ECT; memory loss -

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PSYCHOLOGIC EFFECTS OF ELECTRIC CONVULSIVE TREATMENTS*

I. Post-Treatment Amnesias

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INTRODUCTION

It is a reasonable working hypothesis for research at the psychologic level, that the physiologic changes induced by a series of electric convulsive treatments (ECT) give rise to some basic psychologic change which, in turn, may underlie the clinical effectiveness of the treatments. The first step in seeking for a psychologic variable of this kind is to discover behavioral functions which do, in fact, show a definite and sustained change following ECT.

So far, the only psychologic effects of ECT which have been established, other than the clinical improvement itself, are purely temporary ones. The "organic" syndrome which occurs during the course of a series of electroshock treatments includes a decline in intellectual abilities, memory impairment and a variety of confusional symptoms, but it has been generally observed that such reactions clear up within about two weeks after the termination of the shock series (5, 10). In

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successful cases, however, the alleviation of psychopathologic symptoms produced by ECT persists well beyond the two to three weeks period of recovery from the "organic" syndrome. If our knowledge of the nature of this clinical improvement is to be advanced, it is necessary to determine the specific psychologic changes which also persist beyond this period.

The investigations of hospitalized mental patients to be reported in the present series of articles were devised with this general problem in mind. They are exploratory studies intended primarily to delineate psychologic areas in which future investigations may be profitably concentrated in the search for psychologic changes which might account for the clinical effectiveness of electroshock treatments. The present article will deal with changes in the patients' ability to recall and describe personal past experiences which had been available to recall prior to the treatments. Alterations in association processes, as indicated by reactions to a word association test, will be described in the second article of the series. The third article will be devoted to changes in emotionality, as indicated by various scales of affective disturbances.

The Problem

Extensive amnesias have been noted during the period of treatment but most clinical observers claim that within two to three weeks after the last convulsion, the patients show no deficit in their ability to recall past experiences (2, 5, 8, 10).

There have been only a few reports (on individual cases) claiming that some memory defect was observed after the usual recovery period (1, 4, 6). These isolated case reports provide extremely inadequate evidence for the hypothesis that ECT produces a sustained memory defect. Objective evidence is usually lacking and, furthermore, there is the likelihood that the few cases described might merely reflect the small proportion of mental patients who would be found to develop a memory defect even if no convulsive treatments were given.

As yet no systematic investigation of disturbances in recall following ECT has been reported. It is the specific purpose of this study to investigate the problem of whether or not ECT produces an impairment in ability to recall personal memories which persists beyond the usual period of recovery from the transient organic reactions to the treatments.

Procedures

In order to obtain a substantial sample of personal memories from each patient, a fairly intensive interview was conducted prior to the

time when ECT was begun. No indication was given to the patients that the interview had any connection with electroshock treatments or had any special research purpose. The interview was conducted in an informal, conversational manner, but it was standardized in that the same set of questions, always formulated in the same way, was employed with every patient. The questions were designed to cover a fairly wide variety of personal life-experiences—remote as well as recent, trivial as well as important, pleasant as well as unpleasant. Many of the questions were intended to elicit memories of emotional experiences which might have deep personal significance to the patient.

The following topics were covered by the personal memories interview:

(1) *School history:* Name, location, years of attendance for each school; reasons for transferring or leaving; names of teachers; subjects failed and the reasons for failures; difficulties with school authorities; description of either the graduation ceremony or the last day of school.

(2) *Job history:* Name and address of each employer; nature of the job; reasons for leaving each job; how the first job was obtained; description of the best liked and the least liked job; trouble or difficulties in connection with work.

(3) *History of the mental disorder:* Circumstances involved in the onset and development of the major symptoms; physicians consulted and treatments received; prior hospital admissions; symptoms immediately preceding present hospitalization; specific events leading to hospitalization.

(4) *Heterosexual and marital relationships:* Description of the patient's first love affair and of recent love affairs; difficulties in connection with love affairs; quarrels with spouse, sex partner or "dates".

(5) *Family relationships:* Reasons for personal feelings toward father and toward mother; quarrels with parents; conflicts with siblings.

(6) *Childhood experiences:* Earliest memory in connection with going to school; incidents involving childhood quarrels, punishment, nervousness, happiness, unhappiness, running away from home; family troubles; childhood friendships.

(7) *Miscellaneous topics:* Details about the lay-out and furnishings of the patient's home; accounts of the death and funeral of relatives or friends; the first trip and the last trip out of town.

(8) *Outstanding life experiences:* Responses to questions about personal failures, serious trouble, the worst experience and the best experience of one's entire life, etc.

In covering the various topics, an effort was made to obtain descriptions of specific experiences, with much elaboration of the details, by asking additional questions such as: "Exactly what happened?"; "What happened after that?"; etc. The patient's responses to all questions were written down as nearly verbatim as possible.

Approximately four weeks after the termination of the ECT series, a post-treatment interview was given in order to test the ability of each patient to recall the personal memory material which had been elicited in the pre-treatment interview several months earlier. As a first step in this recall test, the standard set of questions employed in the pre-treatment interview was used. If these questions failed to elicit the memories originally given, they were followed up by a series of detailed questions to determine whether or not the patient was capable of reproducing the specific memory material he had previously given. The examiner's questions, as well as the patient's responses, were again recorded during the interview.

The interview procedure was to ask very general questions at first (e.g., "How did you happen to leave that job?") followed by questions containing specific details which would provide memory cues (e.g., "Did you go to a doctor?"; "Did you go to a doctor while you were still working?"; "Did you ever bring a note from a doctor to the office where you were working?").

