6.1.4). Secondly, only a number of all the studies performed have been published. As it is customary to publish research reports in which the null hypothesis was rejected and unusual to publish those which failed to reject the null hypothesis ³, the tabulated results may inaccurately favor either a Zeigarnik effect or, depending on the category, a "reverse effect" ⁴. Thirdly, several investigators performed more than one experimental study. In general, the number of experimenters involved was not reported. Quite possibly a (large) number of these studies

¹ Cf. Snijders's (1963, p. 81) critical remarks. Rosenthal (1966, p. 15) similarly gave no details regarding the "... set of criteria subsequently [to be] adopted by the assessing community".

² Table 36 gives the universe of published studies on selective recall up to the autumn of 1967, assuming that the bibliography on task interruption is indeed (more or less) complete.

³ Cf. Sterling (1959); Tullock (1959); Cohen (1962); Rosenthal (1966, p. 25, 36); and section 5.2.

⁴ This remark is not in contradiction with the many non-significant results which are tabulated in table 36. In many studies the experimental hypotheses were formulated in terms of differences in recall scores between two or more groups of subjects that had been treated in different ways. The experimental hypotheses may have been verified, however, without RU being significantly larger (or smaller) than RC for either or both of the groups.

were performed under one single experimenter. It is – as yet – an open question whether such studies may be regarded as independent investigations (see section 5.3). At any rate, one should proceed with caution, and it is better to refrain from attaching a weight of one to every single experimental variant by, e.g., *Walsh (1942), *De Monchaux (1951), *Rösler (1955), or the present author. Fourthly, the large differences in the numbers of subjects have consequences for the power of the testing procedures¹. And fifthly, the many missing *P*-values make the computation of a combined probability impossible. Technically, only a binomial test could be applied, if one were unwisely inclined to disregard the first four objections to statistical analysis of the data of table 36.

6.1.2 *Problems of classification*

The possibility of statistical analysis of the results of the studies on selective recall having been rejected, another type of evaluation should be considered.

It is evident from the foregoing discussion (see section 6.1.1) that the various studies should be classified if any evaluation is to be made at all. This means a loss of data, because quite a few studies escape any (relevant) categorization and, consequently, evaluation. A complete systematic picture of research on selective recall cannot therefore be given².

To achieve the aim of classifying as many of the reported studies as possible, a number of well-known categories corresponding to the hypotheses mentioned in the studies were used. Classification problems of any one particular study will be discussed in the section in question. As is evident from the discussion in section 6.1.1, the data compiled in the separate categories are not exact enough to warrant statistical analysis. A rougher evaluation will therefore be applied to the results tabulated in tables 28–34.

6.1.3 *Attempts to verify Zeigarnik's results: Replications*

The exact replications by *Schlote (1930), performed in the late 'twenties with German subjects, did not verify Zeigarnik's results. They even differed

¹ Similar problems were mentioned by Klinger (1966) in his analysis of the existing literature on fantasy need achievement.

² This is a pity, for the present review was intended to be exhaustive, whereas most other reviews on task interruption are confined to certain American publications or, at best, to publications in the English language (cf. Brandt 1963; Salman 1966). Even in Butterfield's (1964) extensive review the only "foreign" study mentioned was Zeigarnik's (1927)!

TABLE 28

Replications		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Schlote (1930)	replication Zeigarnik I				4	> .50							
	Zeigarnik IV						4	1.00					
	Zeigarnik IVa								9	.19			
Dancker (1950)	± replication Zeigarnik I (with healthy control subjects)	10	.002										
Rösler (1955)	± replication Zeigarnik I (with school children)	20	.002										
	id. with pre-school children	20	< .001										
present author	replication Zeigarnik I								34	.53			

TABLE 29

Verification of Zeigarnik effect by means of refinement of method, different methods, etc.		RU > RC					?		RU < RC					
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.		
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Schlote (1930)	intended activities	7	.02											
Sandvoss (1933)	intended activities				3									
Harrower (1933)	jokes			<i>n</i>										
Hartmann (1933)	healthy control subjects				5	.06								
Marrow (1938 <i>a</i>)	paper and pencil <i>tests</i> ^a	30	.00002											
Marrow (1938 <i>b</i>)	id. with encouragement ^a	30	.01											
	id. with discouragement ^a	30	.01											
Heider (1938)	classroom demonstrations			<i>n</i>										
Martin (1940)	juvenile delinquents	200	.0001											
Walsh (1940)	school children; U-tasks: 1 min; C-tasks: 2-3 min	50	< .00006											
	id. U-tasks: on the verge of completion; C-tasks: 2 min	25	.002											

n = number of subjects unknown

^a see text section 6.1.4.

TABLE 29 (continued)

Verification of Zeigarnik effect by means of refinement of method, different methods, etc.		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Walsh (1940)	id. easier tasks	25	< .01	38									
	id. experiment in school class	20	.0004										
Rethlingshafer (1942)	adaptation of Pachauri's (1935 <i>b</i>) group method												
Walsh (1942)	boys 10–11 years old (seen individually)	30	< .01										
	girls 11–12 (seen in a group)	30	< .01										
	boys 13–14 years old	30	< .01										
Lewis & Franklin (1944)	instruction: test of tasks	12	.002										
	instruction: kind of preliminary experiment ^a									12	.001		
Brenman (1947)	mild interruption				9	.11							

^a see text section 6.1.4.

TABLE 29 (continued)

Verification of Zeigarnik ¹ effect by means of refinement of method, different methods, etc.		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Author(s)	Details of study												
McKinnon & Henle (1948)	experiments within research course				23	.19							
De Monchaux (1951)	with subjects naming pictures of puzzles	20	.01										
	with subjects not naming pictures of puzzles				20	.54							
	with subjects working in pairs	20	.01										
Bolin (1952)	paper and pencil tests								16	.12			
Ferradini (1952)	intended activities										80		
	interrupted activities			60									
Altea (1955)	replication Ferradini (1952) interrupted activities								50	.10			
	tasks: naming of figures			30									
	tasks: naming of colors										30		

TABLE 29 (continued)

Verification of Zeigarnik effect by means of refinement of method, different methods, etc.		RU > RC						?		RU < RC					
		Sign.		?	Non-Sign.					Non-Sign.		?	Sign.		
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Mittag (1955)	paper and pencil tasks; young workers, working two at a time	32	.001												
Junker (1960)	very good students; no tension; mental tasks	7	.02												
Horwitz, Glass & Niyekawa (1964)	mirror-tracing tasks, task orientation									17	> .25				
present author	replication Marrow I (first experimenter)									30	> .05				
	replication Marrow I (second experimenter)									24	> .44				
	replication Marrow I (autocratic behavior of experimenter) ^b						12	> .38							
	tasks with clear-cut end ^b						40	.82							
	children											40		.012	
	equalization-of-tasks ^b						20	1.00							

^b In cases where there is a discrepancy in "sign" between the (*RU* - *RC*) scores and the adjusted scores, the results are mentioned in the ?-column.

significantly from hers. The present author's replication showed a similar negative result.

On the other hand, the results of three post-war East-German studies (*Dancker 1950; *Rösler 1955), the designs of which were so similar to Zeigarnik's that they too may be regarded as replications, demonstrated a highly significant predominance of the uncompleted tasks in recall (see table 28).

For the evaluation of table 28 only the replications of Zeigarnik's first experiment were taken into consideration. Significant Zeigarnik effects were obtained by two experimenters, who used 50 subjects in all. Non-significant results were obtained by two experimenters, whose total number of subjects was 38.

Conclusion. The experimental evidence for the existence of a Zeigarnik effect provided by the exact replications of Zeigarnik's first study is not impressive.

6.1.4 Attempts to verify Zeigarnik's results: Change of experimental design

Those studies in which an attempt was made to verify the Zeigarnik effect were selected for discussion in this section. The experimental designs of the studies differed from that of the original to a greater or lesser degree. These variations consisted in refinements of the experimental procedure, different personal experimental methods, or attempts to verify the phenomenon within another theoretical framework. In several instances the researchers apparently succeeded in their attempts to obtain a Zeigarnik effect (see table 29).

However, the experimental instructions of three of the studies that demonstrate the most clear-cut verification of the Zeigarnik effect (*Marrow 1938a, b) should be placed in the category of experiments with ego-oriented instructions, as the emphasis was put on the test character of the tasks, and – especially in the last two experiments – on success and failure¹. Such a classification, in its turn, would tend to imply an expectation of predominantly completed items in recall (see section 6.1.6). As a matter of course the same reasoning is applicable to the Marrow I replications of the author of the present study (see sections 5.2.2, 5.3.1, and 5.3.2).

¹ Cf. Lazarus, Deese & Osler (1952, p. 302) who mention, amongst others, *Marrow's (1938a, b) studies as having "... some bearing on the problem of the effects of stress".

The experimental instructions by *Lewis & Franklin (1944), in which experiment IA was announced as “a kind of preliminary”¹, seem to have been worded in such a way as to induce a task-oriented attitude in the subjects. However, Lewis & Franklin postulated that under these conditions the subjects protected their ego-status and that ego-enhancement systems were aroused. As this assumption was not stated as a hypothesis, before the presentation of the recall data, the results of the experiment are presented in table 29 (Verification of the Zeigarnik effect) and not together with the studies on ego orientation. Lewis & Franklin’s principle argument for assuming that ego-enhancement was involved is the predominance of completed tasks in recall. It is for this reasoning in circles that they were severely criticized by Osgood (1953, p. 585–587).

It should furthermore be noted that *Junker (1960), who obtained a significant predominance of uncompleted items in recall, had discarded the material supplied by most of her subjects because these subjects did not meet the experimental requirements.

A remarkable fact is that *Schlote (1930), using his own method, obtained a significant $RU > RC$, which was not the case when he replicated Zeigarnik’s original experiments. On the other hand, the Italian studies by *Ferradini (1952) and *Altea (1955) in which an Achian technique was also used, do not display univocal results.

Before evaluating table 29, the results of the three original Marrow studies and the three Marrow replications must be excluded, because the results of the latter did not confirm those of the former. For technical reasons the studies reported in the “ $RU > RC$?” column must also be excluded, because it is not clear into which of the two categories of the dichotomy used for evaluation they fall.

The remaining data show that of the 19 publications 8 reported a significant Zeigarnik effect (experiments with 508 subjects), whereas the other 11 papers (experiments with 365 subjects) did not.

Conclusion. Considering that each of the various methods for weighing the experimental results has disadvantages and that all are even more or less incorrect, the conclusion that in about half the cases a Zeigarnik effect was (or was not) obtained, is perhaps the closest (or least faulty) approximation of the trend which is discernable in the results of the studies that aimed at verification of the Zeigarnik effect.

¹ For the exact wording, see chapter 3, section on Lewis & Franklin (1944).

