The Role of Frontal Lobes in Hypnotizability And Episodic Memory

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ABSTRACT

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The results of recent neurophysiological studies support a strong involvement of frontal lobes in hypnotizability and episodic memory (Crawford et al., 1998; Gruzelier; 1998; Tulving & Lepage, 2000). The present study investigated the relation between individual differences in frontal tasks' performance and episodic memory as well as hypnotizability. In experiment I, ninety subjects were assessed on a variety of frontal and non-frontal tasks. Frontal lobe processing was measured using a battery of neuropsychological tasks: the Stroop, the Wisconsin Card Sorting Test (WCST), the Target Detection Test (D2), the Trail Making Tests, the FAS Verbal Fluency Test, the Self-Ordered Pointing Test (SOPT) and the Continuous Performance Test. Episodic memory performance was measured using a Remember/Know (R/K) paradigm following the presentation of a study list under full and divided attention conditions. Hypnotizability correlated positively with frontal tests (WCST, Stroop, and SOPT). Highly hypnotizable subjects displayed faster processing across several frontal tasks. Hypnotizability was also related to a higher number of remember responses on a recognition task using the R/K paradigm, and to greater vulnerability to memory distortions in a divided attention condition. Ten High Hypnotizable (HH) and 10 Low Hypnotizable (LH) subjects selected from the same sample were asked to participate in a second experiment. Episodic memories formulated in response to cue-words in and out of hypnosis were rated for cognitive effort and content. Results did not support an effect

of increased cognitive effort and response time due to the weakening of the executive system in hypnosis as predicted by the Dissociated-Control Theory of hypnosis (Woody & Bowers, 1994). Low and High hypnotizable subjects formulated equally vivid memories however, HH included more self-reference statements in their episodic memories. The results of both studies suggested that the phenomenological experience of hypnosis is goal-directed and that responsiveness and non-volition may be better explained in terms of experiences of autonoetic consciousness and executive control, rather than the activation of automatic responses resulting from a weakening of executive functions.

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I dedicate this thesis to my sons, Oliver and Nikola, hoping that my achievement will encourage them to follow their own passion, and work towards goals that are meaningful to them. Hypnosis is a very complex and intriguing phenomenon. Its complexity has motivated researchers to explore many domains of psychology and as a result new and improved theories are evolving. Perhaps what is mostly exciting about hypnosis is the challenge of explaining unusual phenomenological experiences. I believe that researchers are entering a new area that is taking them one step further in their attempt to study at least one aspect of consciousness.

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The underlying nature of individual differences in hypnotic susceptibility has fascinated researchers for over one hundred years. Although the vast majority of people are able to experience some suggestions, a small percentage of the general population is either very resistant or highly susceptible to hypnotic suggestions (Laurence & Perry, 1982; Shor & Orne, 1963). Contemporary advance in technology and neuroimaging techniques has permitted researchers to examine the physiological aspect of mental processes involved in hypnosis and episodic memory. This new approach has led to further theoretical development of hypnosis and memory, as well as a better understanding of individual differences in subjective experiences. The results of recent neuropsychophysiological studies in the domain of hypnosis and episodic memory have pointed towards a common involvement of frontal lobes (Crawford, Knebel & Vendemia, 1998; Gruzelier; 1998; Tulving & Lepage, 2000). Findings from other studies using various neuropsychological measures have also suggested that hypnotizable subjects tended to perform better on frontal tasks at baseline (Crawford & Gruzelier, 1992; Crawford, 1998; Ray, Blai, Aikins, Coayle & Bjick, 1998). The possibility that pre-existing cognitive differences at the level of frontal lobes may predispose subjects to hypnosis has never gained empirical ground mainly due to the fact that such studies have been conducted using very small samples of subjects at both extremes of the continuum of hypnotic responsiveness. Therefore, the role of frontal lobes in hypnosis and episodic memory experiences has never been investigated.

Over the last hundred years, attempts to explain hypnotizability have instigated numerous controversial debates among researchers. Beginning with Mesmer during the

early 19th century, the compulsive aspect of hypnosis was first attributed to external forces and the supernatural skills of the hypnotist. Mesmer's followers remained mainly interested in studying the systematic process giving rise to hypnosis and by late 19th century, mesmerism and the magnetized subject had given place to suggestibility, dissociation, and automatism.

The use of standardized induction procedure in laboratory research was introduced by Clark L. Hull an American psychologist, in 1933. Hull was credited with allowing hypnosis to enter the realm of experimental psychology. He was interested in the non-volitional aspect of hypnosis and was the first researcher to consider automatism as a possible explanation of the phenomena. Automatism was exacerbated by a state of increased suggestibility, and was defined as a natural tendency of the hypnotized subject to become passive towards the facilitation or the resistance to action (Hull, 1933/1965).

In a dissertation paper published in 1941, Robert W. White argued that Hull's explanation of automatism could not be sustained since the hypnotized subject played an active and discriminating role in the hypnotic process. He added that even Highly Hypnotizable (HH) subjects could display resistance to some suggestion and were able to carry complex mental operations while being hypnotized (White, 1941/1965). White's view of hypnosis was that it offered a powerful medium to produce a radical change in the control of behavior: *"Hypnotic behavior is meaningful, goal-directed striving, its most general goal being to behave like a hypnotized person as this is continuously defined by the operator and understood by the subject"* (Shor & Orne, 1965, pp.197).

While Hull's view was that of hypnosis as a state of hypersuggestibility, White's view on the other hand, was that of a state of light drowsiness where performance

demanding alertness, decisions, and complex judgments were likely to be reduced, and internal images and experiences were likely to be enhanced due to the narrowing of the subject's frame of reference induced by suggestions. White also criticized Mesmer, and Hull for maintaining a stubborn mechanistic view of hypnosis, ignoring its social complexity. He stated that the concept of automatism arose from the level of reflex machinery. Regarding the concept of dissociation, White argued that suggestions were framed so that two separated strivings were required to carry them out, and that this fact did not imply dissociation or a temporary fragmentation of the subject's awareness. Subjects were not dissociated nor were they reacting automatically. They were striving to behave like a hypnotized person and to achieve this goal, they did not want their will to succeed, hence volition was non-effective (White, 1941/1965). White's observations had a major influence on the subsequent development of psychosocial theories.

Another controversial issue among theorists concerns hypnosis defined as a particular altered state or trance-like phenomenon. Charcot and his followers have claimed that this particular state aroused from pathology of the nervous system and a great deal of effort was invested in maintaining Mesmer's dream to establish a physiological model of hypnosis (Dixon & Laurence, 1991). The failure to pinpoint physiological markers of hypnosis has raised some controversy as whether or not hypnosis should be referred to as an altered state of consciousness. Until the end of the 19th Century, psychology had acknowledged only two states of consciousness: the waking state, and the sleeping state. Around 1950, the failure to find physiological evidence to support of particular state associated with hypnosis, caused researchers to realize that the similarity between hypnosis and sleep was based more on metaphors than

physiological markers. Psychosocial theorists of hypnosis, advocated that there was nothing special about the hypnotic state, and challenged the hypothesis by demonstrating that suggestibility can be enhanced without producing alterations in consciousness. Such methods used included task-motivational instructions, imagination training, and manipulation of expectancy (Kirsch & Council, 1992).

Later theories of hypnosis have tended to emphasize either cognitive abilities such as absorption and imagery, or have focused on psychosocial factors such as attitude, beliefs and expectations. The synergistic theory of hypnosis proposed by Nadon, Laurence & Perry (1991) stated that the phenomenon is resulting from an interaction between specific cognitive abilities and the demands of the hypnotic context. The later theory stresses the importance of this interaction and the need to control for social factors when measuring cognitive variables. The experience of non-volition reported by hypnotizable subjects has been and currently remains the hallmark on which boundaries of hypnosis theories are evaluated. Non-volition is currently viewed as resulting from automaticity, which is defined as a way of processing information that is effortless, rapid and involuntary (Schiffrin & Schneider, 1977). For instance, when a subject is given the suggestion that his arm is getting heavy, the feeling of heaviness is described as unfolding effortlessly and without the subject's conscious will. Although there is considerable agreement among theorists that the experience of non-volition appears to be related to automaticity, how automaticity operates in the context of hypnosis remains controversial.

The neo-dissociation theory proposed by Hilgard (1986) emphasizes cognitive abilities and views hypnotizability as a stable trait. Longitudinal studies investigating the

stability of hypnotizability have reported test-retest reliability as high as 0.71 across 25 years (Piccione, Hilgard & Zimbardo, 1989). The theory supports individual differences at the level of information processing, and explains automaticity and dissociation based on a cognitive model organized into hierarchical levels of control involved in the generation of behaviors. Dissociation is produced by the effect of hypnotic suggestions on the central control structure, also called the executive ego associated with the planning, monitoring and coordination of behaviors. The effect of hypnotic suggestions is to bypass this executive ego and to activate subsystems of control interconnected but each having their own capacity to produce inputs and outputs. Respective subsystems of control are assumed to be in place for movement, perception and memory. The theory stipulates that dissociation is partial and produced by an amnesic-like barrier splitting consciousness in two parts; one part experiencing the suggested behavior automatically while a separate part remains aware and in control. In this case, the experience of non-volition is illusory because at some deeper level the subject is motivated to perform the suggested act (Hilgard, 1986; Kihlstrom, 1992). Evidence to support the hypothesis of a double stream of consciousness came from "hidden observer" studies and hypnotic analgesia. Results of such studies yielded that nearly half of HH subjects responding to a hypnotic analgesia suggestion in the context of experimental pain, reported that while experiencing pain reduction, they had a hidden part of them that remained aware and felt pain at a higher intensity (Hilgard, 1973; Hilgard, Morgan, & Macdonald, 1975; Laurence & Perry, 1981).

Bowers in 1992, modified and further expanded on Hilgard's neo-dissociation theory. Guided by recent research development concerning the neurophysiological

aspect of hypnosis, he held the notion of a cognitive model of hierarchical control of behaviors and reconsidered the role of dissociation. According to Bowers (1992) dissociation no longer applies to consciousness, but pertains to the control of behaviors. Bowers' new theory was largely inspired by a cognitive model of behavioral control suggested by Norman and Shallice in 1986. This model stipulates two complementary control systems for the initiation and control of behaviors. A lower-level control system named "contention scheduling" which takes care of routine actions. This system is decentralized and does not require awareness and attention. Its activation is simultaneous and depends on competition and cooperation of schemas that is, once schemas are sufficiently activated and have reached a threshold, either through environmental triggers or by other schemas, they are selected (Norman and Shallice, 1986). Well learned and habitual tasks, such as driving a car to go to work, are performed based on such "contention scheduling" schemas.

A second higher control system called the "supervisory attentional system" is centralized and takes care of novel and complex actions. Its function is to monitor, modulate and evaluate contention-scheduling schemas based on how well they meet an individual's goals and intentions. Although it may be experienced as dominant, the role of the supervisory system is indirect. When the higher-level control system is modulating a schema, the subjective experience of action is "will". If it is monitoring a schema but not modulating it, the corresponding subjective experience is that of an action that follows an idea (ideo-motor act). Finally, if the higher-level control system is not involved, the subsequent subjective experience is that of automaticity. Because hypnotic induction releases lower level functions from the integration that is normally imposed on

them by consciousness, it partially disables the higher level control system, therefore schemas are modulated through hypnotic suggestions and the ensuing subjective experience is that of non-volition. Consequently, hypnosis does not alter the experience of behavior but how it is controlled (Norman and Shallice, 1986; Woody & Bowers, 1994).

This weakening of the executive control system, according to Bowers, results in a condition that is functionally similar to that of patients with frontal lobe disorders. Hypnotizable subjects display behavioral rigidity, they lack spontaneously generated actions, and have slower responses to nonsensical situations than they would normally have in their normal states In addition, hypnotizable subjects often display idiosyncratic and peculiar associations, which appears to be resulting from a disinhibition of control. The removal of the frontal cortex is known to be associated with reports of reduced distress in response to pain and a parallel here can be drawn with hypnotic analgesia. Frontal lobe damage is also associated with memory impairments. Frontal lobe patients have poorer control over the description and verification of memory, maintain a high level of confidence in their recall even though it may be incorrect. They are also prone to confabulation and have difficulty with temporal order of events and organization (Woody & Bowers, 1994; Woody & Farvolden, 1998). In this view, hypnosis should affect episodic memory leaving semantic memory intact, and should activate implicit memory as opposed to explicit memory systems (Spiegel, 1998). A parallel was also made between hypnotic amnesia and frontal lobe memory impairment. Hypnotic amnesia concerns a deficit at retrieval and difficulty with temporal order of events (Woody & Farvolden, 1998).