Even after the questions on specific details of the experience failed to elicit recall, it was usually possible to carry the investigation one step further (when permission was obtained from the patient's psychiatrist) by giving a specially prepared recognition test. Usually this was done by presenting to the patient a large portion of his previous description of the experience, to observe if he would acknowledge having had the experience and be able to give the additional details about it. For some of the unrecalled material, a multiple choice recognition test was used, requiring the patient to select the one answer that described an experience in his own life.

The patients in the control group were given an initial interview comparable in every respect to the pre-treatment interview of the ECT patients. After an average time interval of approximately 11½ weeks (which was the mean period between the two interviews for the ECT group), the control patients were once again interviewed according to the same procedures used with the ECT patients. During the interval the control patients received no form of shock treatment.

So far as could be observed, none of the patients realized that exactly the same ground was being covered in the second series of interviews

as in the first series, several months earlier. At the close of the final session, the patients in both groups were asked to state what they thought the purpose of the interviews was. From their replies it appears that none of them suspected that the purpose had been to test their memory.

Subjects

Nineteen electroshock-treated patients and 11 control patients were included in the study. The former were selected on a random basis and the group comes fairly close to representing a cross section of all patients who were begun on ECT during a four-month period at the two hospitals where the investigation was carried out. Since the group studied did not include patients who were mute, confused or for any reason incapable of responding adequately to the examiner's questions, the ECT sample is representative of the less disturbed patients who were given electroshock treatments.

Each patient in the ECT group received the standard type of convulsive treatment induced by 60 cycle alternating current, administered three times a week (5). The average number of treatments was 17, with a minimum of 8 and a maximum of 27.

In selecting control patients, every effort was made to avoid any source of selective bias which might differentiate the control group from the ECT group. The control cases were located in the same wards as the ECT patients and all of them were being considered for electroshock treatment; in most cases it was for purely administrative reasons that they did not receive shock treatment during the period of this investigation.

The two groups were equated as closely as possible on a variety of factors which could, theoretically, affect the results. The mean age of the ECT group was 29.8 years and of the control group, 30.0 years; the mean number of years of formal schooling for each group was 10.2 and 9.8, respectively. There were only slight (and insignificant) differences between the two groups on the following additional characteristics: type of occupation, sex, duration of current hospitalization, prior admissions and duration of the mental disorder.

Eleven of the ECT patients and 9 of the controls were schizophrenics; roughly equal proportions were subclassified as paranoid, catatonic and mixed. The ECT group included 2 cases of involutional psychosis and 2 manic depressives, while the control group contained one in each of the two categories. The remaining 4 cases in the ECT group had been diagnosed as psychoneurosis or borderline schizophrenia.

Results

(1) *Evidence of Post-treatment Amnesias.*—If we define retroactive amnesia as an objectively observed failure to recall a personal experience which was formerly available to recall, it may be said that all of the ECT patients, as of approximately four weeks following the termination of treatment, exhibited clear-cut instances of retroactive amnesia.

In the case of every one of the 19 patients who received a series of electroshock treatments, there were failures to recall some of the past experiences they had been able to describe in the pre-treatment interview. Such failures occurred so infrequently among the 11 patients in the equated control group as to be almost negligible.

Before describing the evidence which supports these statements, it may be useful to point out that we are concerned solely with a sample of personal memories which each patient was capable of producing at the time of the pre-treatment interview. If at that time a patient happened to be amnesic for some events in his past life, this simply had the effect of reducing the amount of material in the sample of personal memories to be tested in the post-treatment interview.

The evidence of retroactive amnesias following ECT is documentary, rather than quantitative, in character. Failure to reproduce a personal memory is revealed by responses to probing questions which were "hand tailored" to fit the particular contents of the unreproduced material. Because of the inordinate amount of space required to give the protocols, only a few illustrative examples of post-ECT amnesias can be given in full. The following protocols from 5 patients are fairly representative of the type of amnesias found in all of the ECT patients and of the methods used in testing the patient's ability to recall the forgotten experiences:

Case A.—A 34 year old male schizophrenic (paranoid); 22 electroshocks.

Before ECT. (Q. Has there been anything in particular that happened which disturbed you?) . . . I tried to commit suicide. I thought I was losing my mind because I had a funny feeling in my head. A dull feeling all through my head. It wasn't painful but I felt I didn't care about anything because of that feeling. I tried to commit suicide because of that and because I thought I had syphilis . . . I went to my room and got a scarf and put on a sweat shirt and blue work shirt. I had a few beers and at the bar I thought I heard a fellow say, "That smell sure is syphilis." I got a pint of whiskey after leaving my room and then I took a train. I don't know where I got off the train but I had drunk a lot. Then I saw my brother at a bar at S— and I drank some beer there. Then I went to a private driveway to an old mansion up on a hill and I put the scarf over the stone and I stepped off the stone. I tried to hang myself. I don't know what happened but I came to down at a gas station about a quarter mile from that driveway. (Q. What

do you think happened?) Maybe the scarf broke. I don't remember how I got to the gas station. I accused a fellow at the gas station of taking my coat and hat—but he was right. I must have left it back where I tried to commit suicide.

FOUR WEEKS AFTER ECT: FIRST SESSION.

Q. Has there been anything in particular that happened which disturbed you?

A. I already told you all the things.

Q. Did you ever think about suicide?

A. No.

SECOND SESSION.

Q. I believe you told me something about suicide several months ago when I talked with you.

A. About suicide? I don't remember anything about suicide. I can't recall ever thinking about suicide.

Q. Have you ever been drunk?

A. Yes.

Q. Did anything special ever happen when you were drunk?

A. Nothing much ever happened.

Q. Can you remember going to the town S— once when you were drinking?

A. I don't remember.

Q. Do you remember losing any clothing when you were drunk?

A. I remember I lost some clothes but I don't remember how. I lost a top coat through drinking—my brother told me it was in S— when he was here last week—but I can't remember anything about being in S—. My brother said I lost a hat and coat there.