TABLE 30

Studies in which a Zeigarnik effect could have been expected, although different hypotheses were given by the authors		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Pachauri (1935 <i>b</i>)	verbal tasks; same duration U and C: adults	36											
	id.: children	267											
Boguslavsky (1951)	paper and pencil tasks: visual task instructions								80	.89			
	id.: oral task instructions								40	.13			
Baltimore <i>et al.</i> (1953)	observer present								24	> .20			
	subjects of accepted observers								30	> .20			
	subjects of rejected observers								40	> .10			
Rösler (1955)	school children: colored material				16	.07							
Baddeley (1963)	anagrams (solution given after one minute)	28	< .001										

6.1.5 *Different hypotheses*

The designs of a few other studies did not differ much from those of the studies compiled in table 29. It would therefore have been quite reasonable to expect a Zeigarnik effect as experimental result. The researchers, however, gave either a different hypothesis or no hypothesis at all. To the latter category (see table 30) belong *Pachauri (1935*b*), *Baltimore *et al.* (1953), and *Baddeley (1963).

*Pachauri (1935*b*), who wanted to allow the same amount of time for each task, thought this a feasible procedure only if all the tasks involved the same activity. He chose verbal tasks. "It is interesting to determine whether the uniform time allowance has any deteriorating influence on the U-C effect. This is not merely a 'factitious control', because the individuality of the tasks has to be maintained if each has to serve as suitable for either C- or U-items" (*Pachauri 1935*b*, p. 449).

*Baltimore *et al.* (1953, p. 51) did not expect to obtain a Zeigarnik effect with their subjects "because of the anticipated difficulties of obtaining really task-involved performance".

*Boguslavsky (1951) hypothesized that a superior recall of the completed items would be obtained in his & Guthrie's two experiments because of the longer space of time required to finish a task. This, however, is an argument which is applicable to most of the interruption studies.

*Rösler's (1955) hypothesis read that the frequency of recall of completed tasks might be greater if, instead of colorless material, more striking material with gay colors was used. The implication of Rösler's hypothesis is rather depressing: people will only establish tension systems for tasks that are dull and gray ¹!

In two of the five publications ² a significant Zeigarnik effect was reported (experiments with 331 subjects), whereas the other three papers (214 subjects) reported non-significant results.

Conclusion. These results do not differ much from those of the studies

¹ The effect of the superior recall of uncompleted tasks in Zeigarnik's (1927, p. 45) study was entirely due to those tasks towards which the subjects felt indifferent (see section 1.1.4). Cf. *Rethlingshafer (1940) who considered the use of meaningless material the best test of a general tendency to continue. Weiner (1966*b*, p. 33) suggested "... that the influence of motivational variables on retention will be most evident in situations which are conducive to forgetting".

² The *Baltimore *et al.* (1953) experiments were performed with six experimenters.

which aimed at verification of the Zeigarnik effect (section 6.1.4): in about half the cases a significant $RU > RC$ was (was not) obtained.

6.1.6 *Task orientation versus ego orientation*

The aim of many of the interruption studies was to obtain a difference in selective recall between task-oriented (-involved) subjects and ego-oriented (-involved) subjects.

Task orientation was manipulated either by expressly stating that the subject's abilities were not at stake, but that it was only a number of characteristics of the tasks that were being studied, or by giving hardly any instructions at all (cf. Zeigarnik 1927). To induce ego orientation, on the other hand, the experiment was usually introduced as an intelligence test¹. For task-oriented subjects, in the main, Lewin's theory was accepted: task tensions will persist as long as the tasks have not been finished and thus uncompleted items will be recalled better than completed ones. In the case of ego-oriented subjects, however, a theory of defense mechanisms was often used: failures will be repressed and thus completed tasks will be recalled better than uncompleted tasks.

By working with success and failure rather than with completion and incompleteness as experimental variables the need for self-esteem was introduced in the experiments on task interruption². This is to say that under success-failure conditions the quasi-needs to complete each separate task are subordinated to the wider need for self-esteem, which precludes the formation of separate tension systems for each individual task. The fact that it is possible to regard one and the same phenomenon (task interruption) – though under (slightly) different circumstances – as either a factor which causes cessation of the work on a (small) task or as the frustration of an important need, and to derive contradictory hypotheses from these different points of view (and circumstances), almost makes for ambiguity in the experimental results.

Ambiguity of interpretation is also increased by Zeigarnik herself. From her subjects' behavior she inferred that there were three principal attitudes towards the work on the tasks. One of these was the need to show off. The subjects who belonged to this category were (very) ambitious and took the

¹ Because of the nature of the instructions Butterfield (1964) labeled them non-skill versus skill instructions. For problems encountered with stress induction, see Lazarus, Deese & Osler (1952).

² Cf. Kounin (1963, p. 147–148).

experiment for an intelligence test. Zeigarnik, who felt that the role of the experimenter should be adjusted to each individual subject, put on an examiner's cold face with the ambitious subjects in order to strengthen their original attitude (Zeigarnik 1927, p. 18–19). These same subjects, of whom it may be said that they worked under intelligence test conditions, mentioned – according to Zeigarnik ¹ (1927, p. 59) – an exceptionally greater number of uncompleted than completed tasks in recall.

Table 31, in which the results of the experiments in which task-oriented instructions were used are tabulated, gives an almost shocking picture. Of the 16 publications which could be used for evaluation only 2 reported a significant Zeigarnik effect (experiments with 60 subjects). On the other hand, 3 other papers (with 74 subjects) gave significant RU < RC results! All the remaining 11 papers (with 530 subjects) showed non-significant recall results for the task-oriented groups.

The reason for these results may be that several of the subjects did not become task-involved by the instructions ². It may be that the experimental situation in general tends to elicit ego involvement in the subjects ³. It may, furthermore, be that the use of scrambled sentences as the experimental task ⁴ is not conducive for obtaining a Zeigarnik effect (cf. section 6.2.6).

The results of the experiments in which ego-oriented instructions were used seem to be somewhat less inconsistent ⁵ than those of their task-oriented counterparts. Nevertheless, 10 out of the 14 papers (experiments with 553 subjects) gave non-significant results. The remaining 4 publications (with 496 subjects) reported a significantly larger recall of completed than of uncompleted items.

When the results of the success-failure experiments ⁶ (see table 33) are added to those of table 32, the non-significant trend of the results becomes more pronounced. Only 4 out of the 12 publications (experiments with 157 subjects) showed a significant predominance of RC to RU, whereas the

¹ See, however, section 1.1.3.

² Cf. Alper (1946a).

³ Cf. Rotter (1954, p. 191).

⁴ For critical comments on the use of these tasks, see chapter 3, section on *Alper (1946b).

⁵ *Rand (1963, p. 103), however, thought it undisputed “that the stronger the stress, the larger the deviations in recall, within certain limits”. Cf. Rand (1960, p. 175–177); Butterfield (1965, p. 366–367).

⁶ The only difference between the success-failure studies of table 33 and the experiments with ego-oriented instructions of table 32 is that the latter are coupled with experiments with task-oriented instructions, whereas the former are not.

TABLE 31

Task-oriented instructions (this table should be compared with table 32: Ego-oriented instructions)		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Abel (1941)	high-school students				70								
	college freshmen							66					
Rosenzweig (1943)	jigsaw puzzles; informal group				30	> .05							
Alper (1946 <i>b</i>)	scrambled sentences ^a							10	.28				
Black (1947)	scrambled sentences									18		.02	
Glixman (1949)	task orientation							60					
Gilmore (1949)	test with little personal significance						<i>n</i>						
Gilmore (1954)	low stress							129	> .10				
Eriksen (1952 <i>a</i>)	scrambled sentences				22								
Eriksen (1952 <i>b</i>)	id.							23					

n = number of subjects unknown.

^a see text section 6.1.6.

TABLE 31 (continued)

Task-oriented instructions (this table should be compared with table 32: Ego-oriented instructions)		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Hays (1952)	interpolated reading material after each task				10								
Zolik (1955)	scrambled sentences											41	< .001
Ralph (1956)	jigsaw puzzles; boys, 6 years old						30						
	id.: boys, 9 years old	40	.02										
Caron & Wallach (1957)	public school subjects									18			
	private school subjects				15								
Ito (1957)	non-stress: C = success; U = failure	20	.005										
Smock (1957)	jigsaw puzzles; 5th grade children				30	> .10							
Clements (1959)	low anxiety			12									
Forrest (1959)	mirror-drawing			20									

Italics: statistical results taken from the original study.

TABLE 31 (continued)

Task-oriented instructions (this table should be compared with table 32: Ego-oriented instructions)		RU > RC					?		RU < RC					
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.		
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Butterfield (1963)	children 4th grade, external locus of control							16	>	.32				
	id. internal locus of control							15	>	.22				
	children 6th grade, external locus of control							16	>	.52				
	id. internal locus of control										15		.02	
Green (1963)	paper and pencil tasks			48										

TABLE 32

Ego-oriented instructions (this table should be compared with table 31: Task-oriented instructions)		RU > RC					?		RU < RC					
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.		
		<i>n</i>	<i>P</i>		<i>n</i>	<i>n</i>			<i>P</i>	<i>n</i>		<i>P</i>	<i>n</i>	<i>P</i>
Abel (1941)	high-school students				202									
Rosenzweig (1943)	jigsaw puzzles; formal group								30	> .50				
Alper (1946 <i>b</i>)	scrambled sentences; threatening of self-esteem ^a				10	.69								
Black (1947)	scrambled sentences											18	.0005	
Glixman (1949)	slight stress								60					
	weeding out of unsuccessful students								60					
Gilmore (1949)	test interpreted as intelligence test						<i>n</i>							
Gilmore (1954)	median stress											171	< .05	
	high stress											144	< .01	
Eriksen (1952 <i>a</i>)	scrambled sentences								39					
Eriksen (1952 <i>b</i>)	id.											44	< .05	

TABLE 32 (continued)

Ego-oriented instructions (this table should be compared with table 31: Task-oriented instructions)		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Hays (1952)	interpolated reading material after each task							15					
Zolik (1955)	scrambled sentences										119	< .001	
Ralph (1956)	jigsaw puzzles; boys, 6 years old						30						
	id.: boys, 9 years old						40						
Caron & Wallach (1957)	public school subjects							23					
	private school subjects									19			
Ito (1957)	stress: C = success; U = failure							22	.13				
Smock (1957)	jigsaw puzzles; 5th grade children							30	> .10				
Clements (1959)	anxiety									12			

n = number of subjects unknown.

^a see text section 6.1.6.

Italics: statistical results taken from the original study.

TABLE 33

Ego-oriented instructions (success – failure, stress) without matched task-oriented instructions. (This table should be compared with table 32)		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Rosenzweig & Mason (1934)	jigsaw puzzles; crippled children							40	> .45				
Trowbridge (1938)	jigsaw puzzles; male college students						15						
Rosenthal (1944)	undergraduates (susceptible to hypnosis); normal waking state										13	.01	
Sanford (1946)	replication Rosenzweig & Mason (1934) with normal children							49	.18				
Sanford & Risser (1948)	repetition Sanford (1946) with the same children; 2½ years later							26	.17				
	rhyming words			15		.42							
	rhyming words			26		.82							
Taylor (1953)	jigsaw puzzles									82			

Italics: statistical results taken from the original study.