Cognitive-social theorists have given great consideration to Bower's theory of automaticity and agree that most of everyday life behaviors are triggered automatically based on the operation of lower-level control systems and models of actions, such as the one proposed by Norman and Shallice (1986). However, automatic responses, according to social theorists, are not taking place as the result of a weakening of the executive control system, and they are performed with intention. The intention does not have to remain at the level of awareness at all times. According to the sociocognitive view, one of the major weakness of the dissociated-control theory concerns its failure to explain self-hypnosis (Kirsch & Lynn, 1998).

Sociocognitive theorists are interested in the role of cognition in the social context of hypnosis. They argue that hypnosis is a culturally defined social context in which behaviors are expected to occur without voluntary effort. This context creates culturally based expectancies and response sets. Hypnotic susceptibility results from a strong motivation as well as a conscious intention to feel and behave in line with suggestions coupled with self-conforming expectations to succeed. The sense of non-volition, is created by an automatic response triggered by ambiguous suggestions about physical states that subjects attribute to the effect of hypnosis after the suggestions have been experienced. Expectancies function as response sets that allow behaviors to be triggered automatically. In this view, hypnotic responses are goal-directed strategies and actions, resulting from both intentional and automatic responses (Kirsch; 1997; Lynn, 1997; Lynn & Rhue, 1990).

While it is generally accepted that hypnosis is fundamentally social in nature, and involves a form of strategic self-presentation, sociocognitive theorists have been

criticized for not exploring the nature of the enactment and the cognitive abilities underlying individual differences in hypnotic responding (Kirmayer, 1992). Other researchers in the field of hypnosis are maintaining that hypnotic responsiveness results from the interaction of cognitive abilities and social factors. The interactive view stresses the importance of studying patterns of cognitive abilities which may predisposed subjects to respond to suggestions, outside the hypnotic context (Nadon, Laurence & Perry, 1991). Recently, findings from a growing body of research have begun to shed light on individual differences in cognitive patterns which may give rise to unusual experiences in hypnosis.

NEUROPSYCHOPHYSIOLOGICAL EVIDENCE

The weakening of higher executive control system hypothesis in hypnosis grew out of empirical support from two main areas of research investigating potential biological markers of hypnosis. The first area concerns physiological measures such as electrodermal activity, regional cerebral blood flow (rCBF), and hemodynamic changes using a variety of techniques such as, electroencephalogram (EEG) frequency analysis, positron emission tomography (PET) and functional nuclear magnetic resonance imaging (fMRI). Physiological measures have been taken during baseline (waking) state, hypnotic induction, and hypnotic suggestions. A second area relates to performance on neuropsychological tests, particularly those targeting frontal lobe functions. The results obtained from this increasing number of studies point towards a strong involvement of frontal lobes in various hypnotic conditions, from relaxation induction to hypnotic analgesia (Crawford, Knebel & Vendemia, 1998; Gruzelier, 1998; Spiegel and King, 1992). Interestingly, such studies are also suggesting the presence of cognitive and

physiological individual differences between LH and HH at baseline (Crawford et al., 1998; De Pascalis, 1999; Ray, Blai, Aikins, Coyle & Bjick, 1998).

In a non-hypnotic state, HH were found to display faster EEG activity related to a greater capacity to access positive and negative life-emotional experiences (De Pascalis, 1998). HH were also found to generate more theta activity than LH individuals in frontal and temporal areas of the cortex (Crawford & Gruzelier, 1992; Graffin, Ray & Lundy, 1995). Such differences are associated with a greater disposition for more focused and sustained attention, and greater cognitive flexibility predisposing HH to hypnotic suggestibility. Shorter latencies for somatosensory ERPs have also been reported for HH subjects (Lamas & Crawford, 1998).

Gruzelier (1998) suggested a three-stage model of traditional hypnotic induction based on neuropsychophysiological evidence. The first stage involves fixation on a target and the focus of attention on the hypnotist's voice. This ability is associated with left hemispheric frontotemporal processing of the attention control system. While HH engage in the process relatively easily, LH fail to do so. During the second stage, subjects are engaged in deep relaxation through eye closure and suggestions of fatigue. The successful completion of this stage is based on the ability to "let go" which is generally associated with frontolimbic inhibitory processes. The second stage also involves, according to Gruzelier, the handing over of executive and planning functions to the hypnotist. Finally at stage III, hypnotizable subjects engage in passive imagery and cortical activity shifts from frontal to more posterior areas.

Understanding the psychophysiological mechanisms involved in the reduction and/or elimination of pain achieved by HH through hypnotic analgesia, has been of

primary interest for many neuropsychologists working in the area of hypnosis. Current fMRI and PET studies have suggested an implication of multiple cortical and subcortical sites in the processing of pain. The International Association for the Study of Pain defines pain as *"An unpleasant sensory or emotional experience which we primarily associate with tissue damage or describe in terms of tissue damage, or both"*. Areas of a pain neural network have been identified by an increase in rCBF in the primary and secondary somatosensory cortices, prefrontal and motor areas, thalamus, insula, anterior cingulate and anterior regions of the brain interacting with other brain regions (De Pascalis, Magurano, Bellucci, & Chen, 2001). Hypnotic suggestions given to HH subjects to modulate pain unpleasantness and intensity have been found to produce an increase in frontal rCBF. Modulation of pain unpleasantness was associated with corresponding changes in activity in the anterior cingulate cortex, suggesting that the anterior cingulate cortex plays a role in the affective component of pain. In contrast, modulation of pain intensity was found to produce corresponding changes in activity in primary sensory cortex (Rainville, 1998; Rainville, Duncan, Price, Carrier & Bushnell, 1997).

In Crawford et al. (1998), the effect of pain modulation was found to be limited to HH subjects and resulting from their superior cognitive flexibility and attentional skills. Hypnotic analgesia is likely to depend upon the activation of a supervisory, attention control system involving the anterior frontal cortex allocating or withdrawing attention to pain and subsequently producing changes on the activation of posterior cortical systems. Such cognitive differences have been demonstrated by consistent HH superior performance on attention tasks and faster reaction times to complex decision-making

tasks (Crawford, Horton, McClain, Furmanski, & Vendomia, 1998; Crawford, Horton, & Lamas, 1998).

Hemispheric differences in hypnotized subjects have also been investigated. HH subjects were found to display greater left hemisphere activation during the initial phase of hypnosis, possibly allowing them to focus attention and to use cognitive strategies. Following the hypnotic induction, HH displayed a reduction in left hemispheric involvement (disattend) as the activation shifted to the right (Crawford, 1982; Crawford & Gruzelier, 1992). Bilateralized changes were reported to be more diffuse in medium hypnotizable subjects and more focal in HH (Gruzelier, 1998).

Neuropsychological tests known to reflect executive functions, and targeting attention, inhibition, decision making. strategies, perceptual automaticity and verbal fluency have been linked to both hypnotizability and hypnosis. Ray et al. (1998) administered four neuropsychological tests (WCST, FAS, Stroop, and Towers of Hanoi) to 15 HH and LH subjects previously screened for hypnotizability but unaware of the selection criterion for neuropsychological tests. In general, HH subjects performed better than LH on all frontal tasks. For the WCST test, HH responded significantly faster than their LH counterparts. Performance on the Stroop and FAS tests was superior for HH but the difference in scores between HH and LH was not significant. The researchers concluded that the general superiority in performance of HH subjects in the sample may have reflected general intelligence as opposed to specific functions however, a link between hypnotizability and IQ has never been established.

Gruzelier and Warren (1993) administered word and design fluency tasks to subjects both at baseline and while they were hypnotized. Subjects did not differ at

baseline on word fluency, however, in hypnosis, LH showed an increase in fluency from baseline while HH showed a decline. Hypnosis caused both LH and HH to improve their design fluency performance. In another study conducted in 1998 by Gruzelier, the Conners Continuous Performance Test (CPT) was administered to HH and LH subjects under similar conditions. The CPT measured the capacity for sustained attention and for the control of inhibition. In this test, subjects were required to press a key for every letter appearing on a computer screen at varying speed except for the letter "X". Response time was measured and greater variance was interpreted as an index of inability to sustain attention. In hypnosis compared to baseline measures, HH made more omission errors and showed more variability in response time. In contrast, the performance of LHs improved both in terms of accuracy and reaction time variance (Gruzelier, 1998). The drop in performance on some frontal tests in hypnosis namely on Verbal Fluency and CPT for HH and its opposite effect on LH subjects gave support to the "weakening of higher frontal executive functions" hypnosis proposed by Woody and Bowers (1994).

Kallio, Revonsuo, Haemaelaeinen, Markela and Gruzelier, (2001) looked at attentional differences between 8 HH and 9LH subjects at baseline and during hypnosis. Neuropsychological tests administered in this study included the Stroop, a simple reaction time task, a choice reaction time task, a vigilance task, a verbal fluency task and the Differential Attentional Processes Inventory (DAPI). The later required subjects to rate themselves on a 7-point scale with regards to past experiences of focused attention and absorption. For the simple reaction time task, subjects were required to press the zero key on a key board as quickly as possible when ever zero appeared at random delays on a computer screen. The choice reaction time task was identical except that subjects

had to match different numbers with their corresponding keys on the computer as quickly as possible whenever the numbers appeared on the computer screen. The vigilance task was similar to the CPT test. Subjects were tested twice on the tests at one-week interval in both conditions (normal and hypnosis). The results indicated that HH and LH differed only on the DAPI questionnaire. Attentional abilities did not differ at baseline and only for verbal fluency tasks, HH were found to have a poorer performance in hypnosis. Hypnosis produced longer reaction time on all tasks regardless of the subjects' level of hypnotizability. The researchers concluded that the results provided little support for a "weakening of executive functions" theory of hypnosis.

Studies investigating perceptual automaticity have indicated that highly hypnotizable subjects experienced greater facilitation and interference on Stroop tasks, and were faster at learning and implementing strategies to improve their performance (Dixon, Brunet & Laurence, 1990; Dixon & Laurence, 1992). Subjects for these studies had been previously classified as HH, medium hypnotizable (MH) and LH but were also kept unaware about the link between the Stroop task and hypnotizability. Individual thresholds for word perception were first established using a staircase method. Color words were first presented followed by a color patch to be named. Subjects were submitted to both subthreshold and suprathreshold conditions for word presentation. In order to manipulate strategic effects, subjects were given information regarding the probability of occurrence of congruent (e.g. red word and red color patch) versus incongruent (blue word and red color patch) trials. In a first and second testing sessions probability of congruence were changed from 25% to 75% respectively. The results indicated that compared to LH, HH subjects displayed shorter reaction time on congruent

trials in all conditions. However, HH were found to have larger discrepancy between their reaction times on congruent and incongruent trials when they expected the word and color patch to match on 75% of the trials, and when they were able to consciously perceive the word preceding the patch. The effects were interpreted as resulting from possible stronger connection strengths along verbal pathways and a combination of both automatic and strategic effects (Dixon & Laurence, 1990).

In order to examine automaticity independently from the effect of strategy and to study their interaction, a second study was conducted using only red and blue words and patches. Delays between the presentation of the word and color patch were manipulated to control for strategies and all subjects were informed that 3 out of 4 times the color and the word would not match (incongruent). At very short delays, subjects had no time to implement strategies. HH remained faster than LH subjects at naming color patches for congruent trials, however as delays increased they were faster than LH subjects at implementing strategies and reversing the Stroop effect (becoming faster at naming color patches when the word and the patch did not match as suggested by the experimenter) (Dixon & Laurence, 1992).

The results of a neuropsychological investigation of ERPs using a Stroop-like task indicated faster processing at the level of frontal lobes for highly hypnotizable subjects when compared to low hypnotizable subjects. In this study (Baribeau, Le Beau, Roth & Laurence, 1994), subjects had been screened a year earlier for hypnosis in a different laboratory. The Stroop consisted of four tasks; naming color word written in black ink (word condition), naming the color print of a series of XXXXs (neutral condition), naming the color print of congruent color words (congruent condition), and naming color

print of incongruent color words (incongruent condition). Due to the complexity of ERP recordings, the four tasks were presented in blocks rather than randomly. Although HH displayed faster reaction times on most tasks, the larger discrepancy between congruent and incongruent trials observed in Dixon & Laurence, 1990 and 1992 was not replicated. The main finding involved HH subjects' shorter latencies of a P300 negative wave at the frontal site for the word and neutral conditions. The results suggested that the greater automaticity exhibited by HH subjects was more likely to be perceptual than verbal in nature.