THIRD SESSION.

Q. When I talked with you several months ago you told me something about suicide thoughts you had before coming to the hospital.

A. I've been trying to remember that, but I can't.

Q. Do you think you might have tried to commit suicide?

A. I don't think I ever did. Did I? At Staff one of the doctors said that I tried to commit suicide but I don't think that's true.

Q. I'd like you to take a look at this list and see if one of these things applies to you: (The patient was shown the following list of 8 items, which were also read aloud to him, slowly).

A. Took a big overdose of sleeping pills in your room in P.

B. Turned on the gas in a room with the windows shut.

C. Tied a scarf over a stone and stepped off of it, on a private driveway to an old mansion.

D. Started to slash your wrists while in a bathtub.

E. Stayed in a garage and breathed the exhaust of a car with its motor on.

F. Started to jump out of the window of a high building.
G. Got hold of a gun and started to use it when at your mother's house.
H. Took a bottle of iodine to drink when at your wife's room.

A. None of them means anything to me. Did I actually do one of those things?

Q. We'll talk about that later. Right now I want you to see if any of these seem familiar.

A. None of them do.

Q. Suppose that one of them did apply to you. Take a guess which one it might be.

A. I don't know. I'll guess "H."

Case B.—A 33 year old male psychoneurotic (anxiety state) or borderline schizophrenic; 20 electroshocks.

BEFORE ECT. (Q. What circumstances led to your coming to this hospital?) I had been feeling I needed a psychiatrist for some time. I went to one about a year and a half ago. He had me write out my case history and we talked about things, but it didn't do much good. Recently I went to another one, Dr. A, and he arranged for me to come here.

FOUR WEEKS AFTER ECT: FIRST SESSION.

Q. What circumstances led to your coming to this hospital?

A. The way I was feeling at the time.

Q. Did you see a psychiatrist?

A. That's a funny thing. Last Sunday I saw my family doctor and he mentioned that he had sent me to a psychiatrist by the name of Dr. A. But I don't remember ever seeing any psychiatrist before I came to this hospital. I can't remember how I happened to come here. I'd like to be able to recall that. The Doctor was so busy last Sunday, that I didn't have time to ask him how it happened. I don't remember seeing Doctor A at all. I would like to know about it. Could you give me some information about it?

SECOND SESSION.

Q. Are you able to recall seeing a psychiatrist before you came here?

A. I must have seen Dr. A after I was turned down by the Army. I don't remember seeing him even once but I know I must have because of what my family doctor said.

Q. Can you remember anything about Dr. A?

A. No, I don't even recall what he looks like.

Q. How long ago would it be?

A. About five and one-half to six months ago.

Q. Did you see a psychiatrist about a year before that?

A. No. I never did see a psychiatrist before until the Army doctors examined me.

Q. Did you ever get any kind of psychiatric treatment?

A. No. I don't know what happened with Dr. A, but as far as I know he didn't give me any and that would be the only time I went to a psychiatrist.

Case C.—A 17 year old male schizophrenic (mixed); 20 electroshocks.

Before ECT. . . . Last year I read a book by Freud. I read about homosexuality and ever since then I was worried about it in myself. I feared becoming a sissy or a queer. I don't want to have anything to do with it. . . Now I have to fight these homosexual thoughts. . .

Q. When did you read the book by Freud?

A. Last January. I became ill one day and had to fight thoughts about wanting to have normal sex relations. It reached a peak one day and I had to go to the movies. Then I went to a friend's house and saw his book on Freud. I read it to try to analyze myself. Next morning out of a clear sky, I had these thoughts of homosexuality I had just read about.

Three and One-Half Weeks after ECT: First Session.

Q. Have you been at all concerned about sex problems?

A. I'm so confused sexually, I don't know where I am. I don't know how it started but I began to be worried I was a homo.

Q. How do you think that worry might have gotten started?

A. I don't remember and, as a matter of fact, I don't want to remember. I probably just got to thinking about it once when I was thinking about girls.

Q. Have you ever been afraid of becoming a sissy?

A. No. But I never liked to fight anyone though.

Q. When was the first time you got the idea of homosexuality?

A. I think I used to know but I can't remember now, since ECT. They made me forget everything.

Second Session.

Q. Have you ever read psychology books?

A. Yes.

Q. Which ones?

A. I don't remember.

Q. Have you ever read Freud?

A. Yes, but I don't remember anything about it. I was only interested in psychology on the side. My main interest was in chemistry and the natural sciences.

Q. Were you ever worried about anything after reading about it in Freud?

A. I can't remember anything I read about in Freud.

Q. Were you ever interested in reading Freud in order to analyze yourself?

A. I don't know.

Q. Where did you happen to get hold of Freud's book?

A. I can't remember that.

Case D.—A 28 year old male schizophrenic (paranoid); 20 electroshocks.

BEFORE ECT. (Q. What was the reason for your coming to this hospital?) After I left the Army I couldn't hold a job. I did clerical work with M—, a watch concern, for about seven months. I lost that job because my employer said that I, that I (stutters) that I didn't have my mind on the work —my attitude wasn't good. I went to the VA then and told them about my condition. I went to a psychiatrist, Dr. F, through them. (Q. For how long?) For a month. I told him about my chronic depressed condition. He said it was best to go to the hospital. So it was the VA that sent me to Bellevue and they sent me here.

FOUR WEEKS AFTER ECT: FIRST SESSION.