TABLE 33 (continued)

Ego-oriented instructions (success – failure, stress) without matched task-oriented instructions. (This table should be compared with table 32)		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Jourard (1954)	student nurses							58	<i>> .50</i>				
Steininger (1957)	high-school students						48						
Tamkin (1957)	jigsaw puzzles; normal control group							24	.61				
Coopersmith (1960)	children									48	.0009		
Miller, Swanson & Beardslee (1960)	middle-class boys									57	.02		
	working-class boys				49	.41							
Lowe (1961)	student nurses						65						
Yamauchi (1965)	stress									39	.01		
Weiner (1966a)	competitive situation				68	.25							
present author	success-failure							17	.30				

Italics: statistical results taken from the original study.

other 8 papers (with 372 subjects) reported non-significant results. The addition of the results of the original Marrow studies and the Dutch Marrow replications to this table would, as was suggested in section 6.1.4, certainly not make for a more consistent general trend in the success-failure studies.

Conclusion. The most obvious trend which can be discerned in the studies using pre-experimental instructions – whether they were task- or ego-oriented – is the non-significance of the results. Besides this general tendency the success-failure studies tend towards the result $RU < RC$. For the studies on task-orientation no additional trend could be detected in the recall data.

6.1.7 *Personality variables*

The experiments in which personality variables were taken into account (see table 34) presented mostly non-significant results. In several cases this should perhaps be ascribed to the small number of subjects in the ultimate breakdowns (especially *Atkinson & Raphelson 1956).

*Alper (1957), who had hypothesized that under task orientation Strong Egos, and under ego orientation Weak Egos recall predominantly uncompleted items, nevertheless obtained $RU < RC$ results for all four subgroups. This result was, perhaps, partly due to the use of scrambled sentences as the experimental task (see section 6.1.6). *Mittag's (1955) results were more in line with Alper's hypotheses than Alper's own results.

*Lelkens (1964) was not very successful in her effort to verify Rosenzweig's (1934; 1938*a, b*) hypotheses that impunitives tend to recall more completed than uncompleted tasks, and that the opposite relation holds for extrapunitives (and intropunitives).

*Rand (1953), who had derived his hypotheses that high-anxiety girls recall relatively more interrupted than completed tasks, and that high-anxiety boys recall relatively more completed than interrupted tasks partly from Festinger's (1957) theory of cognitive dissonance, did not obtain any significant relationship between test anxiety and recall in his results.

In three separate investigations the relation between achievement motivation and selective recall was studied¹. All the breakdowns either show results which were non-significant, or showed a lack of data to decide

¹ *Atkinson (1953) (different breakdowns of the same data were analyzed by McClelland *et al.* (1953)); *Atkinson & Raphelson (1956); *Martin & Davidson (1964).

TABLE 34 (continued)

Personality variables		RU > RC			?		RU < RC						
		Sign.		?			Non-Sign.		Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Atkinson (1953), see McClelland <i>et al.</i> (1953)	achievement orientation: high <i>n</i> Achievement			9									
	id.: middle <i>n</i> Ach.										8		
	id.: low <i>n</i> Ach.								7				
	task orient.: high <i>n</i> Ach.				10								
	id.: middle <i>n</i> Ach.				11								
	id.: low <i>n</i> Ach.								11				
	relaxed orient.: high <i>n</i> Ach.								9				
	id.: middle <i>n</i> Ach.			10									
id.: low <i>n</i> Ach.				8									

TABLE 34 (continued)

Personality variables		RU > RC					?	RU < RC				
		Sign.		?	Non-Sign.			Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Mittag (1955)	success/failure: socially well-adjusted workers								32	> .25		
	id.: insecure workers	10	.004									
	id.: ambitious workers									10	.008	
Atkinson & Raphelson (1956)	achievement orientation: high <i>n</i> Achievement				4							
	id.: low <i>n</i> Achievement								4			
	task orientation: high <i>n</i> Ach.								6			
	id.: low <i>n</i> Ach.				6							
	relaxed orient.: high <i>n</i> Ach.								7			
	id.: middle <i>n</i> Ach.								7			
	id.: low <i>n</i> Ach.								7			
	achievement orientation: high <i>n</i> Affiliation								4			

TABLE 34 (continued)

Personality variables		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Atkinson & Raphelson (1956)	id.: low <i>n</i> Affil.				4								
	task orient.: high <i>n</i> Affil.				5								
	id.: low <i>n</i> Affil.				7								
	relaxed orient.: high <i>n</i> Affil.				7								
	id.: middle <i>n</i> Affil.								8				
Alper (1957)	id.: low <i>n</i> Affil.								6				
	task orientation: strong ego										9		
	id.: weak ego										9		
	ego orientation: strong ego											9	
	id.: weak ego								9				

TABLE 34 (continued)

Personality variables		RU > RC					?	RU < RC				
		Sign.		?	Non-Sign.			Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Rand (1963)	boys, high anxiety								37	> .50		
	id. low anxiety								47			
	girls, high anxiety				51	> .50						
	id.: low anxiety								40	> .10		
Lelkens (1964)	extrapunitives				17	.10						
	impunitives				14	.64						
Martin & Davidson (1964)	achievers, achievement orientation			10								
	achievers, relaxed orientation								6			
	underachievers, achievement orient.									9		
	underachievers, relaxed orient.								4			

Italics: statistical results taken from the original study.

whether $P > .05$ or $P < .05$. It is, therefore, rather arbitrary to attempt to decide how much success or failure *Atkinson & Raphelson (1956) had in duplicating *Atkinson's (1953) results, or what the confirmation value of the experimental results was for the theory on achievement motivation (see section 2.5).

In the experiments described in chapter 5 personality factors were not explicitly studied. The results, however, implicitly detract from the importance of personality variables in selective recall. In several of the experiments¹ the difference in RU – RC scores between the two interruption series, A and B, to which the subjects were randomly assigned, was so great (task memory effect) that it is almost justifiable to conclude that the sign of the recall difference score (RU > RC or RU < RC) depended solely on the result of the toss-up (“heads or tails”) by which a subject was assigned to the A- or the B-series.

Conclusion. The results of the studies discussed in this section do not support the hypothesis that a clarifying contribution to the study of selective recall is made by taking personality variables into account².

6.1.8 *Final evaluation of studies on selective recall*

With the necessary reservations regarding the problems of evaluation mentioned in section 6.1.1, the following tentative conclusions on selective recall may be drawn from the analyses made in the preceding sections of this chapter.

Of the studies which were intended to show a Zeigarnik effect, less than half actually did so³.

Of the studies which were intended to show a so-called “Rosenzweig effect”, less than half actually did so⁴.

The studies on personality variables did not offer a substantial contribution to the clarification of the study of selective recall.

¹ Two-person experiment, Zeigarnik's replication, equalization-of-tasks experiment, success-failure experiment.

² Cf. Rand (1960, p. 175). Cf. also Rosenzweig's (1944b) comment that “... the comparative neglect of the personality of the subject represents a weakness of ... [Zeigarnik's] approach.” Cf. Feather (1962, p. 104).

³ Significant RU > RC: 14 papers (949 subjects). No support of the hypothesis: 30 papers (1221 subjects).

⁴ Significant RU < RC: 8 papers (653 subjects). No support of the hypothesis: 18 papers (925 subjects).

6.2 *Evaluation of the assumptions of the interruption study*

In the first part of this chapter it was shown that the experimental results of the interruption studies are far from univocal. This observation is not new, although not everybody seems to have made it (see table 35). The equivocality will partly be due to faults in the experimental procedure. The variety of experimental results¹ may partly be due to the tension system theory itself, which – because of its none too clear formulation – practically invites problems of operationalization. The many faulty interpretations of the relationship between interruption and tension that have been given in experimental papers and in handbooks² also form an indication of problems of this kind. It therefore becomes necessary to scrutinize the assumptions underlying the interruption studies closely and to give special attention to their logical consistency. This will be done by analyzing the experimental situation step by step.

In short, a Zeigarnik situation consists of the following elements. When – because of the experimenter's instructions – the subject intends to perform a task, a quasi-need is established which, from itself, presses towards completion of the task, i.e., towards tension discharge. If, however, the activities which are used for the execution of the intention are blocked (interruption), the quasi-need remains unsatisfied, i.e., the system remains under tension. Such a state of tension is evidenced by resumption of the unfinished task as well as by a superior recall of the uncompleted relative to the completed tasks.

¹ The variety of results cannot consistently be interpreted by any one of the theories discussed in chapter 2.

² Firstly, it has sometimes been said that a quasi-need is set up as a *result* of the interruption (e.g., Allport 1937, p. 198; *Abel 1938; *Cartwright 1942; Hilgard 1956, p. 284; Mandler 1964, p. 172; cf. furthermore section 2.1). Secondly, the interruption has been said to *increase* the subject's desire to finish the task (e.g., Chaplin & Krawiec 1960, p. 338). Thirdly, a tension system has been said to be created by a task *or goal* (e.g., Wolman 1960, p. 464). Fourthly, the tension system has been said to be built up when a task is being performed (Maier 1955, p. 482). And fifthly, tension has been said to be released by resumption as well as by recall (e.g., *Abel 1938; Alper 1952). It might be felt that *Winder (1952) and *Rösler (1955) discussed the last point more correctly by mentioning the possibility of recall being a substitute method of tension discharge, but it should not be forgotten that *Mahler (1933) found that the substitute value of stating the solution (and not just the name of the task) verbally was high for problem tasks, but low for performance tasks.