Automaticity in relation to memory has been extensively investigated in the 1990s. In implicit and explicit memory studies, more hypnotizable subjects have consistently displayed superior explicit recall than less hypnotizable subjects (Slako, Lepage & Laurence, 1996; Tremblay, 1996). In such experiments, lists of words were presented during a study phase and subjects were asked to rate the words for pleasantness (semantic) or to count their number of "t" junctions (structural). Recall was incidental and implicit and explicit measures included stem completion and forced recall tasks. In Tremblay's (1996) experiment a post-hoc awareness questionnaire was used to investigate if subjects were conscious of using previously studied words to complete stems. HH were found to become more aware as the stem completion task progressed and to perform better on forced recall tasks.

In another study investigating familiarity and conscious recollection using the Process Dissociation Procedure (PDP) proposed by Jacoby (1991), memory indexes in combination with higher performance on a D2 target detection test were found to be predictors of hypnotic responsiveness. Subjects were presented with a list of words to be

remembered either under full or divided attention. All subjects were later given two stem completion tests; one during which they were instructed to use words from the study list to complete stems (inclusion), and one during which they were instructed to avoid using words from the list (exclusion). Following the stem completion tasks, a recognition test comprising the words from the study list and an equal amount of distracters was administered. Subjects were asked to circle every word they recognized as being part of the study list. Conscious recollection, recognition errors, and accuracy on the D2 target detection test emerged as significant predictors of hypnotic susceptibility (Slako, 1995). Keeping in mind that individuals with damage to the prefrontal cortex are performing poorly on target detection tasks, and have shown to be significant impaired on explicit memory tasks, the findings are pointing towards pre-existing superior frontal abilities in hypnotizable subjects.

Another interesting aspect of the " weakening of higher executive functions" hypothesis concerns a parallel between HH subjects' behaviors in hypnosis and that of frontal lobe patients. In hypnosis HH subjects, according to Woody and Bowers (1994) have poorer access to memories requiring the formulation of descriptions (episodic) as opposed to stereotypical memories (semantic) and their ability to discriminate appropriate or correct records from inappropriate or incorrect ones should be diminished. Interestingly, evidence to substantiate the effects of hypnosis on memory distortions has been found (Laurence & Perry, 1983; Labelle, 1990), however, findings from more recent studies are indicating that vulnerability to memory distortions tends to be more related to suggestibility as a trait than to the effect of hypnosis. Suggestibility was found to predispose subjects to memory distortions and memory creations regardless of the

technique being used (Schacter, 2000). These findings are indicating that individual differences in cognitive profiles are likely to lead to different subjective experiences in conjunction with episodic memory. Therefore a thorough neuropsychological assessment of frontal function in HH subjects may determine if frontal lobe functions play a central role in hypnosis.

ASSESSMENT OF EXECUTIVE FUNCTIONS:

The frontal lobes have been labeled as forming the most complex area of the brain and currently, their functions are far from being clearly understood. Anatomically, five subcortical circuits have been identified, and neuropsychological studies have shown distinctive syndromes associated with damage to these different connections. A motor connection located in the supplementary motor area appears to be related to pre-movement activity, serial processing of movements, concurrent parallel processing and olfactory functions. Damage to a second circuit situated in the frontal eye fields has been associated with abnormal eye movements, transient cerebral gaze palsy and deviation. A third, dorsolateral prefrontal circuit located in the convex area of the frontal lobe was found to play a major role in executive functions. Damage to this circuit was associated with perseveration, motor programming sequence abnormalities, reduced verbal and design fluency as well as poor learning strategies. Damage to a fourth circuit located in the inferolateral prefrontal cortex, named the lateral orbitofrontal circuit, was associated with personality changes, imitation and utilization behavior, irritability and disinhibition, as well as an impaired ability to distinguish different odors. Utilization behavior refers to the patient feeling impelled to grasp and use objects which can be reached or which are in the patient's visual field. This form of impairment has also been referred to as the

"environmental dependency syndrome" (Stuss, Eskes & Foster, 1994). Finally, damage to a fifth connection located in the anterior cingulate gyrus and labeled as the anterior cingulate circuit has been found to be linked to akinetic mutism, profound apathy, monosyllabic speech, reduced movement, incontinence and indifference to pain. All circuits were found to originate in the frontal lobes and to have direct and indirect projections to striatal structures and the thalamus (Cummings, 1993).

Frontal lobe pathology has been most widely investigated through neuropsychological assessment of executive functions, a term referring to cognitive abilities involved in volition, planning, purposive action, and effective performance in goal-directed situations (Lezak, 1995). Standardized assessments have traditionally included tests such as the Wisconsin Card Sorting Test (WCST), as well as the Stroop and Verbal Fluency (FAS). The WCST consists in presenting subject with four stimulus cards, differing in color, form and number. The subject is then given 128 response cards and is asked to place them in front of one of the four stimulus cards according to where he/she believes it should go. Feedback is provided in the form of "right or wrong" with no other cues. The first correct type of classification is based on color, all other responses are called wrong. Once the subject has achieved ten consecutive responses, the sorting principle changes to form without warning and again all other responses are wrong. Subjects go through the three types of classification twice during the administration of the test for a total of six categories. This test is viewed as a measure of concept formation, and reactive flexibility to the particular demands and context of a situation.

The WCST has been by far, the most widely used test for the assessment of

executive functions. Evidence to support the validity of this test has been mainly based on a study done by Milner in 1964 with patients who underwent frontal dorsolateral lobectomy for treatment of epileptic seizures. Patients were assessed before and after surgery and were compared to a control group with temporal, parietal and occipital lobe excisions. Following surgery, patients with lesions to other parts of the brain showed a decline of 7 points on IQ tests measures, while the dorsolateral frontal lobe group showed no declined in general intellectual function and only an impairment on the card sorting test.

The Verbal Fluency task involves producing as many words as possible beginning with the letters F, A and S in 60 seconds. This task is said to measure spontaneity and flexibility and to rely on effective search strategies. Patients with dorsolateral left frontal lobe lesions showed a reduced performance on the Verbal Fluency Test (Milner, 1964). Few validation studies on the WCST have compared the performance of frontal lobe patients to that of normal controls. Evidence to support that the test is sensitive to frontal damage exclusively, or particularly to the dorsolateral frontal region has not been found consistently. This may be due in part, to the difficulty of finding patients with focal lesions and/or brain injury that does not involve other areas of the brain (Mountain & Snow, 1993). Activation of the dorsolateral prefrontal cortex is however, the most consistent finding in studies using regional rCBF and PET scans. One ERP study suggested fronto-temporal activation during the completion of the WCST with a strong involvement of working memory mechanisms (Barcelo, Sanz, Molina & Rubia, 1997).

Inconsistency in findings supporting the validation of the WCST to assess executive functions appears to be also related to the recency of the injury. Reduced

performance on this test were found to be more prevalent right after frontal lobe damage and to tamper off over time (Stuss, Eskes & Foster, 1994). Levine (2000) has observed that patients with traumatic brain injury resulting from rapid deceleration displayed severe difficulty with self-regulation of behavior in everyday life, despite having normal performance on the WCST. Self-regulatory disorder is defined as the failure to regulate behavior in unstructured situation where one must set the goals to determine the appropriate path to the goals. Levine argues that the validity of the WCST and Verbal Fluency tests as traditional frontal measures has emerged from research on patients with dorsolateral prefrontal lesions, while the traumatic brain injury patients have contusions lying along the more ventral part of the frontal lobes. Inertial forces during rapid deceleration are causing focal contusions in areas where the brain is surrounded by bones of the inner skull, damaging the anterior and ventral frontal as well as temporal areas. Levine also argued that impaired self-regulatory functions are extremely difficult to capture with neuropsychological tests and that such tests must include; basic rules that are easily understood, they must be goal-oriented, the path towards the achievement of the goal must be implicit, and certain features of the task must be opposed to goal attainment requiring inhibition for adequate performance to occur (Levine, 2000). Interestingly, if one applies the criteria to the assessment of hypnotic suggestibility, the task appears to fulfill the requirements of self-regulatory behavior quite well.

Although there are currently several theories of executive functioning, Norman and Shallice's Supervisory Attentional System (SAS) is the only theory that has been applied to hypnosis and the Dissociated Control Theory. Such model as described earlier, refers to contention scheduling for routine behaviors, which needs to be inhibited

and override in nonroutine situations. Considering that SAS is a frontal system, frontal lesions should hinder patients' ability to override contention scheduling, leaving them at the mercy of environmental stimuli. According to Norman and Shallice, patients get stuck in perseveration patterns because their inflexible contention scheduling schemata are activated by task demands. Patients' impaired SAS is unable to inhibit the activated contention scheduling schemata and replace it with a more adequate schema (Norman & Shallice, 1986). As a result of difficulty in supervisory attention capability, a number of attentional tasks have also been included in standard assessment of executive functions. Sustained attention has been examined using versions of the traditional continuous performance test, target detection tasks, as well as resource allocation tasks such as those involving divided attention (Grafman, 1999).

Several demographic variables have been found to interact with the performance on neuropsychological tests measuring executive functions, therefore accurate interpretation of test scores is dependent on the extent to which performance is confounded by such factors. Performance on the WCST and the Stroop has been found to deteriorate with age, however, the effect appears to be significant in subjects over 70 years of age. For gender, women were found to outperform men on most measures of the WCST. Education was also found to have a significant impact on the WCST performance. Subjects with more than 16 years of education do better than subjects with only a high school level of education. Evidence suggesting an advantage of education for the Stroop and Verbal Fluency tests has also been documented. Verbal IQ has been found to correlate with performance on the Verbal Fluency test, and to have a substantial effect on other frontal measures as well. Finally, cardiovascular illness was found to

account for 28% of the variance on the WCST scores, but to have no effect on other measures (Boone, 1999).

The fact that frontal lobes play a role in adequate memory functioning has been well established (Grafman, 1999; Stuss, Eskes, & Foster, 1994; Yener & Zaffos, 1999). Prefrontal cortex connections with subcortical structures are known to interact with memory for source and context, retrieval and encoding, categorization, temporal sequencing, planning, strategy use and application, attention, and proactive interference. The main interest of the current study concerns the role of frontal lobes in the context of episodic memory.

FRONTAL LOBES AND EPISODIC MEMORY

Tulving (1985) argued that memory research has been exclusively concerned with a particular kind of memory while ignoring others. He suggested three different kinds of memory or if it is preferred three kinds of memory systems: procedural, semantic, and episodic. These systems have common features, primarily they all make possible the use of acquired and stored knowledge. However, they differ in many ways and constitute a class-induction hierarchy in which semantic may be viewed according to Tulving (1985) as a subcategory of procedural and episodic as a subcategory of semantic. They also differ in that they are each characterized by a different kind of consciousness. (Tulving 1985; Wheeler, Stuss & Tulving, 1997).

Procedural memory is concerned with the acquisition, retention and use of perceptual, cognitive and motor skills in current situations. Its corresponding kind of consciousness is "anoetic" (without-knowing) and strongly relies on lower level control systems. Seeing from a developmental position, procedural memory would be the most

basic form of memory and the first one to appear in life. Newborn infants for instance, would be conscious in the sense that they are capable of registering perceptual information, creating internal representations, and adopting particular patterns of behaviors in response to the present environment (Tulving, 1985).

Semantic memory on the other hand, has to do with the representation of knowledge possessed by an individual about the world in general. This kind of memory is associated with "noetic" (knowing) consciousness and allows a person to cognitively operate on, objects, events and their relations stored in memory in the absence of such objects and events. Semantic memory develops after procedural memory, in early childhood and perhaps is parallel to the acquisition of Piaget's "object permanence" in infants (Wheeler, Stuss, and Tulving, 1997). From an evolutionary perspective, it is clear that survival is enhanced by relevant acquired knowledge or skill, thus both procedural and semantic memory systems provide means of improving the efficiency of behaviors through learning. Neither of the systems require awareness of how, where and when the skill or knowledge was acquired in order to be effective (Tulving & Lepage, 2000).