Q. What circumstances led to your coming to this hospital?
A. I went to Bellevue and they sent me here.
Q. Before going to Bellevue did you go any place to get help or advice?
A. I don't recall.
Q. Did you ever go to the VA?
A. I might have. But I don't think so. I don't recall because it's been some time now—several months ago, I think, and I don't remember those things. Usually a person likes to forget the past.
Q. I realize that, but I do need to get some information about it.
A. I can't remember though.
Q. Before you went to Bellevue did you ever see a psychiatrist?
A. No.
Q. Did you ever go to a doctor's office?
A. I don't recall that. I only remember going to Bellevue.
Q. How did you happen to go to Bellevue?
A. I don't recall.
Q. How did you find out about Bellevue—did someone suggest it to you?
A. I don't remember who suggested that I go to Bellevue or who sent me there.
Q. Where were you working before you came to the hospital?
A. I only had odd jobs. I forget the names of where I worked.
Q. Did you work at any one place for around six months?
A. I don't know. I worked at a watch concern. I don't know the name.
Q. How did you happen to leave the watch concern?
A. It was because I did good work. I always do good work.
Q. I don't understand. Why did you leave?
A. I don't remember.
Q. You just said something about leaving because you did good work.
A. Yes, I always did good work.
Q. What did that have to do with your leaving?
A. I was just saying that I did good work. I wasn't talking about leaving.
Q. Did you leave the watch concern because you were fired or did you quit?
A. I don't remember.

SECOND SESSION.

Q. Did you ever go to see a Dr. F?

A. You mean Dr. F? (corrects examiner's pronunciation) How do you know his name?

Q. You mentioned his name to me when I saw you several months ago.

A. Gee, that's funny. His name is familiar to me but I don't remember him. Maybe I went to him. Was he a dentist? Now that you gave me that name I can recall the name. But I can't place him. I think I may have seen him or met him but I can't remember. I really don't recall him or what he was. I don't recall if he was a dentist or a medical doctor. I think I recall going to some kind of medical man, but I don't remember what for—whether it was to have my teeth fixed or to help get a job or for this nervous condition of mine. All I know is that I went to some kind of doctor. Maybe that was the doctor, Doctor F.

Q. When do you think you might have seen him?

A. Maybe it was before I went to Bellevue, I don't know. I just can't remember what kind of a doctor I went to.

Q. What kind do you think he might have been?

A. Probably a dentist.

Case E.—A 38 year old female schizophrenic (borderline or mixed); 10 electroshocks.

BEFORE ECT. (Q. How did your illness begin?) . . . About four years ago, right after I lost my child. . . I took thyroid then which caused palpitations. I didn't know, at the time, that that caused it. I felt terrified by them. It was a real panic, as if I were on railroad tracks with a train coming. I was trying to be very brave about the death of my baby, going to work in the hospital where it died, collecting legal papers on it, and so forth, trying to be the super-woman. Then I had the palpitations; a friend told me I should get psychiatric help. I saw my family doctor and he sent for a neurologist. I spent the night at my doctor's office and then I went to the H Sanatorium for a week. I was hopeful of getting all better. They didn't feel I was really ill. After that, I began analysis.

THREE AND ONE-HALF WEEKS AFTER ECT.

Q. Did you take some medication after the loss of your child?

A. I don't remember.

Q. Thyroid?

A. I think so.

Q. What reaction did you have to it?

A. I don't know.

Q. During that period did you have any special symptom which disturbed you?

A. I felt depressed.

Q. Anything else?

A. I don't recall.

Q. Did you have palpitations?
A. I vaguely remember having palpitations now that you mention it.
Q. How did you feel about them at the time?
A. I don't recall how I felt.
Q. How did you feel at the moment when you had the palpitations?
A. Probably not too well.
Q. Did you ever go to a sanatorium?
A. Yes, I remember going to one.
Q. What was the name of it?
A. I don't recall the name.
Q. What were the circumstances that led to your going there?
A. I don't remember why I went or what happened. I remember being there, though.
Q. How long were you there?
A. I don't remember. I don't think it was for very long. I really can't reconstruct that whole period.

For each of the above examples, as well as for many other instances of post-ECT amnesia, it has been possible to authenticate the events referred to in the memory material elicited in the pre-treatment interview by using independent sources of information available in the patient's case history records.

The quoted examples serve to illustrate the way in which post-ECT amnesias are manifested but they fail to convey the extensiveness and variety of personal experiences subject to amnesia in each individual case. Every one of the 19 patients included in the study showed at least several instances of amnesia and in many cases there were from ten to twenty life experiences which the patient could not recall.*

Before ascribing the observed amnesias in ECT patients to the effects of ECT itself, it is necessary to consider the results for the equated control group, in order to check on the possibility that mental patients may develop such amnesias even when a series of electroshock treatments is not interpolated between the first and second interviews. The amount and the character of the memory material elicited in the first interviews of the control patients was comparable in every respect to that obtained from the ECT patients, as might be expected from the fact that the same standard set of questions was used.

In general, it was found that the control patients were able to reproduce practically all of the material they had given in the initial interview and they recalled it so readily that the examiner rarely needed to resort to using questions giving specific cues, so often required for the ECT patients.

*The author has available typescript copies of protocols which provide evidence of the occurrence of post-ECT amnesias for every one of the patients in the ECT group.

There was only one type of difficulty found consistently among the control patients: occasionally they reproduced inaccurately the *dates* assigned to specific events in their personal histories. Among the control patients there were practically no convincing examples of forgetting of the sort regarded as evidence of retroactive amnesias among the ECT group. Five of the 11 control patients were able to reproduce every detail of the personal memories they had given in the first interviews; 6 of the control patients each showed a single instance of a possible recall failure but these were limited to a single detail of a personal experience which was otherwise reproduced accurately. The most extreme example of a recall failure among the control patients was the following: In the first interview, when describing his boat trip to a Pacific island during the war, the patient (a 36 year old male schizophrenic, paranoid type) asserted: "I couldn't sleep at night." In the second interview, three months later, he reproduced all of the details about the trip except that he asserted that he had no difficulty resting at night on that trip.

