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# MEMORY UNDER HYPNOSIS

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## SUMMARY

### Background:

The impact of hypnosis on memory has not been the object of much research, as hypnosis has primarily been used in therapy, not in experimental research. The purpose of this research was to determine whether hypnosis significantly affects the process of recalling.

### Material/ Methods:

Sixty persons participated in the experiment. After three individual hypnotization trials, the subjects were divided into three groups: groups I and II consisted of persons unsusceptible to hypnosis, while the members of group III were susceptible. Two kinds of memory materials were used in the experiment (10 words and 10 sentences). First, the subjects individually were presented while awake with the memory material, four times. After a week's interval, the subjects individually reproduced the memory material: in group I, while awake; in group II, in a state of relaxation; in group III, under hypnosis.

### Results:

The subjects examined under hypnosis significantly better reproduced the memory material. The difference between persons in a relaxation state and those reproducing material while awake was statistically insignificant.

### Conclusions:

These results show that hypnosis affects memory processes in two ways: first, it selectively activates certain groups of memory traces while inhibiting others; secondly, it creates favorable conditions for recalling thanks to better concentration, disregarding distorting stimuli, and greater motivation for recalling. In this case, the impact of hypnosis would be comparable to the impact of relaxation or narcoanalysis, though it could vary as to the force of its impact.

**Key words:** recalling, regression, amnesia, hypermnnesia, Posttraumatic Stress Disorder (PTSD)

## INTRODUCTION

In the first half of the 20th century, the impact of hypnosis on memory processes was the problem that evoked the greatest interest among hypnosis researchers. This included recalling, hypnotic amnesia, and learning. Within these questions, the primary focus was on memory improvement under hypnosis, called "hypnotic hypermnesia." The literature related to this problem includes over a thousand publications.

Several interesting dependencies were discovered in the course of this research, but very few experiments of this type have been carried out for several years, since hypnosis is considered primarily a method of therapy, and not a tool of experimental research. Thus it may be worthwhile to recall the previous studies in this field, and to present the results of current research carried out by the author of the present publication.

Improved memory under hypnosis, called "hypnotic hypermnesia," is defined as improved memory under the influence of hypnotic suggestion, as a result of which past events can be recalled which are not accessible to the person at a given moment. It is also related to the removal of post-traumatic and after-drug amnesias (Łopacka-Sęczyk & Machaj, 2007:54).

There are two different methods of obtaining hypnotic hypermnesia:

1. suggesting the ease of recalling under hypnosis.
2. suggesting "regression" under hypnosis, i.e. looking back upon past events, experiences and forms of behavior.

In the former case, the research deals with two different experimental situations:

1. recalling facts remembered independently of tests under hypnosis, such as the first and last names of colleagues from primary school, the day of the week of birthdays celebrated many years ago.
2. recalling material learned in a waking state, especially for further tests under hypnosis.

Various types of memory materials are used in the latter case, such as lists of meaningless syllables, series of numbers, sequences of playing cards, texts, and melodies. In this case, the experimental procedure is as follows: First, the memory material is exposed in a waking state. After this part of the experiment, an interval follows, from several minutes to 10 weeks or longer. Subsequently, the examined subjects are divided into two groups. In the first group, they reproduce the material in a waking state, while in the other, under hypnosis. The difference in the results is thus the effect of hypnosis.

The history of research on the impact of hypnosis on memory processes began in 1930, when Huse carried out the first scientific experiment in this field. He presented the examined subjects with a list of nonsense words. After a 24-hour break, recalling took place under hypnosis. Huse (1930) did not obtain improved results for the subjects examined under hypnosis.

On the other hand, the research performed by Stalnaker and Riddles in 1932 gave a positive result. They examined 12 persons who recalled a text learned in a waking state the previous year. The suggestion that the recalling would be easy for the subjects under hypnosis resulted in reproduction improving by 53.7% in relation to the results achieved while awake. On the basis of these results, Hull (1933) claimed that the impact of suggestion strengthened by hypnosis weakens the force of retroactive inhibition (the impact of later acquired experiences on the level of recalling earlier content).