Finally, a third kind of memory system, called the episodic memory system is assumed to have evolved more recently. This system, according to Tulving, is probably unique to humans and it is suspected to develop later and deteriorate earlier in life than other systems. The episodic memory system, as described by Tulving, is the only memory system that is oriented in the past. The episodic memory system allows humans to mentally travel through subjective time, from the present to the past and to the future. The ability to mentally travel through time gave rise to the possibility of re-experiencing past events through autonoetic consciousness (self-knowing). The episodic memory

system's operation depends on semantic memory that is, knowledge about a past event is a mixture of information from general knowledge which can be remembered objectively, as well as personal information. Episodic memory, however, is what adds a unique 'flavor' to phenomenal recollective experiences (Tulving, 1985).

Tulving's theory makes a clear distinction between consciousness and awareness. Consciousness is a competence of the human mind rendering an individual more of less capable of becoming aware of the world. It is generally referred to as a state and does not have an object. Awareness on the other hand, is a manifestation of this competence and always is of something. A person can be in a particular state of consciousness and be aware of certain elements of the world depending upon the object of awareness (Tulving & Lepage, 2000)

The concept of episodic memory has been introduced by Tulving in 1983. Although the concept clearly referred to memory of personal events, the emphasis in the early 70s was primarily based on information processing. The development of neuroimaging techniques in combination with neuropsychological data produced a shift of interests among researchers away from how the information was processed to the identification and localization of brain structures associated with specific cognitive states and operations. Tulving's new definition of episodic memory and its corresponding state of consciousness arose from case studies of patients with frontal lobe lesions and neuroimaging research. Such findings are suggesting that the episodic memory system strongly relies on frontal lobes and the executive system for encoding and retrieval (Tulving, 2001).

Tulving's concept of autonoetic consciousness originally developed from a case

study of a man who was the victim of a motorcycle accident in 1981 which left him with a very unusual kind of brain damage. The patient (K.C.) retained normal intellectual abilities and a full memory of semantic details related to his personal life such as, where and when he was born, where he went to school, and what kind of car he was driving. This kind of details is classified as semantic because they are impersonal facts or information. K.C. was unable to remember, however, a single episode of his life as a personal experience and his amnesia covered a period from his birth to the present day (Tulving, 2001). Selective loss or absence of episodic memory along with spared semantic memory has been observed in patients who have sustained injuries that are restricted to the prefrontal cortex. This type of brain damage was also associated with source amnesia that is, the ability to recall where and how information was acquired. While source amnesia is common to all in everyday life, patients with prefrontal cortex injuries are unable to recall when and how they have gain knowledge about a particular subject even when the learning occurred during the same testing session (Janowsky, Shimamura, & Squire, 1989).

Another area that provided insight into autonoetic consciousness relates to prefrontal lobotomy, a psychosurgical procedure that was done until the 50s to treat various psychiatric symptoms. Following this procedure, patients were found to have become indifferent to the problems of the past, present and future that were disturbing to them prior to surgery. These patients were aware of their personal problems and clearly were able to recall facts and events of their lives, however postsurgically; they described the facts and events in a personally detached manner with a lack of warmth and intimacy. Researchers concluded that the severing of connections between the prefrontal cortex and

the thalamus altered the person's sense of self and reduced the experience of self-continuity (Wheeler, 2000). Observations from case studies of prefrontal injuries and those from patients treated with lobotomy suggested that episodic memory and semantic memory rely on separate neural mechanisms (Tulving, 2001).

Developmental studies have also yielded results in a similar direction. Children above the age of 1 are able to learn an incredible amount of information and require a well-developed semantic memory ability along with noetic awareness. Although they may be able to recall events, evidence suggested that young children do not have the capacity to recollect their past in the rich, personal way that comprises episodic retrieval. A study conducted by Gopnick and Graff in 1988 examined how well young children remembered how and when they acquired knowledge (source amnesia). Three, four and five years old children learned about the content of a drawer either through seeing objects being placed in it, being told about the object placed in the drawer by the experimenter, or being given sufficient information to figure out the content of the drawer. When asked how they had learned about the content of the drawer, older children had no difficulty answering the question correctly. Most of the three year old claimed that they just knew and tended to answer in an impersonal manner ("There are crayons in the drawer" rather then "I saw crayons in the drawer"). Young children lack the ability to reflect upon the past, introspect about present thoughts, and actively plan and anticipate the future. Children are suspected to go through changes in terms of awareness between the age of 2 and 6 years (Perner & Ruffman, 1995). Children below 5 years of age were also found to have difficulty understanding the difference between remembering and knowing an event or a piece of information. The difficulty is not solely based on language comprehension

but on the fact that in order to understand remembering, the child must be able to experience reliving an event and being able to reflect on this action (Wheeler, 2000)

At the other end of a continuum, older adults were found to be especially prone to source amnesia and were reported to tend to rely more on familiarity than on episodic material to make recognition judgments such as "old and new" after studying a word list. Differences in memory patterns have been found to correlate with performance on frontal tasks (Parkin & Walter, 1992; Craik, Morris & Loewen, 1990). Memory impairments associated with aging have been found to be due to a gradual loss of neurons in the frontal cortex beginning as early as 20 years of age (Squire, 1987). Recent neuroimaging studies are adding support for an age-related deterioration of frontal functions, however, results from such studies are somewhat difficult to interpret due to the complexity of other potentially contributing health factors associated with aging (Boone, 1999).

PET studies investigating episodic memory in healthy adults have suggested an important contribution of the right frontal lobe in episodic memory retrieval, and a role in the establishment and maintenance of a particular cognitive state, perhaps necessary for the integration of memory into the overall structure of a person's life history. The left frontal lobe appears to be more involved in the episodic "encoding" process. This hemispheric asymmetry has been observed with similar neuroimaging techniques repeatedly across different research settings located in England, USA and Canada (Buckner, 1996; Fletcher, Frith, Grasby, Shallice, Frackowiak, & Dolan. 1995; Nyberg, Cabeza, & Tulving, 1996).

Right frontal lobe activation in relation to episodic retrieval has been observed regardless of the accuracy of response. Therefore, activation resulting from an encounter

with relevant information that has been searched for has been ruled out. The pattern of activation was interpreted as a form of "retrieval mode", that is subjects were set into the retrieval mode through task instructions and generally became oriented towards the past (Tulving, 1999). Another interesting finding concerned the retrieval of information relevant to the "self" vs. that of "others". Subjects were asked to recognize sentences recently heard about others and sentences derived from their own biographical notes. Only the later type of sentences yielded a right frontal activation during a recognition task (Craig, Moroz, Moscovitch, Stuss, Winocur & Tulving, 2001). These findings suggested that the right frontal lobe may play a role in retrieving memories that have an affective valence, that is memories that are personal, reflective and intimate (Levine, 2000).

Although Tulving credited William James as the first author of a definition of episodic memory, he felt that although this kind of memory has been of interest for a long time, researchers until recently have generally ignored it. The recent renewed interest in episodic memory as provided the development of methods that allowed one to study memory and subjective states of awareness in laboratory. Experimentally, episodic memory has been commonly measured in two ways: through source amnesia, and through the use of the remember/know (R/K) technique. The R/K paradigm has been proposed by Tulving in 1985 and further developed by Gardiner (1988). Subjects are instructed to report their states of awareness at the time they recall or recognize words they previously encountered in a study list. If they have any recollection of the experience at the time they encountered the word, they make a remember response. If they are aware that they encountered the word in the study list, but have no recollection of anything they experienced at the time, they make a know response. This paradigm has

been extensively used since it was proposed and the results indicated that subjects could quite easily distinguish between experiences of remembering and knowing (Gardiner & Conway, 1999). Studies using this paradigm have examined both types of memory responses in relation to accuracy.

Theoretically the technique is experiential in the sense that both remember and know responses are related to different kinds of conscious experiences (autonoetic and noetic consciousness). When subjects are making a remember responses, they are reporting an episodic memory based on information such as what crossed their mind when they encountered the words, what came before or after, how they noticed the shape of the letters, what happened in the room at the time they studied the word, or any other details that brings the experience back to mind. On the other hand, when subjects are making a know response, they recall learning the word on the list but have no memory of the learning experience. Knowing is associated with the conscious experience of semantic memory. It is like remembering that "Paris" is the capital city of France without recalling where and when one has acquired the information.

Subjects have been found to be able to discriminate easily between the two types of conscious memories (see Gardiner, Ramponi, & Richarson-Klavehn, 1998 for transcripts of such responses) however, some problems have been raised with the possibility that "Know" responses could be used as a residual category when a forced choice method is used. When subjects respond to an item as "old" they are forced to judge if the item is either remembered or known. In this situation the know judgments may include items that were familiar but not necessarily consciously recalled and the recognition may be based on other strategies than that of conscious recall. In order to

eliminate this possible contamination, a "Guessing" response option has been added to the paradigm (Gardiner, Java & Richardson-Klavehn, 1996). Although subjects are not encouraged to guess, they are able to clearly categorized items that feel "old" but that are not recalled from those that are. The addition of the guessing response category was an important refinement to the original paradigm, since further experiments have established that know and guessing responses differ considerably in terms of accuracy rates (Gardiner & Conway, 1999; Gardiner, 2000).

The paradigm responses of remembering and knowing have been said to be mutually exclusive in the sense that both states of consciousness cannot coexist. A person cannot at once and concurrently relive a past experience in the absence of a memory of that particular episode. On the other hand it can be argued that the two types of memories are redundant in the sense that all "remembered" items are by definition "known" at the semantic level (Gardiner & Java, 1993).

Remembering and knowing responses in recognition memory are also said to be functionally independent in the sense that a variety of independent variables were found to have an effect on one type of responses but not the other, to have opposite effects, or to have parallel effects (Gardiner, 2000). Such functional independence has been found to often resemble but not equate the functional independence of explicit and implicit memory processes or measures of recollection and familiarity indexes as proposed by Jacoby's Process Dissociation Procedure (Jacoby, 1991). The paradigm differs on a conceptual basis; that is, it is a qualitative measure of a first person's experience and not a quantitative estimate of the contribution of a particular memory process to the conscious experience of memory (Gardiner & Java, 1993).

A number of variables were found to increase remember responses while having no effect on know responses. Several studies looked at word frequency effects on types of recall experiences. Guttentag and Carroll (1997) presented a list of high and low frequency words to groups of subjects. The words were read by a female experimenter at the rate of one word per 2 seconds. The recognition test was done in a pencil and paper format immediately after the list was read. The remember responses rate was higher for low frequency words. Gardiner and Java obtained similar results in 1990. These researchers used high and low frequency words of equal imagery value and included an equal number of one, two and three syllable words. The words were hand-printed on a deck of cards and presented to individual subjects at the rate of one word per 2 seconds. The recognition test took place after a 24-hour delay. Low frequency words increased the amount of remember responses and had no effect on know responses. For accuracy, the results indicated a higher number of false positives for know responses. Gardiner, Richarson-Klavehn and Ramponi (1997) replicated Gardiner and Java (1990), however, both study list and recognition test were administered on a computer. A word frequency effect was found again for remember responses and not for know responses. Low frequency words yielded a higher number of remember responses. For accuracy, no difference was found between remember and know responses. More guessing responses were given for lure words, and a higher tendency to guess was observed for words of higher frequency.

The effect of level of processing during the study phase was also the subject of several research investigations. In Gardiner's 1988 experiment subjects were tested in groups and were given booklets to write down responses. The words were 36 one-

syllable or two syllable nouns. Half the subjects were asked to generate and write down a word that was meaningfully related to the given word (semantic encoding) and the other half was asked to write down the first word that came to mind that rhymed with the given word (phonemic encoding). The recognition test consisted of three columns of words of 24 words. Subjects had to circle the words they recognized from the study list and had to indicate a remember or a know response to recognized words. The results revealed a strong advantage of semantic processing only for words that were accompanied by a remember response. A very low false positive rate was observed for both conditions.