TABLE 35
Selected quotations

PRO	CONTRA
<p>"... where other investigators have repeated our experiments in a competent manner, our results have stood up very well on the whole". LEWIN 1940, p. 8</p>	<p>"When a research operation requires as much discussion of its 'psychological meaning' as interruption does, it is time to find a new operation". SEARS 1950, p. 113</p>
<p>"... the Zeigarnik effect has been regularly obtained when the conditions were the same". WOODWORTH & SCHLOSBERG 1954, p. 692</p>	<p>"Few investigators could unequivocally reproduce Zeigarnik's ... findings". ALPER 1952, p. 78</p>
<p>"Der Zeigarnik-Effekt gehört also heute zu den am besten gesicherten Fakten der experimentellen Psychologie." RÖSLER 1955, p. 165</p>	<p>"After 1927, the year of the original experiments, confirmations were relatively frequent, but as time elapsed they have become increasingly rare". BALTIMORE <i>et al.</i> 1953, p. 23</p>
<p>"When Zeigarnik's original conditions have been exactly reproduced the same findings have been obtained". CARTWRIGHT 1959, p. 33</p>	<p>"If, in fact, the subject had an initial tension system to complete each of the various tasks – which assumption, in view of the difficulties of producing the Zeigarnik effect, is always open to question ...". HORWITZ 1954, p. 6</p>
<p>"Dieser Befund von ZEIGARNIK ist in fast 30jähriger experimenteller Forschungsarbeit immer und immer wieder erhärtet worden". FERDINAND 1959, p. 458</p>	<p>"The instability and difficulty of reproducing the Zeigarnik-effect has led to various proposals to relate the phenomenon to personality-characteristics". RYAN 1958, p. 82</p>
<p>"Der Zeigarnik-Effekt rechnet zu den besonders gut gesicherten Fakten der experimentellen Psychologie ..." FERDINAND 1959, p. 465</p>	<p>"... die geringe Reproduzierbarkeit des Zeigarnik-Effektes ..." HECKHAUSEN 1964, p. 249</p>
<p>"... we assume it is a well-known fact that interrupted tasks ... tend to be well remembered". MILLER, GALANTER & PRIBRAM 1960, p. 66</p>	<p>"Die weitere Erforschung ... hat – durch eine Reihe sonst nicht erklärbarer, mit Zeigarniks Ergebnissen nicht übereinstimmender Resultate – rasch zu einer grossen Erhöhung der Anzahl der Variablen geführt ... Das Bild, welches dieser Bereich der Gedächtnispsychologie seit einigen Jahren bietet, ist das des Chaos". HÖRMANN 1964, p. 262</p>
<p>"This phenomena, which has been repeatedly observed when Zeigarnik's procedure is carefully followed, is now commonly referred to as "the Zeigarnik effect". ATKINSON 1964, p. 84</p>	<p>"ZEIGARNIK-EFFEKT, die Erscheinung, dass unerledigte ... Aufgaben besser behalten werden als erledigte; Nachprüfungen ergaben keine eindeutige Bestätigung." HEHLMANN 1965, p. 643</p>
<p>"... there is no reason why Zeigarnik effect might not predict academic achievement level as well or better than need-achievement measures". MARTIN & DAVIDSON 1964, p. 316</p>	
<p>"Our results ... indicate that the Zeigarnik-Ovsiankina effect is a true one ..." STERNLICHT & WANDERER 1966, p. 178</p>	
<p>"Thus there is strong evidence that the differential recall of incompleting tasks is a valid behavioral criterion of aroused achievement motivation." WEINER 1966a, p. 694</p>	

The various elements of the situation will be treated separately and mainly from a Lewinian point of view. The discussion will, in general, center around the following topics: basic assumptions, what happens in a Zeigarnik experiment, how the subject (probably) perceives the situation¹, and critical comments.

6.2.1 *Intention*

According to Lewin the subject intends to perform a task because of the experimenter's instructions². "The experimental subject's 'acceptance of an instruction' implies dynamically an intention which is hardly distinguishable phenomenally from mere understanding. Often the mere 'thought', that 'this could be done in such a way' or 'it would be nice if this would happen', fulfills the function of an intention"³ (Lewin 1926*b*, p. 371–372; 1951*b*, p. 140).

This is an assumption which raises several questions. First of all, is it at all possible to transfer an intention by means of verbal instructions? Lewin rather neglected the problem at hand⁴ by stating that an intention is "hardly distinguishable ... from mere understanding". It is known from studies (in small group research) in which the effectiveness of the pre-experimental verbal instructions had been checked that the reactions (replies) of subjects frequently did not concur with the suggestions contained in the instructions⁵. In these experiments, all that is required from the subject is to listen attentively and to believe what the experimenter is saying. It appears to be difficult to transfer statements that have (only) to be believed. The transfer of the *intention to perform* a certain task will be even more difficult, because there is, in general, no particular emotional relationship – apart from an authority relationship⁶ – favoring such a transference between subject and

¹ Cf. Riecken (1962).

² Birenbaum (1930) – unlike Zeigarnik – used the concept of intention in a restricted sense: only with respect to plans which are to be carried out *at a later time*.

³ As formulated in the second sentence quoted, Lewin's dynamic theory of intention is hardly distinguishable from the cognitive theory of Miller, Galanter & Pribram (1960). See section 2.8.

⁴ Cf. Leeper (1943, p. 120).

⁵ Cf. Festinger (1953, p. 157–160); Van Bergen (1964). Also: Anderson (1930); Jenkins (1933); Alper (1946*a*); Mulder & Stermerding (1963). "Does any of our subjects ever believe us?" (Brown 1965, p. 580).

⁶ See Criswell (1958, p. 103); Hollander & Willis (1967, p. 68).

experimenter ¹.

What actually happens in the experimental situation is that the subject is given a task. There is a huge difference between a subject who is willing to do whatever the experimenter asks him (for he has committed himself to adhere to the terms of the experiment), and a subject who intends to perform a task for the task's sake only. Lewin and Zeigarnik have recognized this problem and refer to the first category of subjects as "pure" experimental subjects, i.e., subjects who do everything the experimenter wants them to ², except to establish separate tension systems for the separate tasks. "Pure" subjects are said to recall an equal number of uncompleted and completed tasks.

It is necessary – according to Lewin – for the intention to be based on a genuine need. Often, more general needs ³, which vary from person to person, come into play as well: "... *for instance*, to persist as far as possible with a decision once made, is the corollary of a *certain* life-ideal" ⁴. However, the essential genuine needs are those from which the intentions have emanated, i.e., those needs which led one to decide ⁵ on the action in question ⁵. One of these genuine needs might be the need to please the experimenter ⁶ or, stated in more general terms, the need to please a person whom one had promised co-operation. I cannot see much difference between this need and "the need to help a friend" ⁷ (one of the examples that Lewin gave of a genuine need). Moreover, if the statement that the essential genuine need is that need which led one to decide on the action in question, is taken seriously, it can only refer to the need to please or to obey the experimenter ⁸; and obedience was characteristic of Zeigarnik's "pure" subjects.

¹ Fisher (1954, p. 429), however, flirted with the idea of a transference relationship between subject and experimenter.

² Lewin (1926*b*, p. 341; 1951*b*, p. 104); Zeigarnik (1927, p. 61).

³ *Willensziele*.

⁴ Lewin (1926*b*, p. 370; 1951*b*, p. 138). The italics are the present author's.

⁵ This statement may perhaps be considered as an indication of the link that Lewin (1947) later explicitly created between motivation and action, i.e., decision. See also *Horwitz & Lee (1954).

⁶ Cf. Prentice (1944).

⁷ Lewin (1926*b*, p. 370; 1951*b*, p. 137).

⁸ McColl (1939), who in a critical review of Zeigarnik's study wondered "how the psychical system corresponding to the environmentally presented task is originally set up" (McColl 1939, p. 77) suggested certain other needs with which the subject might approach the experiment, like the "need-to-do-well", the "need-to-do-as-requested", or the "need-to-be-done".

The decision to perform the task (and not, e.g., to throw the material out of the window) is taken in the context of a particular social relation. The only reason that one continues to copy the model of a honeycomb pattern or occupies oneself with counting backwards is simply because it was the request of the experimenter. The average subject would not dream of performing the majority of the Zeigarnik tasks just for the sake of performing them, e.g., on a free afternoon¹. Outside the specific experimental (and social) context in which the tasks are presented to the subjects there would be no question of any intention to perform the large majority of these types of activities unless, of course, they fitted into a larger meaningful whole², which, according to Zeigarnik (1927, p. 62–65), would nullify the predominance of uncompleted items in recall.

6.2.2 *Quasi-needs*

Quasi-needs, according to Lewin, derive their name from their close relatedness to real needs³. Are these two concepts really so closely related? Although a proper definition has never been given⁴, one may say that a quasi-need is established the very moment that a subject – because of the experimenter's instructions – intends to perform a task⁵. Quasi-needs have the characteristic of pressing of their own accord towards completion of the tasks.

By virtue of this characteristic the quasi-needs may appear to be very similar to “real” needs or drives. The quasi-need, however, is established in the context of an interpersonal relation⁶, by means of the transfer of an intention, and completion of the task takes place within the same interpersonal setting. It may thus be doubted whether the quasi-need of its own

¹ Zeigarnik (1927, p. 53) admitted that the subjects frequently disliked the continuous activities. Nevertheless Kendler (1963, p. 332) stated that Zeigarnik's “subjects reported that all the tasks were challenging and fascinating to work on”.

² Cf. Prentice (1944, p. 335–336); cf. also Horwitz's (1956) distinction between particularistic needs and meta-needs.

³ Lewin (1926*b*, p. 349; 1951*b*, p. 117).

⁴ Cf. Krech (1949, p. 87).

⁵ Zeigarnik (1927, p. 29).

⁶ “The needs of the individual are, to a very high degree, determined by social factors” (Lewin 1946, p. 289). Cf. Hilgard (1949, p. 379). However, according to general usage, drives or needs should be defined in terms of only one organism (cf. Duijker (1961) in a critique of the drive concept).

accord presses towards completion or whether the main pressure is exerted by the presence of the experimenter ¹.

Lewin seems to have been aware of this problem himself. In a discussion on induced needs he mentioned the experiments by Lippitt & White (1952), who “tested the effect of induced needs during the presence and the absence of the inducing power field” ², i.e., the leader (or, in our discussion: the experimenter). Within a few minutes after the leader had left the room, the work output dropped decisively in the autocratic group atmosphere, which was “dominated much more by induced forces than by forces corresponding to the own needs of the children” ³. “This was in contrast to a democratic group atmosphere, *where the work had been chosen and planned by the group itself*, and where the work output was unchanged when the leader left ⁴”.

Accordingly, the quasi-needs which are established during a Zeigarnik experiment are induced needs: the subjects are given a series of tasks which are not of their own choice. It may thus well be wondered whether drive properties should be ascribed to such “quasi-needs”, which in their origin as well as their discharge are dependent on (the presence of) the experimenter.

6.2.3 Tension reduction

Systems under tension tend towards discharge of this tension. A task, as long as it is unfinished, may be thought of, according to Lewin, as a system under tension; completion of the task means tension release. If, however, the activities which lead towards tension discharge are blocked, the system remains under tension ⁵.

When it is said that tension is discharged as soon as a task has been completed, attention is concentrated on the task which has just been finished, and no reference is made to the subject’s attitude towards future activities ⁶.

¹ “Quasi-needs, therefore, are essentially temporary attitudes” (Allport 1935, p. 807).

² Lewin (1946, p. 293).

³ Lewin (1946, p. 268).

⁴ Lewin (1946, p. 293); the italics are the present author’s.

⁵ The question “what becomes of this tension at the time when the subject turns to subsequent tasks?” has been brought up previously (Köhler 1940, p. 46); cf. Crafts *et al.* (1938, p. 59). McColl (1939, p. 82) reported difficulties in representing the task systems topologically.

⁶ Hoppe (1931, p. 4). See for criticisms of tension reduction theories, e.g., Child & Whiting (1950); Scheerer (1952, p. 272–273; 1954, p. 115–116); Allport (1953, p. 117–118; 1954, p. 11–13); Henle (1956); White (1960). Nuttin’s (1964, p. 75) distinction between closed and open tasks in relation to need reduction should also be mentioned here.