In subsequent years, several experiments related to the issue under discussion were carried out. It was found that numerous factors affect the value of the hypermnnesia, including the language abilities of the examined person (cf. Pachalska et al., 2010). Moreover, the experiments showed that in order to achieve hypermnnesia, it is indispensable to evoke a profound hypnotic trance. The conclusion that the value of hypermnnesia increases with the increase in the length of the interval between memorizing and recalling is also well attested. A 24-hour interval is the shortest span of time for the impact of hypnosis to be noticeable. It is also generally accepted that the value of hypermnnesia increases with the recalling of events that in the past evoked emotions or were related to them (Augustynek 1996).

The impact of several other factors upon recall under hypnosis remains unknown, or at least controversial. Young (1940), for example, claims that hypnotic hypermnnesia does not result from the impact of hypnosis, but rather from the optimization of conditions favorable for recall during the test. The creation of identical conditions for recalling under hypnosis and during a waking state leads to the quantitative equalization of the reproduced material.

Hypnotic regression became also the subject of numerous studies. They started with experiments using intelligence tests. Their experimental design was similar to that of the majority of authors. The subjects were divided into two groups. The subjects from one of the groups were hypnotised, while the others were not. Next, it was suggested to all subjects that they were 5 years old. Intelligence tests were used to assess which group behaved in the way characteristic of the suggested age.

Platonov (1933) and several other researchers found that the results obtained under hypnosis corresponded to the suggested age. Those subjects who played the role of children while awake did it far worse.

In 1949, Watkins suggested to his hypnotized students a regression to age 6, and ordered them to read a certain text once aloud, and for the second time silently. The subjects had difficulty with the spelling of individual words. The students in the control group, whose task consisted in playing the role of a 6-year-old child while awake, behaved in a similar way. However, the subjects' eyeball movements, filmed while they were reading, revealed an interesting fact. In the case of the controls, these movements were normally coordinated with the lines of text, while the hypnotized subjects manifested a reduced degree of coordination. In accordance with Hering's law (Katzenstein 1971), postulating the perma-

ment coordination of the eyeballs when reading in persons who have mastered this skill, such a result is impossible to achieve through simulation. On the other hand, in the initial stages of learning to read, such a phenomenon is typical.

In 1948, Wolberg carried out a similar study using regression to the 10th, 7th and 4th years of age. Each time he asked what the day of the week was on Christmas Day, the name-day and birthday of the examined person. At the level of the suggested age of 10, 92% of responses were correct, 82% showed regression to the age of 7, and 68% at the level of 4 years of age. The results from the four-year olds surprised Wolberg himself, since the comparative tests proved that the majority of children at this age do not yet know the names of the days of the week.

Barber (1976), when analyzing the course of Wolberg's experiment, came to the conclusion that it was first of all the experimenter who knew the correct answers to the questions he had posed. The questions were formulated in the following way: "Was it Sunday, or was it Monday?" and so on. The subjects were instructed say "yes" or "no." In this situation the sound of the hypnotizer's voice and its modulation while asking the questions might have prompted the correct answers to those examined.

One cannot also exclude the possibility that the subjects arrived at the correct answer by the rule taught in English schools that the days of the week move back one day each year, and two days in leap years.

In 1948, Girdo and Bowersbuch conducted an experiment in which regression to 4 months of age was suggested to six adult men in the course of their hypnotic sleep. Three of them had Babinski's reflex typical of the suggested age. Light rubbing of the sole of the foot of a healthy adult causes the big toe to go down. In infants up to 6 months of age, the big toe goes up, and the remaining toes straighten out. When the reaction typical of infants occurs in an adult, it usually indicates serious damage to the central nervous system.

The results obtained by Girdo and Bowersbuch (1948) can, however, be questioned. As early as 1921, Burr stated that the occurrence of Babinski's reflex in adults is always diagnostic for damage to the central nervous system, whereas in examining children we obtain such wide deviations in the reflex that it cannot be diagnostic. For example, out of 389 children examined, the "textbook" reflex occurred only in 13.

Barber (1976) claims that the subjects of the discussed experiment, being informed of its objective, could spontaneously simulate the reaction expected by the experimenter. In addition, the actual assessment of the response was highly subjective.