The marked contrast between the sparse, limited recall failures found in the control group and the profound, extensive recall failures found in the ECT group leads to the conclusion that the post-treatment amnesias, observed approximately four weeks after the termination of ECT, are produced by the series of electroshock treatments.

(2) *Persistence of Post-treatment Amnesias.*—How long do the amnesias following ECT persist? Do they clear up rapidly or do they continue indefinitely? To obtain some preliminary information on this problem, a follow-up study was carried out on as many of the patients as were available. Altogether, 5 of the 19 ECT patients were re-examined, each of whom had completed ECT from two and one-half to three and one-half months before the follow-up interview. The follow-up recall tests were limited to those memories which each patient had failed to recall when tested approximately four weeks after the last treatment. The same questions were repeated as in the preceding post-treatment interview.

It was found that most of the experiences which the patients failed to recall in the original post-treatment interview were still unavailable to recall. The extensive protocol evidence on this point may be summarized briefly as follows, in terms of the number of past experiences,*

*In summarizing the material, the term "experience" is broadly defined to include any episode or event in the past history of the patient which had been described in the pretreatment interview. For present purposes it did not appear to be worth while to count a unitary chain of events, all or most of which were unavailable to recall, as more than one instance of a recall failure. Hence the number of experiences listed in the summary represents a conservative estimate of the number of personal memories for which each patient was amnesic.

described in the pre-treatment interview, which the patient was unable to recall after the treatments.

Case 1: Five weeks after ECT: Fails to recall 11 experiences. Three and one-half months after ECT: Still fails to recall 8 experiences. Partially recalls 1 and completely recalls 2.

Case 2: Four weeks after ECT: Fails to recall 12 experiences. Three and one-half months after ECT: Still fails to recall 8. Partially recalls 2 and completely recalls 2.

Case 3: Three and one-half weeks after ECT: Fails to recall 10 experiences. Two and one-half months after ECT: Still fails to recall 8. Completely recalls 2.

Case 4: Four weeks after ECT: Fails to recall 11 experiences. Two and one-half months after ECT: Still fails to recall 9. Completely recalls 2.

Case 5: Four weeks after ECT: Fails to recall 9 experiences. Three and one-half months after ECT: Still fails to recall 8. Completely recalls 1.

How long the post-ECT amnesias last is a problem for future research, but from the preliminary follow-up study it appears that most of the amnesias do not clear up within a few months after the termination of treatment. This finding reinforces the results for the four week post-treatment period in supporting the following conclusion: a series of electrically induced convulsions, as administered in standard psychiatric practice† produces retroactive amnesias which persist after the usual recovery period of several weeks during which the obvious impairments observed during the treatment period clear up.

There are three important factors which increase the weight of the evidence supporting this conclusion. First of all, the ECT group contained a wide diversity of personality types. Clinically, the group ranged from depressed patients who had never, at any time, been observed to display psychotic symptoms to schizophrenics of long standing who were excessively delusional and actively hallucinating. In terms of intellectual status, the group included at one extreme a science teacher who had been successful in graduate university studies and, at the other, an unskilled laborer who had been incapable of completing grammar school. Yet all of the patients in the group exhibited the same phenomenon of amnesia for past experiences following ECT.

†It is possible that a shorter series of treatments (fewer than 8) or different spacing (e.g., only once a week) or the use of unidirectional current in inducing the convulsions may have different effects, since such alterations in ECT technique have been alleged to cut down on the degree of temporary memory disturbance (5).

Secondly, there was a fair degree of heterogeneity with respect to additional forms of psychiatric therapy received by the ECT group during the period between the before-and-after-interviews: seven patients received fairly intensive psychotherapy, 2 received ambulatory insulin treatments and psychotherapy, 1 received 50 insulin comas, and 9 were given no special psychiatric treatment along with ECT.* Hence it appears that irrespective of the other kinds of psychiatric treatment given along with ECT, the post-ECT amnesias occurred.

The third factor is the considerable diversity among the ECT group with respect to clinical improvement status at the time of the post-treatment interview. Some of the patients showed practically no improvement after ECT while others showed a dramatic recovery from the major symptoms of their mental disorder and were able to return to their homes. Again, every one of the patients, improved and unimproved alike, exhibited amnesias following ECT. Therefore, it appears that the amnesias are attributable to exposure to the series of electrically induced convulsions, irrespective of whether or not such treatments happen to be successful in producing clinical improvement.

Thus, when account is taken of the range of personality differences among the ECT patients, of the diversity in additional psychiatric treatments received along with ECT, and of the variation in clinical improvement status, the results tend all the more strongly to bear out the hypothesis that the amnesias observed many weeks after the termination of treatment are effects of the series of electrically induced convulsions.

(3) *Characteristics of Post-treatment Amnesias.*—Despite the large number of recall failures after ECT, the amount of remembered material far exceeds in quantity the amount for which each patient was amnesic. From the post-treatment interviews it appears that after ECT the patients remembered most of the events of their past lives which they had described in the pre-treatment interview. Except for a few cases, they were even able to give a fairly complete account of the history of their mental illness, although experiences involving the onset and development of the mental disorder appeared to be much more likely to be forgotten than other types of experiences.

The amnesic gaps which occur do not seem to blot out a whole period of the patient's past. Even when a patient fails to recall a series of events which occurred within a limited time period, there does not appear to be a blanket amnesia affecting everything which happened during that period. For example, from the first protocol quoted above

*In the control group, 7 patients received fairly intensive psychotherapy and 4 patients received no special psychiatric treatment.