Similarly, the systems that remain under tension (representing the uncompleted tasks) are also treated in isolation. In a Zeigarnik experiment, however, in which there are a number of activities still to come (except, of course, in the case of the last task), the relationship between the various tasks, and especially between the systems under tension, should be considered. For one thing, the question arises whether a later (finished) task might not have substitute value for an earlier unfinished task. If the satisfaction of a need in one particular manner is prevented, subjects sometimes spontaneously look for substitute goals¹. Even when the experimenter succeeds in assembling a series of tasks which are as different from each other as can be, the subjects still categorize the activities. Thus, possibly, one verbal (or graphic) task has (at least some) substitute value for another. This process would lead to tension reduction of the systems representing the unfinished tasks and, consequently, to a reduction of the superiority of unfinished tasks in recall.

6.2.4 *The tendency towards completion*

Is it correct to postulate a tendency towards completion for the average subject entering upon a psychological experiment? Is it correct to conceive of such a tendency as a universal human characteristic²? Or is it perhaps more correct to consider the tendency towards completion as an effect of the cultural norm that everything once started ought to be finished³? (see sections 5.4.3 and 5.6.1). In the case of the latter assumption, the experimenter may be seen as the representation of this norm. In this respect his role does not differ much from that of a parent or a teacher: they all want activities to be continued until completion is reached, unless, of course, they themselves interfere (which they quite frequently do)⁴.

Already at an early age, children – at least the Dutch ones – become indoctrinated with the norm of completion. One might even say that it is

¹ Lewin (1946, p. 279).

² Lewin (1926*b*, p. 341; 1951*b*, p. 104). Cf. Metzger (1963, p. 232): “Der Drang, Gestörtes in Ordnung zu bringen und bei Unentwickeltem Geburtshelfer zu sein, gehört zweifellos zu den tiefsten Triebanlagen des Menschen ...”.

³ Cf., e.g., Michael (1953, p. 225): “It seems safe to propose that Western European culture in general and American culture in particular stress the concept of closure. ... And among the ideal behavior patterns favored are those stressing task completion, both materially and temporarily. (Consider, for example, the Zeigarnic [sic] effect.)”

⁴ Think, e.g., of the call to come and have dinner, the schoolbell between hours, the request to come and wash up the dishes immediately or to go shopping with Mom.

literally spoon-fed to them; e.g., almost every child is told time and again to eat up ¹, to finish putting its jigsaw puzzle together (!), or not to stop in the middle of a sonata but to finish playing it. The children themselves are, in general, none too happy with this rule, especially because it is enforced with regard to unpleasant tasks and activities in which the child has lost interest. As long as a task forms a challenge, of course, the child gladly continues it until completion is reached ², and becomes annoyed by any interruption.

As one grows older, there are still a great many things which one does not like to continue up to completion. So if the opportunity arises some people do not finish the tasks they have started (perhaps with enthusiasm), and the knitting work or the correspondence course on body building are thrown into the cupboard, only to be found again when moving. Other people tend to continue their activities after the original motives have evidently died away by re-stimulating themselves at intervals with such verbalized attitudes as "I always finish what I start" (Rethlingshafer 1943, p. 400).

The average subject may be inclined to behave similarly. He will like some of the tasks, dislike others, and start enthusiastically on yet other tasks only to lose interest during the course of the activities. As the tasks in a Zeigarnik-type experiment are of relatively short duration, the chance that feelings of satiation will occur is relatively low, though they nevertheless do exist (see sections 5.1.2 and 5.2.1).

For an experimenter (or a consultant), however, the situation seems to be different, and unfinished work (from the subjects or clients!) suddenly becomes unacceptable ³. An interviewer, e.g., hands in notes which tend to be "finished pieces of composition, with very few incomplete thoughts or

¹ This rule can even be detected in the famous (non-moralizing) modern Dutch nursery rhymes by Annie M. G. Schmidt (1961), amongst others: "De drie mannetjes" (p. 60-61) and "Het mannetje in de maan" (p. 101).

² Cf. Asch (1952, p. 298-300).

³ It may be that psychologists – because of their relatively great capacity for rationalization – rather tend to make a discrepancy between norms for themselves and norms for other people, especially their subjects (Van Bergen 1963*b*). Think, e.g., of social workers who tend to expect their clients to dress properly while often the "finishing touch" in their own clothing is lacking (Van Bergen & Blaauw 1963). According to Mulder (1959, p. 215-216), industrial and clinical social psychologists seem to hold the opinion that the individual wants to hand in a finished product. However, Mulder's (1959) own study with Dutch Navy recruits as subjects did not demonstrate that self-realization has an effect on satisfaction, i.e., that being responsible for the completion of one's own task has an effect on tension reduction.

sentences”, while the actual interview had been “characterized by incomplete sentences and thoughts begun but not finished”¹.

Does the tendency towards completion apply to people of all social strata or only to individuals belonging to certain special classes? Baumgarten (1952*b*; 1953) who in a treatise on the tendency towards completion dealt with the problem of *not* finishing the work one has begun, chiefly observed the tendency towards completion with independent workers in the higher strata of business and in the professions².

Baumgarten’s (1952*b*) observation is the more interesting as quite a number of the experimenters either come from or will soon belong to these higher strata of society. Moreover, in the experimental situation they act as independent workers, even if they themselves are not the (principal) researchers. Perhaps part of the explanation for the persistence with which studies on task interruption are performed lies in the experimenters’ adherence to the norm that tasks once started ought to be finished³. And perhaps part of the explanation why the same experimenters are so often frustrated by the non-significant results of their studies is that people in general – and thus also the (student) subjects who frequently belong to the very same social class as the experimenters – when operating in a dependent position react rather ambivalently towards strict rules.

6.2.5 *Principle of closure*

The tendency towards completion has a correlate in perception, namely, the principle of closure. Or rather, the tendency towards completion may be regarded as a generalization of the perceptual principle of closure which – together with other laws of perceptual organization – was introduced by Wertheimer (1923). Before Wertheimer’s publication, Koffka (1921) had already transposed the principle of closure from the perceptual to the more

¹ Kahn & Cannell (1957, p. 191); cf. Rijkse & Van Bergen (1959). Froehlich (1958) found that clients tended to include less in their interview notes (required for research purposes) than did their counselors.

² In the report of a survey on young Swiss workers made by Baumgarten (1952*a*) in 1940 it is indeed difficult to find complaints expressed by the young men about being interrupted in their work. Cf. Davis (1948, p. 68–69); Cofer & Appley (1964, p. 784); and the difference between the recall scores of middle-class and working-class boys which was obtained by *Miller, Swanson & Beardslee (1960). “We may state more generally that the culture in which a child grows affects practically every need ...” (Lewin 1946, p. 289).

³ One of the items of the Gough-Sanford Rigidity Scale reads: “I always finish tasks I start, even if they are not very important” (Rokeach 1960, p. 418).

general behavioral field: "... the characteristics of 'closure' ... belong not merely to the phenomena themselves, but likewise to the behaviour taken as a whole, including all reactions made to the environment" ¹.

The much too free and wide use of the term closure outside the field of perception has frequently been criticized. E.g., Schoenfeld (1941) pointed out that "'Closure' has not yet been given adequate operational definition as a perceptual process, nor has it as yet been satisfactorily defined or identified on any other level. We cannot even be sure that it is correct to extend the term into any field other than perception, unless it be that of memory where there apparently is some, but far from conclusive, evidence for its existence" ². He concluded that "These extensions of a term which merely names an observed perceptual phenomenon are completely devoid of any real explanatory significance or logical validity" ³. Révész (1953*a*, *b*) even warned against overmuch generalization of Gestalt principles within the field of perception itself, in particular against the transposition of visual principles to haptics.

Is there any reason to expect a differential effect on the working of the principle of closure due to cultural differences, as was assumed with regard to the tendency towards completion? Two studies with contradictory results may be mentioned. Postman & Bruner (1952) found that past experience is of considerable importance in the operation of closure tendencies. During tachistoscopic presentation, subjects trained to work with open circles gave significantly fewer closure responses (drawings) than subjects trained to work with closed circles. Michael (1953), however, did not find a difference between the reproductions of tachistoscopically presented open and closed circles made by persons educated in a culture which stresses closure (white Americans) and persons who had had the fear of completely finishing anything instilled into them (Navahos) ⁴.

¹ Koffka (1921, p. 73; in English: 1928, p. 109). Also: Köhler (1928, p. 199; in English: 1938, p. 392-393).

² Schoenfeld (1941, p. 492). In the remainder of this section examples will be given which tend to show that even in the field of memory there is not more than chance evidence for the working of the principle of closure.

³ Schoenfeld (1941, p. 496). Also: Humphrey (1951, p. 175-177).

⁴ The Navahos are reported to be brought up with "... the fear of completely finishing anything: as a 'spirit outlet', the basketmaker leaves an opening in the design; the weaver leaves a small slit between the threads; the Navaho who copies a sandpainting for a white man always leaves out something, however trivial; the Singer never tells his pupil quite all the details of the ceremony lest he 'go dry'. Singers also systematically leave out transitions in relating myths" (Kluckhohn & Leighton 1946, p. 226).

Is there any empirical foundation at all for the extension of the principle of closure to the field of memory? Is it at all possible to detect any consistent trend in the reproduction or recognition of open and closed figures, in particular of open circles? From a number of experiments that I screened for this purpose, five evidenced a tendency on the part of the subjects to close the gap of the open circles ¹, five indicated that the gap was emphasized ², and six experiments gave results that were either inconsistent or non-significant ³. The accumulated evidence thus provides no support for the Gestalt hypotheses that perceptual and memorial closure will occur with the incomplete circle⁴.

In yet other experiments the differential recall or recognition of open and closed figures was determined. In general, no significant preference in recall for either the one or the other type of figures was obtained ⁵.

From the studies discussed in this section it may therefore be concluded that the principle of closure cannot consistently be verified for the memory of visual forms (in particular open and closed circles), which makes the generalized application of this (non-verified) principle in another field, the retention of actions, a risky affair ⁶.

¹ Irwin & Seidenfeld (1937); Seidenfeld (1938); Crumbaugh (1954), gap 90°; Carlson & Duncan (1955), recognition after 3 minutes; Walker & Veroff (1956), gap 80°.

² Hebb & Foord (1945), children; Crumbaugh (1954), gap 15°; Carlson & Duncan (1955), recognition after 1 week; Walker & Veroff (1956), gap 20°; Karlin & Brennan (1957).

³ Irwin & Rovner (1937); Hebb & Foord (1945), adults; George (1952); Hanawalt (1952); Carlson & Duncan (1955), recognition after 2 weeks; Johnson (1962).

⁴ A similar conclusion may be drawn from other incomplete material, e.g., from the movie presented by From (1957) to 44 Danish subjects. In summary the contents of the movie were: A young man sat at a table, writing. He got up, looked for something, took out his pipe, sat down again, filled his pipe, got up, put on his jacket, and sat down again, thinking. He looked through some books, wrote a few lines, picked up the books, got up, put something into his pocket, sat down again, and looked in one of the books (From 1957, p. 100–101). When the 44 subjects were later asked how the movie had ended, 15 answered "he leaves" and another 6 "I think, he leaves" (From 1957, p. 119). Thus not more than one-third or at the most half the subjects tended to give the movie an acceptable ending ("need for closure").