On the other hand, American researchers, Reiff and Scherer (1959), believe that hypnotic regression, constituting a form of recall, leads to the activation of memory traces that have not been "updated" for a long time. Therefore, in the course of hypnotic regression certain events can be recalled that are not available in a waking state. In their opinion, it is impossible to answer the question whether in this case it is only the past events that are imagined, or whether they are subjectively re-experienced. Reiff and Scherer (1959) attempted to solve this problem

experimentally. In their first experiment, the so called "lollipop" test, they suggested to those examined: "Play in the sandbox." Next, the experimenter gave a lollipop to be eaten by the participant. In regression to the 4th year of age, 80% of the hypnotized subjects ate the lollipop without hesitation, and in the group of people who were merely playing the role of four-year-old children – only 20%. The others wanted to wash their hands first. In a test with actual four-year-old children playing in the sandbox, all the children ate the lollipop.

In their subsequent experiments, Reiff and Scherer suggested to the subjects a regression to the 4th and 7th years of age. They asked the subjects to read out the time on the clock, indicate which side was left and right, perform simple arithmetical calculations, give the word coming to their minds after a word uttered by the experimenter (free associations test), recall which day of the week their name-day fell on in a given year, and give the last names of their classmates from kindergarten and school.

In all of these tests Reiff and Scherer (1959) obtained significant differences, characterised by certain regularities. If in hypnotic regression there occurred differences in the behavior of the subjects in comparison to the level typical of the suggested age, the person tested had a tendency to perform the tasks below the level for a given age. On the other hand, a person consciously playing the role of a child had a tendency to perform the tasks above this level.

One of the most interesting experiments in hypnotic regression was carried out in a psychiatric clinic in Jena by Katzenstein (1971). He studied the eyeball movements, writing and drawings of 2 hypnotized women and 3 hypnotized men. The test consisted of the following stages:

1. Examining eye movements in a normal waking state.
2. Hypnotising the subjects.
3. Suggesting regression to the ages of 8 years, 1 year, 6 months, and finally to the second day of life.

Katzenstein (1971) found that both in the waking state as well as under hypnosis the suggestion that "Your eyes begin to move independently of one another" had no impact on the eye movements of the examined. On the other hand, when regression to the 2nd day of life was suggested, the subject's eyeballs began to perform uncoordinated slow movements, very similar to the movement of a new-born's eyes.

Also, analysis of the handwriting and drawings of the subjects showed features characteristic of the suggested age. In discussing his experiment, Katzenstein (1971) attempted to answer the question as to what the regression mechanism consists of, and why the suggestion itself given under hypnosis without the use of regression cannot be realized when it relates to Babinski's reflex, uncoordinated eyeball movements, etc. Katzenstein (1971) claims that the suggested regression activates the memory traces acquired from birth until the suggested age. At the same time, the extension of cortical inhibition processes, those characteristic of hypnosis, blocks the possibility of updating the groups of memory traces that are not activated by suggestion (i.e. in this case those acquired in a later period). Thus the conditions for the renewal of particular functions at the level typical

of the suggested age are created. The speech, thinking, and intelligence of the examined person become characteristic of the suggested age.

However, several authors express a different opinion. They did not obtain analogous results in their own experiments. Barber (1976) claims that hypnotic regression constitutes merely a simulated behavior that – in the opinion of the hypnotized person – is typical of the suggested age. Owing to their imagination, fantasy, or even hallucinations (easy to evoke in the course of hypnotic sleep) and a knowledge of the behavior of children, the subject more or less successfully plays out the role of a child. With the same effect, it can be suggested to the subject that, for example, at the age of 24, he is 4 or 70.

In Fellows's opinion (1998:62), however, though he generally agrees with Barber (1976), it cannot be claimed that all the hypnotic behavior of the examined person is deliberately simulated, but rather that such a person accepts the suggested events as if they were real.

Erickson and Kubie (1941), in searching for the cause of divergence in these opinions, came to the conclusion that there are two kinds of hypnotic regression that can be obtained. The first type consists in the apparent regression. The examined person recalls past events, talking about them or trying to play them out. The second type consists in actual regression. The examined subjectively experiences past events as if they were new, and his behavior is not affected by experiences acquired later. However, a question arises in this context. Should the regression to the infant age not be equivalent to losing contact with the hypnotized person? In the suggested age, the subject did not understand speech, and thus cannot respond to the suggestions. Yet, the hypnotized person in regression adequately understands and performs the hypnotizer's commands.