(Case A), it is clear that the patient was unable to remember his suicide attempt and most of the other experiences he had previously described for the period of a few months preceding his hospitalization. But he was able, nevertheless, to describe his job as a truck driver during that period, various places he went to, and the like.

The amnesias appear to be circumscribed in character. The forgotten material sometimes stands out clearly as a gap in a sequence of events which the patient is able to remember. In all cases, the amnesias are "spotty" in that the patient is able to recall some experiences which occurred some time before the forgotten event and other experiences which occurred subsequent to it.*

From the literature on the temporary "organic" reactions during the course of convulsive treatments, it appears that the original memory loss produced by ECT is an indiscriminate one, affecting the recall of a multitude of past experiences, pleasant and neutral ones as well as unpleasant and disturbing ones. In the recovery from this temporary organic impairment of memory it is possible that motivational factors play a crucial role in determining the residual amnesias which were observed many weeks after the termination of ECT. Certain qualitative aspects of the post-ECT amnesias provide some initial indication of the possible role of motivational factors in determining the occurrence of recall failures following ECT.

A wide variety of topics had been covered in the pre-treatment interviews but certain of them were more likely than others to be subject to recall failures in the post-treatment interviews. Although amnesias were observed affecting experiences which had occurred at almost any period of the patient's life, ranging back to early childhood, there appeared to be an inordinately heavy concentration of recall failures for events which had occurred during the six month period immediately preceding the pre-treatment interview. But the recent memories, in contrast to the remote ones, mainly involved the patient's pathologic symptoms and the events leading to hospitalization. As was already mentioned, experiences involving the patient's mental disorder were much more likely to be forgotten than other types of material. Among the remaining topics covered in the pre-treatment interviews, quarrels with members of the family also appeared to be disproportionately subject to amnesia.

*Perhaps the fact that the amnesias are so "spotty" and tend to affect only restricted experiences of the past, accounts for the paucity of reports on post-ECT amnesias in the clinical literature. Apparently, in contrast to the diffuse amnesias during the treatment period, the circumscribed amnesias following the recovery period are not likely to be detected unless one deliberately tests for them by examining the patient's ability to recall a fairly large sample of pre-treatment memories.

From a detailed examination of the specific content of the amnesias it seems to be fairly probable that the post-ECT recall failures are especially likely to involve experiences which tend to arouse anxiety, guilt and a lowering of self-esteem. In this respect the post-ECT amnesias do not appear to differ from other types of amnesias of both functional and organic etiology, as described by Sears (9):

"The emotions most frequently found to have constituted the amnesic reactions (or to have been intimately associated with them) are fear, guilt, shame, disgust, sorrow, and feelings of inferiority."

But not all of the material which the ECT patients failed to recall was manifestly disturbing, or even unpleasant in character. Sometimes an apparently emotionally disturbing experience was remembered whereas a related, innocuous one was forgotten. In general, there seems to be insufficient uniformity among the experiences subject to post-ECT amnesia to be able to predict in advance, from the manifest content alone, which of the patient's experiences will be forgotten after ECT.

Yet the fact that there is no obvious motive for a given amnesia does not preclude the possibility that the selectivity may be determined by some subtle motivational features of the patient's personality structure. For example, one ECT patient, a 22 year old female schizophrenic, was able to remember in the post-treatment interview almost all of the details about a panic episode during which she had been terrified by the thought that she might be sexually attacked by several young men who were driving her home from a dance hall. She failed to recall only the isolated event of 'phoning her mother for help when the car stopped at a cafe. Her inability to recall this single event, despite her ability to remember the other details about this highly charged episode, becomes much less inexplicable when one reads in the psychiatrist's report that a major defect in this patient's personality make-up is overdependence on the mother. An adequate determination of the role of motivational factors in post-ECT amnesias will probably require intensive case studies in which the experiences forgotten after ECT are studied in relation to the personality structure of the individual patients. From the present study it can only be said that so far as manifest content of the forgotten material is concerned, at least a fair proportion of the forgotten experiences are obviously painful ones which the patients might well desire to forget.

It should be mentioned in this connection that occasionally the material which was subsequently forgotten had been accompanied in the pre-treatment interview by an explicit statement to the effect that "I don't like to think about that," or "I wish I could forget that." Often

in the post-treatment interview, the patients indicated that they were not displeased about their inability to remember certain of the happenings in their past. On the other hand, many of the patients were distressed about their failure to recall past experiences and frequently made definite efforts to secure information about the events for which they were amnesic. This is well exemplified by the case of a 32 year old male (manic-depressive, depressed) who deliberately asked his psychiatrist to inform him about the history of his mental disorder and thereby learned about a suicide attempt which, nevertheless, he still could not fully recall. A number of the other patients in the present study had availed themselves of the opportunity to find out about forgotten experiences from members of their families, but, as in the case of responses to many of the recognition tests in the post-treatment interviews, the patients usually expressed little personal conviction about the occurrence of such experiences and were unable to reconstruct the details beyond what they had been told about it. At the manifest level there certainly was no general tendency to "protect" the amnesias, since the patients sometimes actively sought for cues to enable them to recall the forgotten material.

From the above discussion, it is clear that while motivational factors may play a definite role in post-ECT amnesias, the recall failures cannot be explained solely in terms of a conscious desire to avoid remembering the experiences. If the selectivity of the amnesias is determined by a "wish to forget," it is probable that the motivational factor is, at least in some instances, not a conscious one.