⁵ No significant differences: Tiernan (1938); McColl (1939, p. 142–144); *Gurnee, Witzman & Heller (1940); and with regard to immediate recognition Soltz & Wertheimer (1959). Closed symmetrical figures were recognized significantly better than open asymmetrical figures after 2 weeks: Soltz & Wertheimer (1959). The effect of stress on the working of the principle of closure also seems to be rather ambiguous. Cf. Moffit & Stagner (1956, p. 355) who found that "for tachistoscopic closure ... the effect of threat-induced anxiety was significant, but that for manifest anxiety [measured by MMPI] was not".

⁶ Cf. Woodworth & Schlosberg (1954, p. 776); Riley (1962).

6.2.6 *Interruption*

Section 6.2.1 opened with the statement that – according to Lewin – the subject intends to perform a task because of the experimenter’s instructions. However, an analogous statement, made with respect to the interruption, would be fatal for all studies on the selective recall of interrupted and completed tasks. A subject should *not intend to stop* working on a task because of the experimenter’s instructions. To be sure, the only verbal instructions at the moment of interruption that were given in Zeigarnik’s own experiments were “Now do this, please”. Although the subject was not *told* to stop working on a task, the collecting of the material of the unfinished task may be regarded as an even more stringent instruction of the experimenter. Why should one suppose that a subject intends to do everything the experimenter asks and not suppose that he intends to drop everything at the request of the very same experimenter ¹?

The heart of the problem, namely the discrimination between the effects of two kinds of experimental instructions, is obscured if the experimenter’s interruption is only regarded as a “barrier” to which a field of restraining forces, depending for its strength on the (interrupted) driving force, corresponds (cf. Lewin 1938, p. 123–125; 1946, p. 259).

The second problem regarding task interruption concerns the subject’s reaction to the interruption itself. Zeigarnik was aware of the possibility that the uncompleted tasks may stand out because of the affective effect of the interruption. She performed two experimental variations (III and IIIa) for the express purpose of checking such a possible shock effect. The results did not differ from those of her main experiment. This led Zeigarnik to discard the hypothesis that the predominance of interrupted tasks in recall should be ascribed to their being affectively emphasized.

The problem of the subject’s reaction to task interruption, however, also has to do with good manners in social interaction. It is plainly impertinent to snatch away material on which a person is working, even if this is camouflaged with the presentation of other material and a smile. To display such behavior outside the psychological laboratory would simply be asking for trouble ². Even inside the laboratory subjects will not accept this if the

¹ Compare the discrepancy between the experimenter as an impersonal behavior initiator and data recording machine (Borstellmann 1961, p. 519), and the experimenter as an inducing agent: “on the one hand, the experimenter acts as though he does not exist; on the other, he behaves as though he were omnipotent” (Mills 1962, p. 24).

² Cf. Maier (1955, p. 481–490) for the frustrating effects of task interruption, which even led up to the killing of a foreman in one factory.

person making the interruption is anyone else than the experimenter and is apparently unauthorized. Then definite resistance is shown, “expostulating with the interrupter and struggling with him for the task” (*Frank 1944, p. 24). Only the experimenter is allowed to behave as impolitely as he pleases or – as the subjects understandingly suppose – as is required for experimental reasons. Nevertheless, the subjects must become rather or even very frustrated by such rudeness. Their good manners, however, prevent them from showing their disappointment and certainly their anger¹. The one ballpoint which was thrown in the author’s face (see section 5.3.2) in the course of a long series of experiments is really almost nothing.

In an experiment in which the interruption should function as a device for continuing task tension, concomitant phenomena like frustration, anger, suppression of anger, and defense mechanisms as a result of frustration, may have a rather disastrous effect. Because they are affectively loaded, these feelings may be of much greater importance for the subject than the undischarged task tensions.

A third problem is the high frequency of the interruptions. In general, half the tasks were interrupted, which meant between nine and twelve unfinished tasks. The subjects often protest against the first or the first few interruptions. After that they come to expect them and some subjects just become a little apathetic². This occurs especially when they conceive of completion and incompleteness as a rather arbitrary business and conclude that it is of no importance whether they do their best or not. Stated in very extreme terms³, the situation may be experienced by some subjects as so

¹ Cf. Mandler (1964, p. 164): “The interruption of an integrated or organized response sequence produces a state of arousal which will be followed by emotional behavior”. “Thus, interruption may lead to expressions of fear, anger, surprise, humor, euphoria . . .” (p. 174).

² A negative shift in the expectations of the subjects with reference to their future results – results which, in a Zeigarnik-type experiment, are not always experienced as personal achievements – must not be viewed as lowering the level of aspiration. “The concept of level of aspiration is relevant only when there is a perceived range of difficulty in the attainment of possible goals and there is variation in valence among the goals along the range of difficulty” (Deutsch 1954, p. 208).

³ Not in as extreme terms, however, as *Mandler & Watson (1966, p. 283–284) who, with regard to individual response to interruption (in particular to being continually activated and interrupted in the same act) discussed Bateson *et al.*’s (1956) theory of schizophrenia, the essence of which reads that people who are subjected to and cannot escape from communications which in themselves are contradictory (“double bind”), may develop schizophrenic symptoms.

chaotic¹ that it almost resembles the no-solution situation in a discrimination apparatus for rats².

For the frustrated subjects the experimental situation resembles the situation described by Lewin (1942), in which the free play activity of a child is interfered with, with regression as its effect. "Because the adult has stopped the child in the midst of play of great interest and productivity, now he feels himself to be on insecure ground; he is aware of the possibility that the overwhelming power of the adult may interfere again at any moment. This "background of insecurity and frustration" not only has a paralyzing effect on long-range planning; it also lowers initiative and the level of productivity"³ (Lewin 1942, p. 111).

If it is accepted that initiative is lowered by a number of interferences or interruptions one may well ask whether the subjects still *intend to perform* the later tasks and establish tension systems for them. If they begin to feel that they are not being treated fairly they may "give up", and the need-to-be-done (McCull 1939, p. 86) may then become prominent.

On the other hand, it should be mentioned that the recall results of two experiments in which fewer tasks were interrupted⁴ (*De Monchaux 1951, 5 : 15, and "Experiment with only three unfinished tasks", section 5.4.1, 3 : 17) did not differ essentially from their 10 : 10 counterparts. *De Monchaux (1951) obtained a significant predominance of uncompleted items in recall, while the present author could not discard the null hypothesis of no difference in recall between uncompleted and completed items.

This line of reasoning is especially applicable to task-oriented situations. If stress instructions are given, the situation may become threatening but will at the same time become less ambiguous for the subject. Within the framework of an intelligence test the interruptions immediately acquire a meaning: I have been too slow, or I have been too stupid. In task-oriented situations, however, an interpretation of the interruptions is less obvious and the subjects have to try and find an acceptable explanation for themselves. Perhaps this is another reason why the results of the experiments

¹ Mandler (1964, p. 179) spoke of "'helplessness' in the face of interruption".

² See Maier, Glaser & Klee (1940).

³ Cf. Dueker (1965, p. 51-53) who observed co-ordination disorders and a diminution of performance as a consequence of interruption. Thelen (1948, p. 591-592), on the other hand, reported that group leaders tend to interrupt group meetings before "closure" is reached in order to effect a prolongation of tension so that the individuals will continue to be active.

⁴ These experiments, however, were not designed to control the feelings of frustration on the part of the subjects, but to study the effects of isolation.

with ego-oriented instructions appeared to be somewhat less inconsistent than those of their task-oriented counterparts (see section 6.1.6).

6.2.7 *Task recall*

The systems which – because of task interruption – remain under tension persist, according to Lewin, until some (short) time after completion of the task series. They are, at any rate, still supposed to exist when the subject is asked what tasks he had worked on during the experiment.

Similarly to the way in which quasi-needs (task tensions) were set up as a result of the experimenter's task instructions, a quasi-need is established because of the experimenter's instruction to give recall (Zeigarnik 1927, p. 30). However, the forces resulting from task tensions are said to correspond to "own" needs, whereas the force corresponding to the subject's quasi-need to recall should only be regarded as an induced force¹ (Lewin 1940, p. 19). Nevertheless, task recall is held to be dependent on both forces: the undischarged task tension systems and the tendency to recall all the tasks².

Recall of more uncompleted than completed tasks is taken as an indication of undischarged tension (Zeigarnik 1927, p. 29). This means that one can only infer that a quasi-need (a system under tension) has been set up after recall has been given. However, it is rather arbitrary to ascribe the value of a given recall difference score to the combined effect of undischarged task tensions and a strong reproduction tendency, or to the relative lack of task tensions (due for example to a large number of subjective completions), to mention only two possible interpretations. The tension system theory cannot be refuted by the outcome of the experiment, "since the correspondence between theoretical and empirical terms is adjusted in accordance with the empirical findings"³.

The instruction to give recall means that the subject is required to recall the *names*⁴ of the tasks, or to describe them in a few words. Had the subjects been asked instead to state at which point each task had been interrupted or from which point they were required to continue the work on each task, they would probably not have been able to reply correctly⁵. In

¹ Cf. Festinger (1953a, p. 234).

² *Rp-Wille*. See Zeigarnik (1927, p. 30–39).

³ Cf. Estes (1954, p. 332, 335); Brunswik (1952, p. 78); Osgood (1953, p. 586); and *Henle's (1942) critique on *Lissner (1933).

⁴ Cf. *McKinney (1935); Rapaport (1943, p. 237); *Rand (1963, p. 28).

⁵ This inability is one of man's most conspicuous limitations, according to Frijda (1965, p. 7–8).

12% of the tasks of the Marrow replications the subjects were not even able to state correctly whether they had or had not finished a task (see section 5.3.3).

Nevertheless, if one tried to find a memory correlate of an unsatisfied quasi-need (i.e., a quasi-need which presses towards task completion), one might also think of an enumeration of those parts of the task which the subject had still intended to perform¹ than of the recall of the name of the task. Such a conception of a memory correlate of quasi-needs would make task recall – although only theoretically – more comparable to task resumption (for a comparison in Lewinian terms, see section 6.2.8).

6.2.8 *Resumption and recall*

According to the Lewinian theory resumption and recall of interrupted tasks are based on the same dynamic principles². Both are reflections of undischarged tension systems which press towards tension reduction.

In the experiments on task resumption several methods of interruption were applied. In those cases in which the interruption was effectuated by the presentation of another task a distinction was made between the main task(s) and the interference task(s)³. According to Ovsiankina (1928, p. 317–320) the majority of the subjects regarded the former as the principal task, whereas the latter was only seen as being of secondary importance⁴. The tendency to resume, which was clearly evident with regard to the main task, was either very weak or even completely lacking with respect to the interference task⁵. Ovsiankina's (1928, p. 319) interpretation, which read that it is not (or hardly) possible to establish another tension system for a new task following an interruption (see section 1.2), undermines Zeigarnik's experimental design. If Ovsiankina's assumption was also applicable to the recall experiments no tension systems would (or perhaps even *should*) be established for tasks following an interrupted task⁶!

¹ Cf. Birenbaum (1930) who observed whether a subject did or did not later (remember to) perform a previously intended activity. Cf. also Miller, Galanter & Pribram's (1960, p. 65) "working memory".