The following case may constitute a good example of regression, both actual and apparent. During a demonstration of hypnosis for groups of doctors, a 45-year-old man was subjected to examination. After he was introduced into deep trance, he was progressively moved back until the period when he was three years old. As a result of the experiment, the subject began to gasp spasmodically, breathing violently, coughing and suffocating. His face and neck became intensely red. He manifested signs of great anxiety. It was obvious to all that he was having an asthma attack. One of the doctors examined him quickly with a stethoscope, and informed those present of an accelerated heart rate. No extensive tests were performed because the subject was genuinely suffering, and so he was awoken quickly. Immediately the asthma attack went away. After consultation, it appeared that in childhood the man had suffered from asthma. His mother remembered that when he was three years old, he had had a severe attack. Of course, the accuracy of her memory in relation to an event which took place 42 years before could not be checked.

A few weeks later, the man was again subjected to a test repeating the previous episode. The experiment was conducted with his consent. A physician was also present to observe the situation. The asthma attack repeated itself, but its course was far less violent. The stethoscope indicated neither rales nor significant

acceleration of the heart rate, and the patient's face was only slightly reddened. It was concluded that this time the attack was simulated, and the examined said later that he felt a clear objection to executing the regression command to the level of three years of age (Augustynek, 1996).

Similarly to post-hypnotic amnesia, regression may also occur spontaneously. Psychoanalysts have been especially interested in such cases, as they fit into their hypnosis theories. What follows is an example from the work of Chertok (1989).

The patient subjected to hypnoanalysis was a 34-old-man, an alcoholic. Already during the first hypnosis, the patient started weeping hard and showed other signs of deep emotion. The investigator tried to console him, but the patient was crying ever more desperately. When asked why he was crying, he answered with despair, using childish words and tone of voice: "Mommy has been mean to me." "How old are you?," the hypnotizer asked. "I am 5 years old," was the answer, "and today is my birthday." Asked again why he was crying, he replied that his father had given him a birthday present: a little goat, which he had wanted more than anything. But his mother did not allow him to bring the goat home, "... because it stinks. She says I can't keep it. She is mean."

The suggestion of regression was used therapeutically. This is justified in view of the theory stating that a person suffering from neurosis can be healed by recalling and becoming aware of the blurred or traumatic memories from their past, when the actual causes of the condition occurred. Only in this way, in some cases, can the emotions associated with stressful moments be unblocked and relieved. The significance of the impact of posttraumatic stress disorder – PTSD - on recalling process, particularly for proactive functions, was demonstrated by Ammar et al. (2006), as well as by Paçhalska et al. (2006).

Raginsky (1951), a Canadian psychiatrist, published an article on the causes of an airplane crash. The pilot of the aircraft which had crashed asked the doctor to help him recover his memory of the events which had led to the crash. The treatment to which he had been subjected for two years had not given any results. The patient could not remember anything that had happened just before the crash of the aircraft. The commission analyzing the causes of the accident concluded that the accident had resulted from pilot error. However, it was impossible to determine the exact nature of the error. The aircraft was damaged, and the pilot was in hospital with a head injury and could not remember anything about the accident. Extremely depressed by the situation, he insisted on a further investigation that would help him realize the type of errors he had made. Subjected to hypnosis, he described thoroughly his activities before the crash. The flight had been carried out in the clouds, without ground visibility. The pilot had severe difficulties using the new model altimeter, which he had not used previously. He made an error in operating it, and this led to an error in altitude assessment: the aircraft descended too rapidly, and eventually knocked against a high building during the landing approach.

Wolberg (1975) describes the following case. A female patient suffered from torticollis. This condition had continued for two years, being resistant to both phar-

macological and psychotherapeutic treatment. When after having been put into a trance she was asked about the cause of her condition, she described excitedly her previous incarnation, in which she had been a member of the royal family. She had been hanged by a rebellious mob at a public square. Having presented this story, she woke up from the hypnotic dream with a straight neck. The psychotherapist did not question her story. Instead, he treated her account as if it were a dream filled with meaningful symbols, revealing her repressed daydreams and fears. In the course of subsequent therapy, without the use of hypnosis, she declared that in her early childhood her elder sister tormented her, often hitting her over the neck. For many years she had not thought about it. She had a fiancé. She invited her sister to the engagement evening. During that evening, she caught her sister with her fiancé in bed. After a while, she had a torticollis attack.

Hypnosis is also applied in criminology. The significant impact of hypnosis upon recalling repressed traumatic contents (related to an experienced robbery or surgical intervention with local anesthesia) has been observed in practice (Lubke et al. 1999).