A few of the patients exhibited verbal behavior which suggests that the amnesias may involve an active motivated process, although apparently not at the conscious level. One case (an 18 year old schizophrenic) displayed the following peculiar behavior in the post-treatment memory interview: When asked a question about a subjective experience for which he was amnesic, "Did you ever have a dream which predicted the future?" his reply was "Yes, I think I did once." But to the next question ("What was it about?") he answered:

> I don't know why I just said 'yes.' The moment you mentioned a dream predicting the future I had the feeling that the answer was 'yes' and I thought I remembered something like that. But now that I try to think about it, it's just a blank. I realize now that the answer is 'no' because I don't actually remember that ever happening.

Perhaps the most suggestive material on the motivational aspects of the memory difficulties following ECT comes from Case B. In the first session of the post-treatment interview, this nonpsychotic patient was unable to recall the following items of information about his school his-

tory, all of which had been given promptly in the pre-treatment interview:

(1) The name of his grammar school principal. (He did recall, however, that this man had received national publicity as a witness in a famous criminal trial).
(2) The names of any of his grammar school teachers. (He had named four of them in the pre-treatment interview.)
(3) The name of a trade high school he had attended for one year.
(4) The course of study he had taken in the trade high school.
(5) The street address of the grammar school he had attended from 5th until 8th grade.

During the same session the patient's request was granted for some extra time to "work on" these items, but he still failed to recall them. The session was later broken off for half an hour while the patient had lunch. When he returned, he announced, proudly, that he had worked on a lot of facts that he couldn't recall before lunch; he then proceeded to give the correct answers for the first four of the five items. He was unable to recall the last one, however, asserting, "I forgot to work on that one, I'd need some extra time to try to get it."

During the afternoon session the question of past difficulties with his mother was raised by the examiner. In the pre-treatment interview this patient had explicitly stated that he hated his mother and he had described a number of difficulties and quarrels with her which had occurred during the past four years, including incidents of her "stealing" his mail; "borrowing $1500 and she never paid it back"; prying into his diary to read about his secret love affair and then "spreading it all over the neighborhood"; "sticking her nose into the case history" which he wrote out for his psychiatrist; etc.

The following protocol is from the afternoon session of the post-treatment interview (four weeks after completing ECT):

A. I only remember that I used to hate her. I can't remember any particular things that we fought about, though. That's one of the things the treatments made me forget and I don't want to try to remember them.

Q. Do you think that you could remember the difficulties you had with your mother if you did try to?

A. Yes, I think I might be able to. I can't think of them now and I haven't thought of them ever since ECT. I'd have to work on it—the way I did this morning on the names of my school teachers. I had to think hard for about 20 minutes to remember their names. But I don't care to do that. I'm trying to overcome the feeling I had toward my mother and I don't want to remember anything about it. I'm afraid if I start thinking about it I might remember it.

In the third post-treatment session, which took place the following day, there was some objective confirmation of the patient's feeling that if he did try to remember he would be able to:*

Q. Did you ever have any difficulty with anyone involving your mail before you came to the hospital?
A. No, not that I remember.
Q. Any difficulty involving a diary?
A. No, I remember I used to keep a diary. (pause) Yes, I did have. I remember now that my mother started to read my diary. That led to trouble. I think she spread the information around about my girl friend. I hadn't thought of that till just now, thinking about the diary.

When asked if he could now remember other difficulties with his mother, he stated, "I think if I tried hard I could remember more but I don't see any point in trying to."

A number of important points emerge from this case material, illustrating many of the major characteristics of post-ECT amnesias. First of all, the patient's initial failure to recall various items in his school history provides an extreme example of the increased effort required for recalling routine information about the past observed in almost all of the ECT patients. Secondly, it will be noted that the patient was able to overcome his difficulty in recalling the various facts about his school history by prolonged effort, by "working on" them. The one item that he did not work on (the street address of his grammar school) remained unavailable to recall.

Turning now to the memories involving difficulties with his mother, we find that he again is unable to recall the material voluntarily. But in this case he is definitely motivated *not* to work on it. Nevertheless when a specific cue is given to him ("difficulty involving a diary") a portion of the forgotten material is recovered, despite the patient's wish to maintain the amnesia. It would appear that once the appropriate symbolic cue emerges into consciousness, the memory is evoked. The many other quarrels with his mother for which the patient was amnesic apparently remained forgotten because he failed to exert the effort necessary to arrive at an effective symbolic cue.

This case material definitely implies that a patient who has received ECT is able to overcome the difficulties in recalling past experiences *provided that he has adequate motivation for doing so.* We see in this case that the set of memories which the patient wished to keep out of consciousness tended to remain forgotten, whereas another set which he was willing to work on was recovered.

*The further probing for these memories was carried out with the permission of the patient's psychiatrist.

Discussion

In the case material just presented we have seen an example of a temporary failure to recall various details about the educational history. Many such instances of what might be called "temporary amnesias" were encountered in the post-treatment interviews of ECT patients. As compared with the control group, the ECT patients required many more cues, in the form of detailed probing questions, before they were able to reproduce many of the experiences which they were capable of recalling.

It is not unlikely that the temporary recall failures are an expression of the same memory impairment observed in the instances where even the massing of memory cues failed to elicit recall. (The term "amnesia," as used throughout this study, has been limited to the latter type of recall failures.) What is being suggested here is that following ECT there are, in addition to the full-blown amnesias, many temporary, partial amnesias (inability of the patient to reproduce an experience without being given an unusually large number of memory cues) in which there is the same basic memory defect.

If we assume that the difference between the temporary and the sustained recall failures is simply one of degree, then the memory impairment observed after ECT may be regarded as a rise in the "threshold" of recall. In other words, after ECT there appears to be an extensive impairment or inhibition of recall processes, sometimes in the form of requiring more cues and more effort to bring a memory into consciousness and at other times in the form of complete failure of the memory to reach the "threshold" of recall.