In another experiment conducted by Gardiner, Java and Richardson-Klavehn in 1996, subjects were presented with a list of 40 six-letter nouns. Half of the words were studied in a semantic task which consisted of generating a meaningful association. The other half were studied in a structural task where subjects were asked to name two letters that were not present in the studied word. For the recognition test, subjects were informed that half of the words were not part of the study list and that they had to determine which words these were. Study words were presented on index cards at about a 4-second rate and the recognition test consisted of four columns of words each on a separate page. High levels of remember responses were observed following the semantic study task, and levels of processing had no effect on know responses. In terms of accuracy, the overall false alarm rate was .03 for remember responses, .11 for know responses, and .24 for guess responses. More guessing was observed for lure words than for studied words in the remember response category. Finally, Gardiner et al. (1999) tested subjects using a list of common two-syllable words. The study list and recognition test were presented on a computer screen. During the study phase subjects were required to rate the ease of

generating an associated word on a 5-point scale for half of the list, and the ease of generating a rhyming words for the remaining half of the list. Semantic processing was found, once again to influence remembering rather than knowing. Accuracy data was not reported in this study.

Rajaram (1993) replicated Gardiner's 1988 findings for the effect of semantic level of processing on remember judgments, however, subjects also gave more know responses to words for which they had to generate rhymes. The reversed effect found for the phonetically processed words for know responses was small, however the researcher interpreted it as greater sensitivity of know responses to perceptual processing. A rate of .16 for false positive was found and more lure words were known than remembered.

Generating words as opposed to reading them was also found to increase the number of remember responses leaving know responses unchanged. Typically this procedure entails subjects to generate antonyms or to provide a descriptive phrase accompanied by the first letter of the word to be studied for half of the word list, and to simply read the rest of the words aloud. This manipulation was found to increase only the number of remember responses (Gardiner, 1988; Gardiner et al., 1999). Error rates were .01 for remember responses, .07 for know responses and .14 for guessing responses. Guessing responses represented and equal amount of target words and lure words. Vocalization of words at study phase produced an effect similar to generating versus reading words, on remember responses in contrast to words that were only read silently (Gregg & Gardiner, 1991). The researchers observed a very low rate of false recognition and lure words were more known than remembered.

The effect of conceptual salience (dominant meaning) and perceptual

distinctiveness (orthographically uncommon words) were examined in a study done by Rajaram in 1998. Subjects encoded either dominant or non-dominant homographs during the study phase. Dominance was established through frequency analysis of homographs such as "chest", which the dominant meaning is associated with a body part and the non-dominant meaning is associated with a cabinet. The dominant and non-dominant meaning were biased with short description as the ones described in the previous example. The short description preceded the presentation of the word. Salience yielded a higher number of remember responses and this effect was not found for know responses. In terms of accuracy, more lure words involved know responses than remember responses and there was no effect of conditions on accuracy.

In a second study done by the same researcher, encoding of orthographically distinct words such as "subpoena" and "calypso" was compared to that of orthographically common words such as "sailboat" and "cookie". The effect of this manipulation was once again evident only in remember responses. Orthographically distinct words increased the number of remember responses, suggesting that this type of memory experience is sensitive to both conceptual and perceptual variables. More lure words were reported as known than remembered and a higher number of false recognition was observed for distinct words (Rajaram, 1998).

Emotional valence and arousal was studied also in conjunction with the R/K paradigm. Photos of high, medium and low arousal representing scenes with negative, neutral or positive emotional content were presented to subjects on a computer screen. Participants were asked to return to the laboratory 2 weeks later and asked to determine "new" and "old" photos using the R/K paradigm. Negative, high arousal and to a lesser

extent positive pictures increased the amount of remember responses while know responses did not vary consistently. The effect was maintained even when subjects were asked to rate the picture for brightness on a 7-point scale while studying them. The error rates for emotional valence were approximately .03 for remember responses, and between .09 and .13 for know responses. More false positive responses were produced for photos involving a positive emotional valence. Similar error rates were obtained for arousal, however, less errors were made for photos of medium arousal (Oshner, 2000).

In Gardiner and Java (1991) study, researchers investigated effects due to the length of the retention interval on remember and know responses. Four groups of subjects were assigned to either a 10-min, 1 hour, 1 day, or 1 week delay condition for the recognition test following the presentation of a study list. The mean of remember responses declined sharply over retention intervals while the mean of know responses showed little change over a period as long as one week. False alarm rates were quite low at shorter delay intervals but tended to increase slightly at the longer intervals. A larger amount of false positive was also found for know responses. The researchers decided to continue to investigate the effect using even longer delays. In a second experiment identical to the first one, subjects were given a recognition test after 1 week, 4 weeks and 6 months. Such retention intervals yielded an equal amount of remember and know responses and although the performance generally declined to quite low levels by 6 months, the subjects made more accurate judgments than inaccurate judgments on the words that they remembered.

The effect of attention during the encoding phase of a study list was examined by Gardiner and Parkin (1990). Subjects were randomly assigned to one of three groups and

were asked to try to remember the words as much as they can. Subjects in the undivided attention group studied the list without distraction. Subjects in the first divided attention group were required to listen to a tape-recorded sequence of tones that included individual tones of low, medium and high pitch with such tones occurring at varying intervals between 6 and 9 seconds. Subjects received prior training and were asked to call out the tones by saying "high, medium, or low" while studying the words on a computer screen. Subjects in a second divided attention group were given identical tasks, except that the presentation rate of the auditory stimuli was doubled in speed. The results indicated that divided attention at study progressively impaired word recognition accompanied by a remember response while the mean number of know responses was not affected by the manipulation. A higher rate of false alarm for know responses was found for the divided attention condition.

Two variables were found to have an effect only on know responses: masked repetition priming and word vs. non-word recognition. Rajaram and Roediger (1997) looked at the effect of perceptual fluency on remember and know responses. They used a list of common nouns of high frequency five to seven letters in length. For the recognition test 60 words were from the study list and 60 words were new. Half of the words were preceded by a masked repetition, that is the words were immediately preceded by the same word in lower case letters for 50 msec. The remaining half of the words were preceded by a masked presentation of an unrelated word. This manipulation resulted in a superior amount of know responses for the masked repetition words. The mean of remember responses was equal for both repetition and unrelated priming conditions. Accuracy was also equal for both conditions (.18 rate of false positives) and

higher for know responses than remember responses.

Gardiner and Java (1990) investigated enhanced perceptual fluency in non-word recognition. A list of 60 items, 30 one-syllable words and 30 non-words four letters in length were used as stimuli and were hand-printed on a deck of cards. The non-words were carefully chosen as to be pronounceable but unlike any real words such as "JOSP, LORT, and SOTE". The recognition test consisted of half studied words and non-words, and half new items. It took place 24 h after the study phase. The manipulation yielded quite a different pattern of results for words and non-words. The recognition of non-words compared with that of words was reflected more in know responses than in remember responses. A higher rate of false positive for know responses was found regardless of the condition.

Some other independent variables have been found to produce opposite effects on remember and know responses. Lecompte (1995) investigated a revelation effect on remember and know responses for word previously studied. Subjects were asked to remember a list of words presented at the rate of one word every 3 seconds. Before the recognition test began, subjects were told that half of the words were from the study list and that the other half were new words. Some of the words were presented normally and some of the words were presented like puzzles. The puzzle-words were presented first with one letter, then with two letters, then with three and so on until the whole word was visible. The subjects were encouraged to try to guess the word as fast as they can. If that word was part of the study list the subjects had to indicate that the world was old and then specify if they had a remember or a know response. The results indicated that for a studied word, revealing the word before a decision is made increased the number of know

responses and decreased the number of remember responses. The manipulation also created a high rate of false alarm for know responses. The effect was interpreted in a transfer-appropriate processing framework; that is, the effect resulted from a poor match between the revealed words and the original words.

Modality effect for pictures and words recognition were studied by Rajaram in 1993. The subjects studied words and pictures and later participated in a recognition test in which all items were presented in word format. The results suggested a clear superiority effect for recognition of studied pictures. Studied pictures yielded a larger number of remember judgments. On the other hand, the number of know responses was enhanced for studied words. The manipulation had no effect on accuracy. For both conditions the false alarm rate was .09 and more errors were made for know judgments.

Age is a variable that has been found to have an opposing effect on types of responses. Parkin and Walter (1992) compared a sample of healthy older adults with a young group on several frontal measures and the R/K recognition task. The mean age of the elderly group was 80 years and the mean age of the young group was 34 years. Subjects studied a list of words and were given the recognition task after a 10-minute delay. The results revealed a significant difference in distribution of remember and know responses as a function of age. The control group produced a larger number of remember responses than know responses. Elderly subject, on the other hand, made more know responses than remember responses. Performance on the WCST correlated with the number of remember responses for the elderly group only. Older adults also displayed a higher false alarm rate for know responses than younger adults.

Although age alone was found to have a opposite effect on remember and know

responses, age also seems to be related to poorer encoding strategies. Mäntylä (1993) tested a group of older adults between 65 and 78 years of age and a group of adults between 20 and 33 years of age. The groups performed equally well on a vocabulary test and did not differ in terms of years of education. Both groups listened to a list of words presented on a tape recorder at the rate of 10 seconds per word and had to write down an association or a short description of the word to be remembered as they went along. Subjects were informed that they would use these notes at a later time to complete a subsequent recall test. Following a 15-minute interval, subjects were given their own associations and were instructed to recall the words. For each word recalled, they had to indicate whether they remembered, knew or guessed. The findings were that older subjects produced fewer remember responses, however the number of know responses did not differ across groups. The author examined the type of encoding strategy used, and he observed that less prototypical descriptions were associated with a larger number of remember responses. Subjects in the elderly group tended to generate more stereotypical cues than younger subjects and this is likely to have enhanced know responses for this group. In terms of accuracy, the groups did not differ. Overall the subjects produced a .17 rate of false positive responses and most lure words were guessed.

Perfect and Dasgupta (1997) tested 20 younger (mean age 23) and 20 older adults (mean age 71) on recognition of words and non-words. The study list included 40 words of medium frequency and 40 pronounceable non-words (i. e. pedon, frumstle) randomly presented on flash cards for 5 seconds. Subjects were asked to think out loud during the study phase and their memory strategies were audiotaped. Following the study phase,

three frontal and two non-frontal tasks were administered. Subjects were later given a paper and pencil recognition test where they were asked to circle the studied words and to indicate if their recognition involved a remember or a know response. Older adults as expected reported fewer remember responses for both words and non-words. They also reported more know responses for both types of items but the between-group difference was marginal. Older adults failed to use encoding strategies more often than younger adults and displayed a higher rate of false positive responses. Although frontal tests performance correlated with the number of remember responses, tests performance was unrelated to the use of strategies and failed to explain the variance in age-related decline in a regression analysis. The results gave little support for a frontal decline hypothesis, and suggested that older subjects' decline in remember responses was more likely to be related to deficits at the encoding stage.

Gardiner et al. (1999) examined the effect of short (500 ms) and long (1500 ms) response deadlines using the R/K paradigm. Subjects were assigned to either the short delay or long delay condition and were presented with a list of 48 words. Immediately after, subjects were trained on a lexical task to respond with respect to a response-signal procedure. For this training task they were presented with a new list of items and were required to press one of two keys to indicate if the item was a word or a non-word. The computer gave the subjects signals and feedback with regard to their response time. Following the training procedure, subjects were given a recognition task and were asked to indicate whether the word was on the first study list or not within the response deadlines. The results indicated that response deadline had a parallel effect on the dependent variables, that is, both know as well as remember responses increased with a

longer response deadline. Accuracy of responses was not assessed in this study.

Knowlton and Squire (1995) examined differences in remembering and knowing responses between amnesiac patients and a control group. Brain damage to the thalamus, mammillary nuclei, frontal lobes and hyppocampus had resulted from alcoholic Korsakoff's syndrome or various head injuries, and had been confirmed through resonance imagery. Subjects studied a list of 36 words and were informed about a subsequent recall test. The R/K recognition test was administered after a 10-minute delay. The amnesiac patients group were impaired for both remember and know responses and their performance was equivalent to that of a control group tested after a one-week delay. The patient group also produced a higher number of false positives for both know and remember responses. The researchers concluded that know responses appeared to depend on brain structures damaged in amnesia, however, remember responses appeared to depend on the same structures and also on the frontal lobes for contextual information.

The R/K paradigm has raised controversy amongst dual memory process and single-process memory theorists. Dual memory process theorists reject the exclusivity attribute of remember and know responses and argue that the two types of recollective experience do not represent pure measures of memory. In an extension to explicit and implicit memory processes, Jacoby (1991) stated that recognition is not a unitary process and that it involves the contribution of two components: recollection and familiarity. Both may operate to yield remember or know responses and their distinct contribution to judgments of recognition can be evaluated using the Process Dissociation Procedure, an equation that provides separate estimates for both processes (Jacoby, 1991; Yonelinas &

Jacoby, 1996). Based on the transfer appropriate processing approach, remembering and knowing are viewed as conceptual and perceptual components of recognition and priming (Rajaram & Roediger, 1997). Remembering is the product of perceptual or conceptual distinctiveness, and both types of memory can be accounted for by their degree of perceptual and conceptual fluency.