In support of this position, a case may be quoted from the practice of the author of the present paper (Augustynek 1996). Mr Z.M. had been severely beaten by perpetrators who remained unknown at the time. He had suffered numerous injuries. As a result, a fracture of the skull base occurred, as well as subarachnoid bleeding and cerebral contusions. He survived owing to the open fracture of the temporal bone, which perforated the meninges, creating a fistula around the ear through which blood could come out without damaging the brain. The victim had an electrical cable tightened round his neck.

He had been found by his brother and transported to hospital. His condition was critical. For twenty days he remained unconscious. The intensive therapy applied saved him from death. After recovering consciousness, he did not remember anything of the critical event. In addition, total amnesia embraced the period of three weeks before the assault. There was no circumstantial evidence pointing to the offenders, and the stolen collection of coins, which constituted a certain collectable value, was not found, either. In this situation, I was asked to try to overcome Z.M.'s amnesia under hypnosis. He showed no symptoms of consciousness changes, nor did he manifest any disorders in orientation. He willingly consented to the test and actively participated in it.

In the course of further research I found that Z.M. had intact memorizing functions, understanding, and logical thinking. Only the memory of the three weeks preceding the event was subject to total amnesia. From the viewpoint of memory functioning, the post-traumatic amnesia relating to the injuries analogous to the injury suffered by Z.M. normally covers a period from a few to no more than several minutes. A longer amnesia indicates the emotional nature of disorders. In this situation, I considered it reasonable to make an attempt at arriving, under hypnosis, at the memory of the events that occurred in the period prior to the robbery.

I applied a standard hypnosis technique. The physiological responses and behavior of Z.M. indicated that he was deeply hypnotized. Then I proceeded to the



main part of the test. I was well prepared for it. Earlier, in conversation with the patient's father, I had obtained information about certain episodes from his son's life in the days preceding the assault. Under hypnosis, using regression to the past period, I suggested to him that he was experiencing the situation of those days again. I described to him the situations which he could not recall. Then I suggested that the curtain of oblivion was drawing open, and that he would be able to recall easily what he had been doing on the critical day. Under hypnosis, Z.M. said that on that day he had returned home around noon. There was nobody at home. His parents were at work, his brother at school. The phone rang. He picked up the receiver. His aunt was calling (this was later confirmed, but at that time this fact was still unknown). After a few minutes someone rang at the door. He opened the door and saw his school classmate, S.M., accompanied by a boy unknown to him (after waking up, Z.M. gave his exact description). S. M. asked him whether his brother was in. Z.M. replied that he was out, at school. S.M. asked him whether they could come in for a while. Z.M. let them in. After a few minutes of commonplace conversation, they asked Z.M. to show them his collection of coins. After looking through the coins, the other boy asked if he could buy them. Z.M. refused to sell the coins, since he was a collector. Z.M. did not remember any further details of the event. Before leading Z.M. out of hypnosis I suggested to him that the recall would be of a lasting nature.

The reliability of the test result was confirmed by the fact that the patient did not recall the details of the assault. He could not remember them because - as numerous studies have proven - the last few minutes preceding the brain trauma are embraced by amnesia. This results from the fact that the consolidation process of memory traces, usually lasting for a few minutes, becomes disrupted. The examined person does not know anything about it, of course. And a certain period of time must have passed from the above described conversation to the robbery. This proves that he did not just imagine or make up the event, but that he was actually recalling it. After the test, he gave official testimony. It constituted the basis for a guilty verdict.

The current knowledge of hypnosis and memory does not allow for a definite answer to the question concerning the mechanism of hypermnesia and hypnotic regression. However, the results of research show that hypnosis affects the memory processes in two ways. First, it selectively activates certain groups of memory traces, while inhibiting other groups. Secondly, conditions favorable for recall are created under hypnosis, thanks to better concentration, non-susceptibility to distraction, the absence of thoughts unrelated to the task, and, finally, a greater motivation to recall. In this case, the impact of hypnosis would be analogous to the impact of relaxation or narcoanalysis, though it could vary as to the force of its impact (see also Brown and Pachalska 2003).