Assuming that there is some generalized difficulty or inhibition in recalling past experiences (perhaps as a residual "organic" effect of the treatments), how can the occurrence of sustained circumscribed amnesias be explained? Why do some memories become available to consciousness while others do not?

One plausible explanation would be that motivational factors may play a determining role because the recall of past experiences following ECT becomes a more difficult task, requiring extra effort to overcome the memory defect. ECT patients may be able to recall most of their past experiences because they are highly motivated to expend the necessary effort in order to avoid the embarrassment and insecurity entailed by lack of knowledge about the details of one's own past life. If relatively high motivation should prove to be a necessary condition for the recall of past experiences following ECT, it would be understandable that some memories, especially those of a painful character, would not

be recalled many weeks following ECT simply because the patient lacked motivation to "work on" them. In dynamic terms, the hypothesis may be stated as follows: During the weeks that follow termination of ECT the patients may be able to recover considerably from the extensive, diffuse amnesias which occur during the period of treatment by exerting the necessary effort to regain personal memories which are not readily available to recall; they may remain amnesic, however, for certain memories which elicit anxiety, guilt, or other unpleasant affects when they are motivated, consciously or unconsciously, to avoid expending the extra effort on recalling those particular past experiences.* The observations on motivational aspects of post-ECT amnesias, which were described and illustrated in the preceding section, appear to be consistent with this hypothesis.

We turn now to the problem of the "recoverability" of the sustained amnesias. If it is true that the memory gaps found after ECT are largely determined by motivational factors, it would follow that the amnesias do not represent an irreversible organic defect. There are some observations which definitely imply that the post-treatment amnesias are not a permanent memory loss.

Many instances were observed in which spontaneous recovery of amnesic material occurred. The results of the follow-up study indicated that at least a small portion of the material for which the patients were amnesic at the time of the post-treatment interview had been recovered within the succeeding months. It has already been pointed out that spontaneous recovery from amnesias was also observed over a much shorter time span. Sometimes in one interview session a patient was unable to recall a given experience, but in the next session a day or two later—and in some cases only a few hours later—the patient was able to recall the temporarily forgotten material. Such observations tend to contradict the hypothesis that recall failures following ECT represent a permanent retention loss, if it is assumed that the temporary amnesias represent the same basic defect as the more sustained ones.

Conclusive proof of the hypothesis that post-ECT amnesias are recoverable would be provided if, in future experiments, it is found that the amnesic material is recovered when ECT patients are interviewed under hypnosis or under the influence of hypnotic drugs, such as sodium pentathol. But so far as the qualitative observations in the

*The hypothesis could be formulated in terms of a shift in the dynamic balance of competing motivations involved in normal recall functions: The additional increment of effort required for the recall of past experiences following ECT may enable the motivational factors favoring the forgetting of various disturbing memories to outweigh those favoring the remembering of them.

present study go, the view which emerges is that post-ECT amnesias involve a reversible retention loss. This is in line with clinical findings on amnesias in other clinical conditions, including traumatic head injury (3) and other syndromes of organic etiology (7).

According to Gillespie (3), inhibition of recall as a voluntary act is the factor which forms the basis for amnesias observed in the following clinical conditions: "Psychogenic conditions, e.g., hysteria; certain forms of organic reaction type, e.g., trauma to the head; Korsakow's psychosis; epilepsy." The fact that epilepsy is included in this list is especially interesting. Gillespie points out that "Retrograde amnesia may occur after epileptic attacks and may stretch back long before the time when consciousness was disturbed by the epileptic seizure itself." Perhaps the amnesias following a series of electrically induced seizures are not dissimilar to those found after a series of spontaneous convulsions in epileptics.

Summary and Conclusions

(1) Definite and consistent evidence of circumscribed amnesias was found following electric convulsive treatments. Approximately four weeks after the termination of treatments, every one of the 19 electroshock-treated patients was unable to recall some of the memories of past experiences which had been elicited in the pre-treatment interview. Such failures occurred so infrequently among the 11 control patients as to be almost negligible.

(2) In a follow-up study on 5 of the electroshock-treated patients it was found that in each case most of the instances of retroactive amnesia persisted as of two and one-half to three and one-half months after termination of the treatments. This finding bears out the preceding one in supporting the general conclusion that a series of electrically induced convulsions, as administered in standard psychiatric practice, produces circumscribed amnesias for past experiences which persist beyond the usual period of recovery during which the temporary organic reactions to the treatments clear up.

(3) In the post-treatment interviews of electroshock-treated patients it was noted that in addition to the definite retroactive amnesias there were numerous instances of recall failures which were purely temporary in that the patient subsequently was able to remember some material which he could not recall at first. If it is assumed that such temporary recall failures involve the same basic defect as the more persistent recall failures, the post-treatment amnesias may be regarded as recoverable rather than as representing a permanent retention loss.

(4) There is some evidence that following electric convulsive treat-

ments extra effort is required for overcoming the difficulty in producing personal memories, when the patient attempts to remember his past experiences. Observations on motivational aspects of the post-treatment amnesias provide some support for the hypothesis that those memories which tend to evoke guilt, lowered self-esteem, or other painful affective reactions may be less likely than others to be recalled because the patient is motivated, consciously or unconsciously, to avoid expending the added effort required for producing them. According to this hypothesis, the general difficulty in producing personal memories may facilitate the forgetting of certain (disturbing) past experiences. This might prove to be a basis for explaining the occurrence of sustained amnesic gaps following electric convulsive treatments.*

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*Additional material relevant to the post-treatment amnesias will be presented in the forthcoming articles in this series. The second article will deal with changes in performances on a word association test which may shed some light on the nature of the memory defect following ECT. The relationship between the post-treatment amnesias and the reduction of disturbing affect following ECT will be described and discussed in the third article.