Single memory process theorists argue that recognition is based on a continuum of memory strength. According to this model, remember and know responses are based on stronger and weaker memory traces, with two response criteria, a more stringent one for remember and a more lenient one for know (Donaldson, 1996). Equations to produce estimates of memory strength are used to account for remember and know judgments. This approach is based on the signal-detection theory and criticizes the R/K paradigm for hypothesizing that remember and know responses are measuring memory states, when in fact they are arising from the application of judgment processes (Donaldson, 1996; Hirshman & Henzler, 1998; Inoue & Belleza, 1998;Hirshman & Master, 1997;Hirshman, 1998).

CURRENT STUDY RATIONALE

The present study aimed to verify the hypothesis that individual differences in hypnotic responding are related to pre-existing differences in frontal lobe processing as measured by neuropsychological tasks. The use of very small sample in previous studies with ERPs and other physiological measures have not allowed for an appropriate assessment of executive functions. Neuropsychological testing of frontal and non-frontal measures as well with a large sample of subjects assessed outside of the hypnotic context is required to verify if measurement of executive functioning is exclusively related to

hypnotizability. A carefully chosen battery of frontal and non-frontal tests may also inform researchers on the contribution of cognitive processes predisposing subjects to hypnosis.

Physiological studies have suggested superior attentional resources in HH subjects giving them better concentration, inhibition and shifting of responses (Crawford et al, 1998; Ray et al., 1998). These studies do not specify however, whether HH differ from LH subjects in terms of superior attentional abilities or executive functions or a combination of both. Hypnosis theorists are suggesting that automaticity is playing a central role in the non-volitional aspect of hypnosis. The Dissociated Control theory of hypnosis proposed by Woody & Bowers (1994) implies that greater automaticity and its consequence of non-volition are related to a weakening of executive functions however, possible individual differences at baseline on such measures have never been considered.

To investigate this possibility, subjects in this study were assessed on a battery of frontal and non-frontal tasks. The frontal battery involved neuropsychological tests assessing executive functions: the Wisconsin Card Sorting Test, the Verbal Fluency Test, and the Self-Ordered Pointing Test. The Stroop was added to include a measure targeting automaticity and inhibition. Other frontal tasks investigated attentional abilities these included: the Trail Making Tests, the Continuous Performance Test of Vigilance, and the Target Detection Test. Non-frontal tasks were selected in terms of minimal overlap with planning and strategic abilities. The Rey Complex Figure Test assessed primarily, visual spatial abilities and non-verbal memory; the Raven Standard Progressive Matrices and the Vocabulary subtest (short version) were used to provide parallel measures of general intellectual abilities, and the Digit Symbol measured memory, learning and psychomotor

speed. In order to insure that social and motivational factors did not influence subjects' performance, the neuropsychological assessment phase took place before subjects were notified about a link between the tests and hypnosis. It was expected that more hypnotizable subjects would display a superior performance on frontal lobe tasks, compared to their less hypnotizable counterparts.

A second hypothesis investigated the relation between frontal task performance and episodic memory. The results of neuroimaging studies indicated that hypnosis and episodic memory rely on similar brain processes. Considering the fact that explicit memory and conscious recollection have been found to be good predictors of hypnotizability, the link between memory variables and hypnotizability was investigated. Differences in distribution for types of conscious memory experiences using the R/K paradigm have been observed for distinct populations including aging subjects, amnesiacs, and patients with frontal lobe injuries. Considering that impaired executive functions yielded different patterns in conscious recall as measured by the R/K paradigm, it was hypothesized that HH may form a distinct population displaying performance in the opposite direction.

To test the second hypothesis, subjects were presented with a list of words under full and divided attention conditions, and were later tested for recognition using the R/K paradigm. Results from previous studies indicated that performance on frontal tests in a healthy normal population did not correlate with the number of remember responses on recognition tasks, therefore frontal test performance was not expected to correlate with types of responses in a word recognition task. However, it was hypothesized that HH subjects would produce a larger number of remember responses in the full attention

condition. Considering the fact that suggestibility has been found to be related to memory distortions, HH were also expected to be more vulnerable to false recognition, particularly in the divided attention condition.

In the past, when generalizations were made from episodic memory studies using word lists, researchers have been often criticized on the basis of limited ecological validity and poor application to everyday life uses of memory processes. The purpose of the second experiment was to investigate how individual differences in frontal lobe processing and/or hypnotizability would be manifested in the production and content of a manipulation involving the production of real episodic memories. The design of the second experiment was based on results obtained in the first part of the study. If empirical support for higher frontal abilities in hypnotizable subjects was found, the sample would consist of high and low hypnotizable subjects tested in and out of hypnotic context. In contrast, if the central frontal hypothesis concerning hypnosis was rejected, the sample would consist of subjects with high and low performance on frontal tasks. Subjects were asked to reconstruct personal events triggered by cue-associative words. The study also aimed at testing the hypothesis of a "weakening of executive functions" in hypnosis as proposed by the Dissociated Control Theory (Woody & Bowers, 1994). Differences in cognitive effort required to produce episodic memories were measured by recordings of reaction time, amount of prompts to guide the subject during the process of reconstruction, inferences, as well as subject's verbal statement associated with the experience of difficulty. The quality of episodic memories was also examined by rating the content of episodic memories in terms of details pertaining to reference to self, affect and vividness.

According to the Dissociated Control theory of hypnosis, HH should display more cognitive effort, and take more time to produce episodic memory in hypnosis as opposed to producing them in a normal condition. Episodic memories produced in the hypnotic conditions by HH subjects were expected to reflect more stereotyped details and be less vivid than those produced in a normal condition. In contrast to HH subjects, LH subjects should not be affected by the hypnosis condition and their production of episodic memories should remain unchanged in terms of quality and cognitive effort across conditions.

EXPERIMENT 1

Method

The purpose of Experiment 1 was to test three central hypotheses. The first one predicted that the performance of more hypnotizable subjects would differ at baseline on neuropsychological tests measuring frontal functions. The addition of non-frontal tests was necessary to rule out the possibility that hypnotizable subjects differed from their less hypnotizable counterparts on measures targeting general intellectual abilities, and/or on neuropsychological tasks relying primarily on processes other than frontal lobes.

The second main hypothesis concerned the relation between episodic memory and hypnotizability. Using the R/K recognition paradigm, it was expected that hypnotizability would be linked to a higher rate of remember responses following the study of a list of words under full attention condition. Finally, a third hypothesis predicted that hypnotizability would also be associated with a higher false alarm rate for subjects studying words under divided atttention condition.

Subjects

Ninety-six subjects (71 females and 25 males) were recruited through advertisements in Concordia University student newspapers and through undergraduate psychology courses for a two-session experiment involving the assessment of executive functions and attention skills. Subjects received a $5 compensation for participation to both testing sessions. They ranged in age from 18 to 45 years. (M = 26.79; SD = 7.34). All subjects were non-color blind and had received at least five years of education in English. Although all spoke English fluently, 39% of the total sample

reported English as their primary language, 28% were bilingual with French as their first language and the remaining 33% reported that their first language was other than French or English. Subjects ranged in education from 11 to 22 years (M = 15.64; SD = 1.77).

Scores obtained on neuropsychological tests from two subjects were discarded due to the subjects' physical conditions; one subject presented with a history of a left frontal open head injury resulting from a car accident, and another subject suffered from a neurological disorder. Data from a third subject were dropped because of technical difficulties during the testing session and finally three other subjects chose not to return for a second session involving hypnosis. The final sample included 90 subjects randomly assigned to one of two experimental conditions (full attention and divided attention).

Procedure

Subjects were tested individually over two sessions. The duration of the first session was two hours including a 10-minute resting period. Following a brief introduction, subjects were asked to read and sign a consent form (see Appendix A). The session began with the presentation of a list of words and was followed by a series of neuropsychological tests as well as a recognition task. Because some of the tasks (Recognition and Rey Complex Figure Delayed Recall) necessitated testing within a precise timeframe, the tests were administered in the same order for all subjects. At the end of the first session, subjects were informed about the link between hypnosis and neuropsychological test performance. They were asked to return about a week later, for a second session involving the assessment of hypnotizability.

At the beginning of Session 2, the subjects were given a second recognition task. Following the recognition task they were asked to read and sign a new consent form for hypnosis and to complete questionnaires measuring absorption, imagery and attitude

towards hypnosis. Once the questionnaires were completed, they received brief information regarding the nature of hypnosis and were asked to raise any questions or concerns they may have about the hypnosis session. Subjects' level of response to hypnosis was measured using the Stanford Hypnotic Susceptibility Scale: Form C (Weitzenhoffer & Hilgard, 1962). The duration of the second session was approximately one hour and 30 minutes. Figure 1 illustrates the experimental procedure and the order of test administration for both experimental sessions.

Materials

Neuropsychological Testing and Memory Tasks:

The neuropsychological tests involved batteries of frontal and non-frontal tests. The frontal battery included the Stroop Test (Stroop, 1935), the Target Detection Test (D2) (Brichenkamp, 1966), the FAS-test of Verbal Fluency, the Trail Making Tests A & B (Reitan, 1986), the Self-Ordered Pointing Task (Petrides & Milner, 1982), the Wisconsin Card Sorting Test Computer Version-2 (Heaton, 1993), and the Continuous Performance Test (Conners, 1994). The non-frontal battery was composed of the Digit-Symbol and the Vocabulary (Short-Version) subtests from the Weschler Adult Intelligence Scale- III (Weschler, 1997), the Rey-Osterrieth Complex Figure Form A (copy and delayed recall), and the Raven Standard Progressive Matrices, Section E (Raven, 1958).

Stroop Test:

The Stroop consisted of 108 randomly presented stimuli: 36 congruent (i.e. the word "red" printed in red), 36 incongruent (i.e. the word "red" printed in blue) and 36 neutral (i.e. a series of XXXs printed in red). The stimuli were in one of four colors: red, blue, yellow or green. They were presented at the center of a MacIntosh 12-inch monitor in capital letters, Times Font 48 points on a white background. Subjects were asked to

EXPERIMENT 1
PROCEDURE

SESSION 1	CONSENT FORM
	WORD LIST
	(Full or Divided Attention Condition)
	DIGIT SYMBOL SUBTEST
	REY COMPLEX FIGURE (COPY)
	STROOP TEST
	RECOGNITION TASK #1
	TARGET DETECTION TEST (D2)
	REY COMPLEX FIGURE (RECALL)
	VOCABULARY (short) SUBTEST
	VERBAL FLUENCY TEST
	RAVEN PROGRESSIVE MATRIX
	TRAIL MAKING A & B
	SELF-ORDERED POINTING TASK
10-minute pause	----------
	CONTINUOUS PERFORMANCE TEST
	WISCONSIN CARD SORTING
SESSION 2	RECOGNITION TASK #2
	CONSENT FORM
	ATTITUDE QUESTIONNAIRE
	IMAGERY QUESTIONNAIRE
	ABSORPTION QUESTIONNAIRE
	STANFORD HYPNOTIC
	SUSCEPTIBILITY SCALE

Figure 1. Experimental Procedure

identify the color of the letter print by pressing keys associated with each color on a keyboard. They were given a 36-trial practice block prior to a 108-experimental-trial block. The Stroop test was programmed by the experimenter using Psyscope 1.1 software for MacInstosh Computer. Response time and accuracy for each type of stimuli were recorded. The mean response time for each type of stimuli was calculated via PsySquash 1.1 software. The Stroop is known to be a robust and reliable measure of perceptual automaticity and cognitive inhibition.

Target Detection Task (D2:)

The test required the subject to search through 6 rows of 40 characters, and cross out occurrences of target characters randomly interspersed among other characters. The test is comprised of three parts of gradually augmenting difficulty A, B and C. Part A has only a simple target; Part B has a single target that is graphically more difficult to detect among distracters. Finally, Part C has a triple target. Subjects were given two rows of Parts A, B, & C as practice trials and were tested on Part C only. Average time taken to complete rows as well as number of omission and commission errors were recorded. Internal consistency on this test is reported to be high, above .80 (Spreen & Strauss, 1998).