Geiselman (1987) reviewed 38 experiments devoted to recalling under hypnosis, carried out by various authors. In conclusion he stated that in 21 experiments an improvement in recall was obtained, while in 17 experiments no differences were observed in the results between the experimental and control

groups. The type of material influenced this dependency. Hypermnnesia was greater in the case of natural material (film, text) in comparison with artificial material (e.g. senseless syllables). The length of the gap between remembering and reproducing also affected the process significantly. With a short gap (below 24 hours) no variations in the results were obtained in 9 out of 12 experiments. On the other hand, hypermnnesia reaches its maximum value after an interval lasting from a few days to a few weeks. Geiselman (1987) claims that when the right methodological principles are observed, hypnosis leads to substantial improvement at the recall level. This conclusion was formulated on the basis of statistical analysis of the compared results (regression equation).

An interesting issue to discuss is how hypnosis improves recall.

One of the first who undertook to examine this issue was Hull (1933). He claimed that the impact of suggestion strengthened by hypnosis reduces the competitiveness of various memory traces within the process of recalling. Accordingly, hypnosis reduces the power of retroactive inhibition. Blum (1961), in turn, claims that under normal conditions, the activation of a certain complex of engrams may not occur. Under specific conditions of hypnosis, a strong incentive, such as hypnotic suggestion, facilitates the activation of these engrams. The effectiveness of suggestion depends on the richness of the links between a given complex of engrams and others. These links result from the subject's prior actions. Therefore, the more that which we perceive is included in our actions, the easier the activation of engrams in a different situational context, for instance during hypnosis. The role of acts may be replaced by an emotional reaction, evoked by that which we remember. In that case, the complexes of engrams connected with the experienced emotion are activated. In Blum's opinion, this phenomenon constitutes the basis of many psychotherapeutic techniques.

Katzenstein (1971) claims that hypermnnesia arises through the activation of relevant memory traces. At the same time, generalized cortical inhibition blocks the activity of other traces, thus reducing their competitiveness.

Yet another position is represented by those authors who claim that hypermnnesia is the result of the optimization of the conditions for recalling. An effect analogous to the hypnotic one can be achieved, in their opinion, through an appropriate modification of the experimental situation. Young (1940) represents the view that applying the same procedure to persons not liable to hypnosis will give the same effect as in hypnosis.

Zelveder (1971) approached the problem from yet another angle, claiming that hypnotic hypermnnesia is not the effect of the activation of a greater amount of engrams, but of a better organization of the recalling process. This is made possible by the constellation of factors facilitating recall that occur under hypnosis. These include the increasing concentration of attention on recall, cutting off from interfering incentives, mental relaxation, and increased motivation. The creation of similar recall conditions, but without the use of hypnosis, will give the same effect in terms of hypermnnesia.

An attempt to reveal the actual mechanisms underlying the neurological mechanisms of hypnosis was undertaken in 2010 by Aleksandrowicz and his team. The objective of the study was to illustrate – using fMRI - the functions of the central nervous system during hypnosis, and to confirm the observation that the subjective reduction of pain sensations under analgesic suggestion is accompanied by functional changes at the neurophysiological level.

14 volunteers took part in the experiment: 7 women and 7 men. Their brains were scanned at rest, and four times in the course of using pain incentives (pricking the right hand):

- in unmodified output conditions
- following analgesic suggestion
- during hypnosis induction
- following analgesic suggestion in hypnosis.

It was concluded that analgesic suggestion given under hypnosis evokes changes of activity in the areas related to pain reception, particularly in the thalamus on the left. The impact of suggestion (and - more specifically – the reception of its content) is associated with increased activity, particularly in the front part of the right cingulate gyrus (R-ACG). Hypnosis induction is correlated with increased activity in the fronto-orbital area, especially in the left hemisphere. The concentration of attention is connected with increased activity in the lower parietal lobe, in the area of angular, upper, and central occipital gyri bilaterally, in the fronto-orbital ganglia, and the point of contact of the insula with the frontal operculum in the left hemisphere (Aleksandrowicz et. al., 2010).

This research trend offers favorable conditions for breakthrough discoveries related to understanding the mechanisms of hypnosis. The author of this paper, in accordance with his own professional competence, has undertaken psychological research into selected issues concerning memory under hypnosis.

So far, the history of research into memory processes under hypnosis has not given unambiguous results. There are still essential discrepancies in this respect. The research presented in this paper has been undertaken in order to contribute – at least in part – to the clarification of these issues. The objective was to determine whether or not hypnosis significantly affects the recall of memory material acquired while awake.