² Lewin (1935, p. 243–244).

³ *Störungshandlung*.

⁴ The same type of activity was involved.

⁵ Cf. Winsemius (1965, p. 89) who – in a study on work accidents – observed that tasks which interfere with the work process are in general performed with far less concern for personal safety.

⁶ Cf. *Boguslavsky's (1951, p. 254) analysis of the data of Zeigarnik's experiment I.

The analyses of the experimental situations of Zeigarnik's and Ovsiankina's studies led to the detection of incompatible propositions within Lewin's tension system theory¹: firstly, it is possible to establish tension systems for tasks, whether they are preceded by an interrupted or a completed task (Zeigarnik); and secondly, after an interruption it is not (or hardly) possible to establish another tension system for a new task (Ovsiankina). This means either that resumption and enhanced recall of interrupted tasks cannot be considered as two equivalent (indirect) measures of undischarged tension systems², or that the theoretical concepts have been operationalized inadequately.

6.3 *Final questions*

It was shown that the combined results of the studies on selective recall were inconclusive (see 6.1). The evaluation of the assumptions made in the interruption studies brought to light several shortcomings with regard to the operationalization of the concepts of Lewin's tension system theory³ (see 6.2).

It would not be fair, however, to criticize Zeigarnik for not having operationalized the theoretical concepts adequately, as her studies were performed some years before 1927, the year which saw the publication of Bridgman's claim "that all concepts should be defined in terms of empirically performable operations"⁴. In the course of the years, however, Lewin gave more attention to the elaboration and formalization of his theoretical system⁵ than to its operational validity. Did Lewin's seemingly fruitful procedure of developing theory and experimentation concomitantly ("... in fits and starts ... now here, now there")⁶ distract his attention from a

¹ The results of the few empirical studies in which both resumption and recall were measured do not show a significant association between these two variables (*Rethlingshafer, 1942; *Winder, 1952; *Altea, 1955).

² Cf. McGeoch (1942, p. 385); Prentice (1944, p. 329–330). The latter, however, mistook repetition choice for resumption. The relation between selective recall and repetition choice has, in general, been found to be low and negative: *Rosenzweig & Mason (1934); *Brenman (1947); *Coopersmith (1960); Butterfield (1965).

³ Cf. Estes (1954, p. 325, 332); Atkinson (1964, p. 104–106).

⁴ Benjamin (1955, p. 3).

⁵ E.g., in 1940 Lewin formalized Zeigarnik's derivations.

⁶ Lewin (1926a, p. 297; 1951a, p. 79). Cf. Murphy (1965, p. 25) who compared Zeigarnik's studies with "hoptoad conquests led off into the unknown ... in which subregions are

painstaking and tenacious study of the relation between theoretical concepts and experimental variables?

The inconclusive results of the studies on selective recall (see section 6.1.8) should be ascribed partly to a similar lack of interest in the relation between experimental variables and theoretical concepts on the part of the later researchers, most of whom should have known better. For only part of the 160-odd studies reviewed were performed within a definite theoretical framework (see the introduction to chapter 2).

With which (theoretical) purposes were the other studies on task interruption – which form the majority of those reviewed – performed? It is perhaps rather odd to speak of studies on “task interruption” instead of studies on the relation of motivation to memory, and to entitle even a complete book (the present one) “Task interruption”. It seems that task interruption “has become one of those instances in the history of psychology when a technique rather than a concept is the focus of intense experimentation” (*Butterfield 1963, p. 56).

Has no progress been made in the study of task interruption since Sears, in 1950, questioned the validity of the interruption technique, for the continued use of which he saw little reason ¹?

When one considers the number of experimenters (well over a hundred) and subjects (thirteen thousand-odd), who all put a greater or lesser amount of energy, enthusiasm, or just plain work into the studies, one might derive some comfort from the thought that “experiments are not merely a way of testing hypotheses, but they are also a way of becoming more clear about what questions should be asked and about questions which seem to lead nowhere” ².

The problem of the selective recall of uncompleted and completed tasks must be regarded as one of those “questions which seem to lead nowhere” ³; nevertheless one wonders how many thousands more of experimental subjects will yet be needed before the problem, which is essentially a non-problem, is discarded.

quickly consolidated.”¹ Cf.: “Flexibility is obtained at the cost of testability” (Estes 1954, p. 332).

¹ “When a research operation requires as much discussion of its ‘psychological meaning’ as interruption does, it is time to find a new operation” (Sears 1950, p. 113).

² Riley (1962, p. 463).

³ Lewin (1949, p. 272) himself characterized a research project which is not “a substantial contribution to a living science” as “a well polished container of nothing”.

Epilogue

“Only ask the questions in your research that you can answer with the techniques you can use. If you can’t learn to ignore the questions you are not prepared to answer definitely, you will never answer any”.

KURT LEWIN
(quoted by Cartwright
1951, p. xiv)

TABLE 36

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Schlote (1930)	replication Zeigarnik I				4	> .50							
	replication Zeigarnik IV						4	1.00					
	replication Zeigarnik IVa								9	.19			
	intended activities	7	.02										
	tired subjects						<i>n</i>						
Harrower (1933)	jokes			<i>n</i>									
Hartmann (1933)	compulsive neurotics				9	.84							
	healthy control subjects				5	.06							
Golant-Ratner & Menteschawili (1933)	patients with paralytic dementia				8	> .81							
	id. after malaria therapy	11	< .003										

n: number of subjects unknown.

Italics: statistical results taken from the original study.

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Golant-Ratner & Menteschawili (1933)	id. after malaria therapy: manic-depressive psychosis								4	.12			
Sandvoss (1933)	replication Schlote (1930): intended activities				3								
Rosenzweig & Mason (1934)	jigsaw puzzles; crippled children								40	> .45			
Stumbur (1934)	schizophrenics: processal stages				11	.45							
	id.: defective stages	14	.002										
Pachauri (1935 <i>b</i>)	verbal tasks; same duration U- and C-tasks: adults	36											
	id.: children	267											
	great differences between duration of tasks			<i>n</i>									
	great differences between difficulty of tasks; children										<i>n</i>		

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC									
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.						
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>					
Pachauri (1935 <i>b</i>)	id.: with instruction that all tasks are solvable			149														
Abel (1938)	subjects with neuro-circulatory efficiency; ambition induced				24	.09												
	subjects with functional unfitness; ambition induced												25		.0003			
Marrow (1938 <i>a</i>)	paper and pencil tests	30	.00002															
Marrow (1938 <i>b</i>)	id. with instruction: U is success, C is failure												30		< .01			
	id. with encouragement	30	< .01															
	id. with discouragement	30	< .01															
Heider (1938)	classroom demonstrations			<i>n</i>														
Trowbridge (1938)	jigsaw puzzles; intelligence test							15										
	id. recall after five weeks							15										

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Abel (1941)	competitive instructions: high-school students				202								
Rethlingshafer (1942)	adaptation of Pachauri's (1935) group method			38									
Walsh (1942)	on day of serious air-raid, girls 10-11 years old								30	> .10			
	on day of serious air-raid, boys 11-12 years old				30	> .10							
	boys 11-10 (seen individually)	30	< .01										
	girls 11-12 (seen in a group)	30	< .01										
	id. recall after 24 hours								30	> .10			
	U-tasks: indifferent tasks; C-tasks: interesting tasks; boys	30	< .01										
id. girls 12-13	30	< .01											

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>		<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>		<i>n</i>	<i>P</i>
Walsh (1942)	boys 13-14 years old	30	< .01										
	fatigue: girls 13-14	30	< .01										
	excitement: girls 14-16	30	< .01										
	boys 12-14 years old, persistent	30	< .01										
Rosenzweig (1943)	jigsaw puzzles; informal group				30	> .05							
	id.: formal group								30	> .50			
Prentice (1943; 1944)	interpolation of second task series										10		
	interpolation of interesting reading material			10									
Lewis (1944)	co-worker experiment								14	> .44			
Lewis & Franklin (1944)	I: "test of tasks" instructions	12	.002										
	IA: "preliminary experiment" instructions										12		.001

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>		<i>n</i>	<i>n</i>			<i>P</i>	<i>n</i>		<i>P</i>	<i>n</i>
Author(s)	Details of study												
Lewis & Franklin (1944)	II: experiment with planted co-worker and experimenter				11	> .08							
	III: completion by experimenter	23	< .05										
Rosenthal (1944)	undergraduates (susceptible to hypnosis); normal waking state success-failure instructions											13	.01
	id.: under hypnosis								13	.30			
Alper (1946b)	scrambled sentences; task orientation								10	.28			
	id.: threatening of self-esteem				10	.69							
Sanford (1946)	replication Rosenzweig & Mason (1934): normal children								49	.18			
Black (1947)	scrambled sentences: task orientation											18	.02
	id.: ego orientation											18	.0005

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?	RU < RC					
		Sign.		?	Non-Sign.			Non-Sign.		?	Sign.		
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Brenman (1947)	mild interruption				9	.11							
	severe interruption				7	.08							
McKinnon & Henle (1948)	research course experiment: before hesitation period				23	.19							
	id.: total recall						23	1.00					
Sanford & Risser (1948)	repetition jigsaw puzzles with Sanford's (1946) subjects, 2½ years later								26	.17			
	rhyming words				15	.42							
	rhyming words				26	.82							
	mothers as subjects, with onlooking daughters										25	.04	
Gilmore (1949)	three more or less ego-involving situations						258						

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Gilmore (1949)	after 3 weeks, interpretation of experiment by subjects: intelligence test						<i>n</i>						
	id.: interpretation: little personal significance										<i>n</i>		
Glixman (1949)	task orientation								60				
	slight stress								60				
	weeding out of unsuccessful students								60				
Kendler (1949)	all jigsaw puzzles completed; success/failure induction										22	< .05	
Baler (1950)	reading selections with high Allport-Vernon value								60	.31			
	id.: with low value										60	.002	
Dancker (1950)	± replication Zeigarnik I with healthy subjects	10	.002										

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Dancker (1950)	id. with dystrophics											21	.0001
Boguslavsky (1951)	printed instructions							80	.89				
	oral instructions							40	.13				
De Monchaux (1951)	naming of pictures Juggle-Jigsaw	20	.01										
	no naming of pictures				20	> .54							
	working in pairs	20	.01										
	U:C = 5:15:naming of pictures	10	.005										
	id.: no naming of pictures	10	.04										
	id.: working in pairs	10	< .00006										
	U:C = 15:5:naming of pictures				10	.55							
	id.: no naming of pictures				10	.60							
	id.: working in pairs				10	.25							

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC					
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.		
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Scholz (1951)	with East-German subjects			<i>n</i>										
Bolin (1952)	paper and pencil tests							16	.12					
Eriksen (1952a)	scrambled sentences: intelligence test instructions							39						
	id.: task orientation				22									
Eriksen (1952b)	scrambled sentences: ego-involvement											44	< .05	
	id.: non-ego-involvement							23						
Ferradini (1952)	intended activities										80			
	interrupted activities			60										
Hays (1952)	with dull interpolated tasks	15												
	with interesting interpolated tasks											10		
	intelligence test							15						