FAS- Verbal Fluency Test

This test is viewed as a measure of verbal spontaneous flexibility requiring generation of a diversity of responses depending on effective search strategies. Subjects are asked to produce as many words as possible beginning with a particular letter. The subjects' verbal responses were audiotaped. Validity measures and norms are available for F, A, and S because these letters have been consistently used for this test. Test- retest

reliability coefficients in normal adults have been ranging from .70 to .88 (Spreen & Strauss, 1998). The score is the sum of all admissible words produced in a one-minute time frame for all letters combined.

Trail Making A & B Tests (TMT):

The task involves drawing a line to connect consecutively numbered circles (Part A) and to connect consecutively numbered and lettered circles alternatively (Part B). Scores are the time required to complete the task for each part. The TMT is an attentional task with an interference component, involving visual scanning skills, set-shifting ability, and complex conceptual tracking. Reliability coefficients reported vary from .64 to .94 (Spreen & Strauss, 1998).

Self-Ordered Pointing Test (SOPT):

This task required subjects to point to a different abstract design on pages displaying the same set of stimulus items arranged in different locations. Although the original test includes a 6, 8, 10 and 12 items part only the 10 and 12 items were used in this study. Each series was presented to the subject 3 times. Each time the subject was asked to begin with a different abstract design. The total number of errors summed across trials and sections were recorded. Perseverance errors were scored when the subject pointed to the same design consecutively. The test measures working memory capacity, the ability to organize information and maintain a record and to monitor ongoing progress. Since the SOPT is a relatively new test assessing frontal functions, no norms are available at the present time. The test has been found however, to correlate with the Wisconsin Card Sorting Test ($r = .33$) as well as with the Stroop Test ($r = .36$) (Daigneault et al. 1993).

Wisconsin Card Sorting Test WCST:

For this test, subjects were seated in front of a Packard Bell 486 processor attached to a 13-inch monitor. They were asked to match each card with four stimulus cards varying in color, geometric form and number. As the test progresses, the subjects are receiving feedback in the form of "right" or "wrong" and must maintain or shift categories. The test is said to measure concept formation, the maintenance of a concept in working memory, strategic planning, learning, and the ability to use environmental feedback to shift cognitive goals. Scores involved the number of categories completed, the number of trials required to complete them, as well as the number of errors and perseverative errors. Age and education corrected standardized scores were used for this study. Test-retest reliability coefficients reported for the WCST are only moderate in value, ranging from .37 to .72 for errors but the use of computer software has been found to increase reliability considerably (Heaton, 1993).

Continuous Performance Test (CPT):

A computarized version of the Conner's CPT was run on the Packard Bell 486 processor with a 13-inch monitor. White lowercase letters on a black background are presented one a time at the center of the screen at 1, 2 or 4 seconds intervals. Subjects had to press a key when any letter other than "x" appeared on the computer screen. This test is said to measure sustained attention, vigilance and impulsivity. Standardized scores for response time are available. Omission and commission errors were also recorded. Measures derived from this version of the CPT are reported as having adequate split-half and test-retest reliability, however, reliability figures have not been published (Halperin et al. 1991).

Digit Symbol Subtest (DS):

The test involved reproduction of symbols associated with particular numbers in a limited timeframe. The test measures psychomotor speed, learning, and visual short-term memory. Scoring is achieved by subtracting errors from the total number of completed items. Age corrected standardized scores were derived from norms based on WAIS-R test. Split-half reliability coefficient reported for this test is .82 (Kaufman, 1990).

Raven Standard Progressive Matrices (SPM):

Test items on the SPM required subjects to infer a rule relating to a collection of elements and then to use the rule to generate the next items in a series. Although the original test involves 5 sections of 12 matrices presented in an order of increasing difficulty from the most simple to the most complex sections, only section E, was used in the present study. In addition, the original version of SPM has no time limit; however, for the purpose of this study a limit of 2 minutes per matrix in the section was imposed. The score was the sum of items correctly solved. The test is known to measure general intellectual abilities, particularly inductive non-verbal reasoning. Reliability estimates for the entire test are above .70 (Spreen & Strauss, 1998).

Rey-Osterrieth Complex Figure Test:

The procedure for this test involves having the subject copy the figure and then, without prior warning, reproduce it from memory. A minimum of 2.5 minutes and a maximum of 5 minutes were used for the copying phase. If subjects completed the task before the minimum time, they were instructed to continue looking at the figure until the experimenter took the figure away. No time limit was assigned for the recall phase. The test assesses visuospatial constructional ability and non-verbal memory. Scoring was

based on 18 elements outlined in the Taylor (1959) scoring system. Split-half and coefficient alpha reliability are above .60 for copying and above .80 for the 30 minute delay condition (Spreen & Strauss, 1998).

Vocabulary Subtest (Short-version):

The short version of the WAIS-R Vocabulary subtest was based on odd numbered items from the original test. Subjects were asked to give a verbal definition for 15 words and were cued for more information based on the WAIS-R standardized instructions. Verbal responses were audiotaped. Age-corrected standardized scores are available for this test. The test generally measures general intellectual abilities, particularly verbal comprehension and conceptualization. Test-retest and split-half reliability coefficients for the entire test are .92 and .96 respectively (Kaufman, 1990).

Study List and Recognition Task:

The material for the memory task consisted of a pool of 133 words of moderate frequency ranked > 2,000 but < 10,000 per million in Carroll, Davies and Richman (1971). The word pool was composed of an equal amount of abstract and concrete words with a maximum of three syllables in length (see Appendix B). The study list consisted of 58 words presented at the rate of one word per 3 sec. with a one-second interval between each word. The study list began with 4 buffer words to control for primacy effect, and ended with 4 buffer words to control for recency effect. For the divided attention condition, a string of random digits ranging from 1 to 4 were played on a tape recorder. The digits were recorded at a rate of one digit per 0.66 sec. Subjects were instructed to raise their hand to indicate that they had detected a "3-2-2' sequence while attempting to memorize words from to the study list simultaneously. The retention

interval between the study phase and the first recognition task was 15 minutes.

The first recognition task consisted of 50 words derived from the study list (TARGETS) mixed with 50 distracter words (LURES). The complete word list is provided in Appendix C. The second recognition task was administered approximately one week later and was composed of 25 words derived from the study list (TARGETS), 25 distracter words from the first recognition task (LURES), and 25 new words (NEW). The word list for the second recognition test is provided in Appendix D. The study list and the recognition tasks were programmed by the experimenter using the PsyScope 1.1 software. Words were presented one at a time, on a MacIntosh LC II 12-inch monitor, in white characters against a black background. The words appeared in capital letters, "Times" font 48 points.

For both recognition tasks, subjects had to judge each word as being part of the study list by pressing "Y" or "N" keys on a keyboard for a "yes" or "no" judgment. For each "yes" response the subject had to further indicate if he/she remembered, knew or guessed that the word was on the list, by pressing "R", "K" or "G" on the keyboard (detailed instructions for this procedure and standardized instructions for the neuropsychological tests are outlined in Appendix E).

Assessment of hypnotizability and other measures:

All subjects underwent an individual hypnosis session involving the administration of the Stanford Hypnotic Susceptibility Scale: Form C (SHSS). The session began with a relaxation induction and was followed by a series of 12 suggestions ranging in response difficulty. Easier items typically involved a motoric component such as a feeling of heaviness in an extended arm when subjects are given the suggestion that

their arm begins to feel heavier and heavier. More difficult items required cognitive responses such as imagining a mosquito flying in the room, having a dream, or forgetting the events of the session until given a cue to reverse the suggested amnesia. A complete script of the SHSS: C is provided in Appendix F.

Following the hypnosis session, subjects were asked to report their subjective experience by answering open-ended questions. Scoring ranges from 0-12, and was based on the experimenter observation of the subject's behavior following suggestions (Scoring criterion are described in Appendix H). The SHSS: C is known to have a Kuder-Richardson total scale reliability index of .85 (Perry, Nadon & Button, 1992). Cutoffs for classification of subjects into categories of degree of hypnotic responding were established as follows: scores from 9 to 12 fell in the "High" category, scores from 5 to 8 in the "Medium " category, and scores from 0 to 4 made the "low" hypnotizable category.

The Individual Differences Questionnaire (IDQ) questionnaire from Paivio & Harshman, 1983), is a 21-item subscale measuring mental imagery. The items on this scale were chosen from the 86 original item version proposed by Paivio (1971). The items were selected on the basis of a three factor solution; habitual use of imagery, use of images to solve problems, and vividness of dreams, daydreams and imagination. Answers to statements such as "I often use mental images or pictures to help me remember things" are formulated in a 5-point Likert Scale format ranging from -2 to 2 (-2 referring to extremely uncharacteristic and +2 to very characteristic). A version of this questionnaire is provided in Appendix K).

The Differential Personality questionnaire: Absorption also referred to as the Tellegen Absorption Scale (TAS): is a 34-item scale measuring the degree of personal

involvement in fantasy, new experiences, and absorbing events. Subjects respond "True or False" to statements describing experiences (i.e. "When I listen to music, I can get so caught up in it that I don't notice anything else"). The total score was based on the sum of all "True" answers (see Appendix L). An internal consistency reliability coefficient of 0.89 has been reported for this scale (Isaacs, 1982).

The Carleton Attitude Scale is a 14-item questionnaire measuring positive attitudes towards hypnosis (see Appendix M). The scale is composed of three subscales measuring positive beliefs about hypnosis, fearlessness concerning hypnosis, and beliefs regarding the mental stability of hypnotizable people. Cronbach's alpha values of .81 for the total scale, .72 for positive beliefs, 68 for mental stability and .70 for fearlessness have been reported in Spanos et al. (1987).

Results

Experiment 1 first sought to address the relationship between frontal neuropsychological tests and hypnotizability by analyzing interrelations between these variables using the entire sample. Variables found to correlate with hypnotizability were used as predictors of this ability in a multiple regression framework. A second question addressed the relationship between hypnotizability and episodic memory. To answer this question the memory data was analyzed by comparing types of memory responses and accuracy by conditions (full vs. divided attention), and was also examined using correlation analyses with hypnotizability scores.

Neuropsychological Data

Outlier Analyses and Normality Tests

In order to screen for univariate outliers, standardized values from all scores on neuropsychological tests and other measures (SHSS, attitude, absorption and imagery scales) were examined. Cases with standardized values in excess of $Z = \pm 4.00$ were considered as outliers. The following outlying scores were deleted: Trail Making B, cases #37 and #67, Rey Complex Figure Copy, case #7. The following outlying scores were modified by assigning a raw score one unit larger than the next most extreme score in the sample's distribution: Target Detection Test Commission Error scores for cases #26 and #61; Target Detection Test Omission Error scores for cases #53 and #58. Stroop reaction time was screened for extreme values using a maximum and minimum descriptive statistics (Psysquash 1.1 software). Reaction times above 2000 ms were replaced by the subject's average response time of all other trials for that particular condition (congruent, incongruent, neutral). Such extreme scores resulted from

occasional distraction during the test administration causing one score to be as high as 11,000 ms and creating distortions in means of reaction time responses usually for one condition. Seventeen cases were found to present such distortions.

Mahalanobis distances between variables were examined to screen for possible multivariate outliers, using SPSS regression analysis (residual) with a dummy dependent variable. No multivariate outliers were found using this procedure. Univariate normality tests were conducted by examining skewness and kurtosis values for each variable. Tests for skewness revealed that all variables were within an acceptable range. Some variables, had slightly elevated kurtosis values. D2 commission errors (3.94) and Stroop errors (3.44), however, the impact related to a departure from zero has been found to tamper off in larger sample (Stevens, 1992). Examination of normal probability plots, as well as bivariate scatterplots indicated that assumptions of normality, linearity, and homoscedasticity were met.