## **MATERIAL AND METHOD**

The subjects for the experiment under discussion were first-, second- and third-year students attending my seminar on suggestion and hypnosis in psychotherapy and research. Sixty subjects, beside their participation in classes, could take part – on a voluntary basis – in a test on susceptibility to hypnosis. In the course of the test, the participants in of the experiment each underwent three attempts at hypnotization, and their susceptibility to hypnosis was established according to the Hypnosis scale (Augustynek, 1996). Based on these results, the subjects were divided into three groups of twenty persons each. Groups I and II

consisted of persons unsusceptible to hypnosis, while group III included persons susceptible to hypnosis.

The course of the experiment was as follows:

First, each of the examined persons participated individually in the presentation of material to be memorized, in the form of a tape recording, identical for all participants. After each of four successive exposures, the subjects reproduced the material in a waking state. This was tape-recorded.

After a week's interval, at the same hour and in the same room with identical equipment, the examined individually reproduced the memorized material.

In group I, directly after the entry of the subjects entered the laboratory, I asked them to reproduce two memorized materials.

In group II, total relaxation was suggested to the subject, who was then asked to play the role of a person deeply hypnotized (these students had sufficient knowledge to play this role). Afterwards, I requested the examined person to reproduce both memory materials.

In group III, those examined were first subjected to hypnosis induction. Next, it was suggested to them that time had moved back a week, that they were again in the laboratory and could hear very clearly the displayed material, and that they were able to reproduce it accurately without effort. After the subjects reproduced the first material, my procedure with the other material was analogous.

Two memory materials were used in the experiment. Both were verbal and meaningful. The exclusion of irrelevant materials (such as paralogues) is justified by the results of previous studies which clearly show that the scale of hypnotic hypermnnesia is the greatest for verbal and meaningful materials (Augustynek, 1996). Erdelyi (1998) expresses a similar opinion. He claims that hypnotic hypermnnesia is the greater the more the memory material is sensible and organized for the subject (e.g. poetry, scientific texts representing a field familiar to a given person, images evoking emotions).

The first material was short and easy to remember. It consisted of the following ten words: bag, pot, vase, room, life, morning, rival, pin, cork, banana. The Polish words corresponding to these had the same number of letters as well as the same pattern of succession of consonants and vowels. The second material was longer and more difficult to remember. It consisted of ten similarly constructed sentences:

1. The cat is a predator.
2. Beavers live in an aquatic environment.
3. Squirrels feed mainly on nuts.
4. Swimming requires the performance of appropriate movements.
5. Numerous organisms lead a sedentary life.
6. Fish often change their location.
7. The shapes of bird nests are not incidental.
8. Migratory birds fly in organized arrays.
9. Systems integration determines proper functioning.
10. The mechanisms of instinct are not yet understood.

On the basis of a tape recording, alongside the assessment of the accuracy of the reproduced memory materials, the time devoted to recalling was measured in each case. For the evaluation of recall, a three-scale assessment was applied. A score of "1" indicated the full and correct reproduction of the memory material (words or sentences); a score of "2" was given for incomplete or distorted reproduction; and a score of "3" was given if nothing was recalled.

In analyzing the empirical material, the level of the best reproduced material immediately after the exposure was compared to recall of the same material after a week's interval. Taking into consideration the fact that the best recall prior to the interval was not always the reproduction after the fourth exposure (for example, it could be better after the third), the best reproduction was selected: the one that could have been better, the same or worse than the one performed after the interval. If such a reproduction was better, it was marked with the score of "1"; if the same, with the score "0"; and if worse, with the score "-1". Then, the recall results for the 10 words or sentences were summed up for each subject. The arithmetical mean for particular persons and groups was derived from this data. The means were juxtaposed and the level of differences between them was assessed. In the course of the further processing of the results, the following parameters were calculated:

- the number of sentences and words correctly reproduced after the interval in each group;
- the number of better reproductions in comparison with the best reproductions of the same memory material element directly after the exposure.

The times of reproductions were also compared, and the correlation between the degree of hypnotization and the time of reproduction of both materials was calculated.