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?	RU < RC						
		Sign.		?	Non-Sign.			Non-Sign.		?	Sign.			
		<i>n</i>	<i>P</i>		<i>n</i>	<i>n</i>		<i>P</i>	<i>n</i>		<i>P</i>	<i>n</i>	<i>P</i>	
Hays (1952)	assistance of experimenter				10									
Winder (1952)	paranoid schizophrenics	35	< .01											
	non-paranoid schizophrenics							35	.25					
Atkinson (1953)	achievement orientation: high <i>n</i> Achievement			10										
	id.: low <i>n</i> Achievement							14						
	task orientation: high <i>n</i> Ach.				14									
	id.: low <i>n</i> Ach.				18									
	relaxed orient.: high <i>n</i> Ach.				11									
	id.: low <i>n</i> Ach.			16										
Atkinson (1953), see McClelland <i>et al.</i> (1953)	achievement orientation: high <i>n</i> Achievement			9										
	id.: middle <i>n</i> Ach.										8			

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
Author(s)	Details of study	Sign.		?	Non-Sign.		n	P	Non-Sign.		?	Sign.	
		n	P	n	n	P			n	P	n	n	P
Atkinson (1953), see McClelland <i>et al.</i> (1953)	id.: low <i>n</i> Ach.								7				
	task orient.: high <i>n</i> Ach.				10								
	id.: middle <i>n</i> Ach.				11								
	id.: low <i>n</i> Ach.								11				
	relaxed orient.: high <i>n</i> Ach.								9				
	id.: middle <i>n</i> Ach.			10									
Baltimore <i>et al.</i> (1953)	id.: low <i>n</i> Ach.				8								
	subjects								24	> .20			
	observers								24	> .20			
	accepted observers	30	< .002										
	rejected observers								40	.10			
accepted subjects								30	> .20				

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		
Jourard (1954)	student nurses; stress								58	> .50			
Altea (1955)	replication Ferradini (1952), interrupted activities								50	> .10			
	tasks: naming of figures			30									
	tasks: naming of colors									30			
Mittag (1955)	paper and pencil tasks; free and easy situation; young workers working 2 at a time	32	< .001										
	II: C-tasks = socially relevant; U-tasks = intermission tasks; skilled workers										56	< .001	
	see II: recall after 1 day										16	.01	
	id.: after 1 week										16	.04	
	id.: after 1 month										16	< .002	

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC					
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.		
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Mittag (1955)	see II: unskilled workers											32	< .004	
	id.: bonus for each completed task											12	< .002	
	id.: payment in advance											12	.04	
	see II: statement made after task series: experiment was not serious											8	.02	
	see II: statement made after task series: exchanging of socially relevant and intermission tasks								12	.73				
	see II: U and C within intermission tasks	12	< .002											
	success/failure: socially well-adjusted workers								32	> .25				
	id.: insecure workers	10	.004											
	id.: ambitious workers											10	.008	

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		
Rösler (1955)	± replication Zeigarnik with school children	20	.002										
	id. with morons							30	1.00				
	id. with pre-school children	20	< .001										
	id. with imbeciles									20	< .001		
	continuous activities only: school children							16	.55				
	id.: morons	16	.02										
	id.: pre-school children						11	1.00					
	id.: imbeciles				11	1.00							
	± replication Zeigarnik, recall next day: school children								16	.58			
id.: morons									16	.02			

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC					
Author(s)	Details of study	Sign.		?	Non-Sign.		<i>n</i>	<i>P</i>	Non-Sign.		?	Sign.		
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Rösler (1955)	gaily colored task material: school children				16	.07								
	id.: morons											16	.008	
	id.: recall next day: school children											16	.004	
	second recall, 24 hours later: normal children	49	< .01											
	id.: feeble-minded children											42	< .01	
	second recall after explanation: normal children											18	.002	
	id.: feeble-minded children											16	< .002	
Zolik (1955)	scrambled sentences: ego-threat											119	< .001	
	id.: no ego-threat											41	< .001	

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Atkinson & Raphelson (1956)	achievement orientation: high <i>n</i> Achievement				4								
	id.: low <i>n</i> Achievement								4				
	task orientation: high <i>n</i> Ach.								6				
	id.: low <i>n</i> Ach.				6								
	relaxed orient.: high <i>n</i> Ach.								7				
	id.: middle <i>n</i> Ach.								7				
	id.: low <i>n</i> Ach.								7				
	achievement orientation: high <i>n</i> Affiliation								4				
	id.: low <i>n</i> Affil.				4								
	task orient.: high <i>n</i> Affil.					5							
id.: low <i>n</i> Affil.					7								

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?	RU < RC				
		Sign.		?	Non-Sign.			Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Atkinson & Raphelson (1956)	relaxed orient.: high <i>n</i> Affil.				7							
	id.: middle <i>n</i> Affil.							8				
	id.: low <i>n</i> Affil.							6				
Ralph (1956)	jigsaw puzzles, task orientation, boys, 9 years old	40	.02									
	id.: 6 years old						30					
	jigsaw puzzles, ego orientation, boys, 9 years old						40					
Alper (1957)	id.: 6 years old						30					
	task orientation: strong ego									9		
	id.: weak ego									9		
	ego orientation: strong ego										9	
	id.: weak ego							9				

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		
Caron & Wallach (1957)	scrambled sentences; public school; stress								23				
	id.: relief of stress								23				
	id.: task orientation									18			
	private school; stress									19			
	id.: relief of stress									19			
	id.: task orientation				15								
Ferdinand (1957)	U: personally relevant tasks, announcement of mark; C: unimportant in-between tasks								20	1.00			
	U: in-betweens that were to be finished later; C: personally relevant tasks, with mark	20	< .008										
	U: in-betweens; C: personally relevant tasks, with mark				16	.90							

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>			<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Tamkin (1957)	id. male control group							24	.61				
Clements (1959)	low anxiety			12									
	high anxiety									12			
	with forewarning of completion/ interruption										32		
Forrest (1959)	without forewarning of completion/ interruption; ego orientation			16									
	mirror-drawing; task orientation			20									
Jäger (1959)	id.: ego orientation										20		
	recall after 30 minutes	62	.02										
	after 1 day							57					
	after 2 days										49	< .01	
	after 6-9 days										25		

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Coopersmith (1960)	children; threatening self-esteem											48	.0009
Junker (1960)	mental tasks; very good students; no tension	7	.02										
Miller, Swanson & Beardslee (1960)	stress; boys; working class				49	.41							
	id.: middle class											57	.02
	id.: had experienced psychological discipline								60	.45			
	id.: mixed discipline								20	.27			
	id.: corporal discipline				26	1.00							
	id.: arbitrary obedience requests				41	.56							
	id.: explained obedience requests								51	.16			
	id.: occasional rewards								40	.70			
id.: frequent rewards								44	.74				

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Miller, Swanson & Beardslee (1960)	id.: early weaning							48	.053				
	id.: late weaning				51	.74							
	id.: severe toilet training							63	.17				
	id.: no severe toilet training				39	1.00							
Talland (1960)	Korsakov patients						<i>n</i>						
Lowe (1961)	stress						65						
Baddeley (1963)	anagrams; solution given after 1 minute	28	.001										
Butterfield (1963)	non-skill instructions; children 4th grade; external locus of control							16	> .32				
	id. internal loc. contr.							15	> .22				
	id. children 6th grade; external loc. contr.							16	> .52				

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?	RU < RC				
		Sign.		?	Non-Sign.			Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	
Butterfield (1963)	id. internal loc. contr.									15	.02	
	skill instructions; children 4th grade; external loc. contr.								15	.92		
	id. internal loc. contr.								15	.13		
	id. children 6th grade; external loc. contr.				16	> .16						
	id. internal loc. contr.								16	> .22		
Green (1963)	paper and pencil tasks: task orientation			48								
	id.: ego orientation									48		
Rand (1963)	boys, high anxiety								37	> .50		
	id. low anxiety								47			
	girls, high anxiety				51	> .50						
	id., low anxiety								40	> .10		

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		
Horwitz, Glass & Niyekawa (1964)	mirror-tracing tasks, task orientation								17	> .25			
Lelkens (1964)	extrapunitives, before hesitation period in recall				17	.10							
	id. total recall				17	.09							
	impunitives, before hesitation period in recall				14	.64							
	id. total recall								14	.82			
Martin & Davidson (1964)	achievers, achievement orientation			10									
	achievers, relaxed orientation								6				
	underachievers, achievement orient.										9		
	underachievers, relaxed orient.								4				
Sternlicht (1964)	recall after 4 weeks			90									

TABLE 36 (continued)

Results of experiments discussed in chapter 3		RU > RC					?	RU < RC				
		Sign.		?	Non-Sign.			Non-Sign.	?	Sign.		
		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>
Yamauchi (1965)	stress										39	< .01
Sternlicht & Wanderer (1966)	interpolated relevant cognitive behavior			30								
Weiner (1966a)	competitive situation				68	.25						
present author (chapter 5)	two-person experiment				54	.28						
	jigsaw puzzles								12			
	replication Zeigarnik I								34	.53		
	replication Marrow I (first experimenter)								30	> .05		
	replication Marrow II								6			
	replication Marrow I (second experimenter)								24	> .44		
	replication Marrow I (autocratic behavior of experimenter)*							12	> .38			

TABLE 36 (continued)

Results of experiments discussed in chapter 5		RU > RC					?		RU < RC				
		Sign.		?	Non-Sign.				Non-Sign.		?	Sign.	
Author(s)	Details of study	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>P</i>	<i>n</i>	<i>n</i>	<i>P</i>		
present author (chapter 5)	U:C = 3:17							15	.72				
	tasks with clear-cut end ^a						40	.82					
	children									40	.012		
	equalization-of-tasks ^a						20	1.00					
	success-failure							17	.30				

^a In cases where there is a discrepancy in sign between the (*RU*) – (*RC*) scores and the adjusted scores, the results are mentioned in the ?-column.

n: number of subjects unknown.

Italics: statistical results taken from the original study.

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Abstract

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This study on task interruption comprises a critical evaluation of the Zeigarnik effect. Four parts can be distinguished.

(1) The various theoretical backgrounds to the interruption studies which were performed within a definite frame of thought are discussed, and the influences on Lewin's thinking with regard to the problem of the recall and resumption of interrupted tasks are traced.

(2) A historical review of interruption studies is given. An effort has been made to compile all the studies ever performed (published) on the Zeigarnik effect, task resumption, and repetition choice.

(3) Experiments on selective recall performed with 338 Dutch subjects are described. In none of the 12 different experimental variations was a Zeigarnik effect obtained; in several of them the median recall difference score was zero.

(4) The combined results of the studies on selective recall which have been performed since 1927 are shown to be inconclusive. The assumptions made in the interruption studies are evaluated; several shortcomings with regard to the operationalization of the concepts of Lewin's tension system theory are brought to light. It is concluded that the problem of the selective recall of uncompleted and completed tasks should be regarded as a non-problem.