In the development of the collected material, several statistical methods were used. Their selection was based on the concepts of Brzeziński and Stachowski (1984). For the calculation of the average of individual results, the arithmetic mean was applied. To determine the strength of the relationship between the examined variables, Pearson's correlation coefficient was calculated from primary data. However, in order to answer the question as to whether there are significant differences between the results of groups or individual tests, variance analysis was applied using the Fischer-Snedecor F test. By applying this test, the coefficient of regression (trend) equations was obtained. In the text, alongside the F test values, the level of its significance was read from the tables (Brzezinski & Stachowski, 1984, pp. 409-415, table C). This analysis makes it possible to state whether there occur any statistically significant differences in the tested collection of results. Where such differences were found, subsequently there was an examination into which groups or tests they occurred among. Duncan's test was used for this purpose, calculated on the basis of the algorithm presented by Platt (1977, pp. 243-245). The results obtained by Duncan's test determined which groups or tests showed statistically significant differences at the significance level of 0.05. This conclusion was formulated by comparing the value of Duncan's test

calculated from empirical data with its critical value read from the tables (Platt, 1977, p. 344-345, table XIa).

## RESULTS

When starting to analyze the results, it was crucial to determine whether or not there had occurred significant differences in the results between the groups in the level of reproduction immediately after the exposure. Such a difference would indicate an intentional (not random) selection of subjects for each group. In this case, further analysis of this material would be groundless. To resolve this problem, the groups were compared in terms of the number of words and sentences correctly reproduced in the best reproduction immediately after the exposition (see Table 1).

For words, the value of the F test was 1.3 ( $\alpha = 0.26$ ). The value of the F test for sentences was 1.7 ( $\alpha = 0.20$ ). The differences between the groups were thus non-significant, and therefore Duncan's test was not used. In this situation, it was possible to analyze the results obtained in recall after the interval. First, the number of words and sentences correctly reproduced after a week's interval was compared (see Table 2).

The value of the F test computed for the words was 4.4 ( $\alpha = 0.01$ ), while for the sentences  $F = 6.1$  ( $\alpha = 0.001$ ). This result shows that significant differences between the groups occurred in the test. This fact justifies the application of Duncan's test, which showed that in the case of words, the differences between groups 1 and 3, and between groups 2 and 3, were significant. As regards the sentences, all differences between the groups were significant.

The results of the discussed experiment allow for comment on yet another question. If Pavlov (1926) and his followers, Kuba and Margolin (1940), and Platonov (1959) were right that hypnosis is characterized by the extension of cor-

Table 1. Number of correct reproductions of memory materials before the interval in each group

Group	Number of correct reproductions before the interval	
	words	sentences
I	167	114
II	169	116
III	175	125

Table 2. Number of correct reproductions of memory materials after the interval in each group

Group	Number of correct reproductions after the interval	
	words	sentences
I	89	54
II	88	73
III	126	96

Table 3. Reproduction time of memory materials after the interval in each group

Group	Number of correct reproductions after the interval	
	words	sentences
I	12.0	34.8
II	13.45	39.65
III	17.65	65.00

tical inhibition, a slower performance of activities under hypnosis would be expected when compared to the waking or relaxation states. Table 3 presents the reproduction times of both memory materials in each group.

For the time of sentence reproductions, the value of the F test was 14.47 ( $\alpha = 0.002$ ), while for words  $F = 8.51$  ( $\alpha = 0.006$ ). Duncan's test defined as significant the differences between groups 1 and 3, as well as 2 and 3, for both materials. Thus both materials took significantly longer to reproduce under hypnosis than in the waking or relaxation states.

The correlation between the degree of hypnotization degree and the time of word and sentence reproduction was also calculated. For words,  $r = 0.11$ , and for sentences,  $r = -0.22$ . These correlations are too weak and do not allow one to conclude that there is a significant relationship between the test variables. In this case, only a certain tendency occurred to extend the reproduction time of memory materials under hypnosis. This result can indicate that hypnosis is characterized by lower activity of the cerebral cortex, due to the extension of cortical inhibition processes.

## CONCLUSIONS

The subjects examined under hypnosis remembered best the memory material learned during a waking state. The difference between them and other subjects is statistically significant. On the other hand, the difference between the subjects simulating hypnosis and the ones reproducing material in the normal waking state was insignificant, although there was a slight tendency towards better performance by the subjects simulating hypnosis. These dependencies apply to both materials. However, an answer to the question as to what the mechanism of hypermnesia actually is can be obtained only through further research.

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