Demographic Factors

Independent sample t-tests were conducted on all neuropsychological test scores in order to screen for gender differences. Only the Digit Symbol (DS) score variable showed a significant difference between male and female performance; $t_{(92)} = -1.95$, $p < .05$. Female subjects on average had higher standard scores than male subjects on this test: $M = 12.13$, $SD = 1.80$ for males, and $M = 13.09$, $SD = 2.17$ for females.[1]

Language differences were of concerns for three variables; VF, VOC, and the Stroop. One-way ANOVAS were performed on these variables with language groups (English, English & French, English & Others) as a between subject factor. The sample was composed of 38% English speaking subjects, 28% English and French speaking

subjects, and 33% spoke English and a third language. The groups did not differ for the VF score, $F(2, 91) = 1.84, p = .16$. Language had no effect on Stroop measures as well; $F(2, 90) = 1.71, p = .19$ for congruent trials; $F(2,90) = .65, p = .53$ for neutral trials; and $F(2,90) = .64, p = .53$ for incongruent trials. However, a significant language effect was found for the VOC subtest, $F(2, 91) = 4.20, p = .02$. Subjects whose first language was English performed better on this test, $M = 12.08$; $SD = 2.13$ compared to subjects whose first language was French, $M = 11.56$; $SD = 1.92$, and students speaking a third language, $M = 10.63$; $SD = 2.18$.

In order to investigate whether education was not a major confounding variables, subjects were grouped into four groups: (1) High School = 11 to 12 years; (2) College = 13 to 14 years; (3) Bachelor = 15 to 17 years and (4) Graduate = 18 years and over. The distribution of subjects according to levels of education was 6% high school, 20% college, 66% Bachelor, and 8% Graduates. A one-way ANOVA with all tests scores (excluding WCST standard scores which were age and education corrected) and education groups as a between subject factor was performed. Although SOPT errors and one STROOP measure (STROOPC) appeared to be possibly influenced by education[2], only the difference on STROOPC due to education was large enough to reach statistical significance: $F(3, 89) = 2.51, p = .06$ for SOPTE, and $F(3, 89) = 2.72, p = .05$ for STROOPC. In contrast to what would be expected, subjects with the highest level of education (n=8) gave slower response on congruent trials. Considering the small number of subjects classified in this category, the difference in performance was assumed to reflect individual differences.

Frontal Hypothesis:

To examine the role of frontal lobe processing in hypnosis Pearson Product correlation coefficients (pairwise) were performed first between frontal neuropsychological test scores and hypnotizability: (WSCT, VF, SOPT, STROOP and SHSS). Significant positive correlations were observed between SHSS and all three WCST standard score measures; WCSTC ($r = .29, p < .01$), WCSTPE ($r = .25, p < .05$), and WCSTE ($r = .28, p < .01$), as well as the number of perseverative errors on the SOPT ($r = .22, p < .05$). The intercorrelation matrix for these tests is presented in Table O1, Appendix O.

The analysis of intercorrelations for the STROOP variables (frontal-automaticity) and hypnotizability was conducted next. The results indicated significant negative correlation coefficients between all STROOP measures and SHSS ($r = -.23, p < .05$ for congruent trials, $r = -.21, p < .05$ for neutral trials, and $r = -.25, p < .05$ for incongruent trials). Since all three STROOP measures significantly correlated with SHSS, they were collapsed into a single STROOP measure for the remaining analyses. The intercorrelation matrix for the Stroop variables is displayed in Table O2, Appendix O. Indexes of facilitation (STROOP congruent – neutral) and interference (STROOP incongruent – neutral) were not found to correlate significantly with SHSS; ($r = -.09$) for facilitation and ($r = -.17$) for interference.

A third analysis of intercorrelations examined the relation between hypnotizability and frontal attentional measures: D2, Trail Making Tests and CPT. Significant correlation coefficients were observed for two of the D2 measures: reaction time D2RT correlated negatively ($r = -.28, p < .01$) and omission errors D2O correlated

positively ($r = .25, p < .05$) with SHSS (see Table O3, Appendix O for matrix of correlation). Scores on the Trail Making Tests and the CPT did not correlate with hypnotizability.

The following correlation coefficients were observed among frontal tasks; WCST errors as expected were found to strongly correlate with the SOPT score ($r = -.32, p = .002$). WCST errors and perseverative errors correlated with the Stroop and the D2 reaction time measures ($r = -.22$, $r = -.24$) for the Stroop, and ($r = -21$, $r = -.30$) for D2 reaction time. WCST perseverative errors also correlated with response time on the Trail Making A test ($r = -.26$), and a measure of attentiveness on the CPT ($r = -.22$).

Verbal Fluency was found to correlate only with D2 reaction time ($r = -.22$), and to be more strongly related to performance on the Vocabulary Test score ($r = .42$, $p < .001$). SOPT errors correlated significantly and equally with both D2 reaction time and D2 errors ($r = .26$). SOPT errors also correlated significantly with attentional measures: Trail Making A ($r = .22$), Trail Making B ($r = .43$), CPT reaction time ($r = .21$), and CPT commission errors ($r = .33$). The Stroop was found to correlate significantly with attentional measures as well: with D2 reaction time ($r = .38$), with Trail Making A & B ($r = .34$ and $r = .37$) respectively, and with CPT reaction time ($r = -.37$). The Stroop was also observed to strongly correlate with the DS score ($r = .46$). D2 reaction time significantly correlated with Trail Making A & B ($r = .40$, $r = .38$) respectively. An additional measure of cognitive flexibility was derived from Trail Making B minus Trail Making A reaction time. Although this measure was found to correlate positively with STROOP measures ($r = .23$ for

congruent; r = .23 for incongruent; r = .27 for neutral), the cognitive flexibility measure did not significantly correlate with SHSS (r = -.13).

Intercorrelations between non-frontal neuropsychological test scores and hypnotizability (SHSS) were investigated to further examine the hypothesis that superior processing abilities in more hypnotizable subjects were exclusively related to frontal tasks. Variables examined for non-frontal tests included REY Complex Figure scores, the Vocabulary subtest score, the Raven Standard Progressive Matrices score, and the Digit Symbol score. SHSS did not correlate significantly with REY Complex Figure variables: copy (r =.05), recall (r = -.06), and reaction time (r =.01). Vocabulary also did not correlate significantly with SHSS (r = .10). There appeared to be some relation between SHSS and the Raven and DS scores however, correlation coefficients were not large enough to reach significance (r = -.20) for the Raven score, and (r = .20) for the DS score. The correlation coefficients and their statistical significance are reported in Table O4, Appendix O.

Correlation coefficients between other neuropsychological tests were also of interest to examine evidence of shared cognitive processes among these measures. The Rey Complex Figure reaction time correlated significantly with all other tasks involving a speed component: Stroop (r = .21), D2 reaction time (r = .32), Trail Making A (r = .20), and DS score (r = .22) with the exception of a negative correlation with CPT reaction time (r = -.21). The Rey Complex Recall variable was found to significantly correlate with the Raven score (r = .35). Finally, the Raven score and the Vocabulary score, both indexes of general intellectual abilities correlated significantly as well (r = .26).

Prediction of Hypnotizability

A standard multiple regression was performed between hypnotizability (SHSS) as the dependent variable, and frontal measures which were found to be related to SHSS. These variables included WCSTC, SOPTPE, STROOP reaction time on incongruent trials, D2RT and D2 omission errors. The WCST conceptual variable was chosen among other WCST variables because this score reflected a more general performance on this test. Response time on STROOP incongruent trials was also viewed as a better measure of frontal inhibition than reaction time on other trials. Variables that had gained empirical support as predictors of hypnosis (ATTITUDE, ABSORPTION and IMAGERY) were entered in a first block in order to examine the contribution of frontal variables independently, and over and above that of known predictors[3]. Table 1 displays correlation coefficients between predictors and the dependent variable, unstandardized regression coefficients *(B)*, standardized regression coefficients *(β)*, R^2 and adjusted R^2 values.

As expected significant correlation coefficients were observed between SHSS and ATTITUDE ($r = .29$), ABSORPTION ($r = .34$) and IMAGERY ($r = .29$). When the three variables were entered together, only ATTITUDE emerged as a significant predictor. The established predictors of hypnosis combined accounted for 18% of the variance (15% adjusted). When frontal test variables were entered in a second block, two frontal variables emerged as significant predictors: SOPTPE and D2 omission errors. The five frontal tests variables combined contributed to an additional 17% (14% adjusted) in variability accounted for in hypnotizability.

In order to determined the percentage of variance accounted for by each frontal

Table 1

Summary of Standard Regression of Frontal Variables on Hypnotizability (N= 90)

Dependent Variable			SHSS score			
Block 1			$R^2 = .18$ Adj. $R^2 = .15$		$F(3, 86) = 6.19, p < .001$	
Predictor Variables	*M*	*SD*	*r*	*B*	*SE B*	β
Attitude	73.87	12.49	.29	.05	.02	.22*
Absorption	20.63	6.43	.34	.08	.05	.19
Imagery	60.90	13.30	.29	.03	.02	.16
Block 2			$R^2 = .35$ Adj. $R^2 = .29$		$F(8, 81) = 5.45, p < .001$	
Predictor Variables	*M*	*SD*	*r*	*B*	*SE B*	β
Attitude	73.87	12.49	.29	.03	.02	.14
Absorption	20.63	6.43	.34	.07	.04	.17
Imagery	60.90	13.30	.29	.03	.02	.14
WCST (conceptual)	104.19	9.69	.29	.05	.03	.18
SOPT perseverative	1.08	1.17	.22	.49	.20	.22*
STROOP (RT inc)	724.22	124.53	-.25	-.01	.01	-.11
D2 reaction time	21.87	4.80	-.28	-.06	.05	-.12
D2 omission errors	7.77	7.28	.25	.07	.03	.19*

** $p < .01$, * $p < ..05$

task predictor, a second hierarchical regression analysis was conducted. The order of entry of frontal task variables was determined on theoretical bases and established empirical support linking predictor variables to hypnosis. WCST conceptual was entered first, followed by the STROOP incongruent measure. The next variables were D2 omission errors, and D2RT. Reaction time on the D2 target detection was associated with more omission errors, therefore the variance for errors logically, had to be removed first. Since SOPTPE had no history of correlation with hypnosis, it was entered last. Table 2 presents the unstandardized regression coefficients (*B*), the standardized regression coefficients (β), and increments of change Δ.

The regression was significant at the end of each step. After Step 1, with WCST conceptual alone in the equation, $R^2 = .08$, $F = (1, 88) = 8.09$, $p < .01$. After Step 2, with the STROOP incongruent variable added to the equation, $R^2 = .12$, $F = (2, 87) = 5.67$, $p < .01$. After Step 3 with the addition of D2 omission errors as a predictor, $R^2 = .17$, $F(3, 86) = 5.90$, $p < .001$. At Step 4 with D2 reaction time adding to the equation, $R^2 = .18$, $F(4, 85) = 4.81$, $p < .002$. Finally at Step 5 with SOPTPE as the last predictor in the equation, $R^2 = .25$, $F(5, 84) = 5.51$, $p < .001$.

Pearson's correlation coefficients were also examined when subjects were classified by hypnotizability groups (HIGH, MEDIUM, LOW). For the LOW hypnotizability group ($n = 24$), ABSORPTION had the highest correlation with SHSS scores ($r = .46$), $p < .05$. For the MEDIUM hypnotizability group ($n = 54$), ATTITUDE ($r = .42$), $p < .01$), and STROOP ($r = -.31$), $p < .05$ significantly correlated with SHSS scores. For the HIGH hypnotizable group ($n = 12$), the following variables had the strongest correlation coefficients; WCST conceptual ($r = .46$), STROOP ($r = -.32$), D2 reaction time ($r = -.38$), and ATTITUDE ($r = .28$). None of the coefficients for the high hypnotizable group reached significance due to small sample

Table 2

Summary of Hierarchical Regression Analysis for Frontal Tests as Predictors of Hypnotizability (N= 90)

Variables	*B*	*SE B*	β	ΔR^2
Step 1				
WCST (conceptual)	.08	.03	.29**	.08
Step 2				
WCST (conceptual)	.06	.03	.24*	
STROOP (RT)	-.01	.00	-.18	.04
Step 3				
WCST (conceptual)	.06	.03	.22*	
STROOPC (RT)	-.01	.00	-.20	
D2 omission errors	.09	.04	.24*	.05
Step 4				
WCST (conceptual)	.06	.03	.19	
STROOPC (RT)	-.00	.00	-.16	
D2 omission errors	.08	.04	.21*	
D2 reaction time	-.07	.06	-.13	.01
Step 5				
WCST (conceptual)	.06	.03	.22*	
STROOPC (RT)	-.00	.00	-.19	
D2 omission errors	.07	.04	.18	
D2 reaction time	-.06	.06	-.12	
SOPTPE	.55	.21	.25**	.07

** p .01; * $p < .05$

size. Mean standardized scores on the WCST conceptual variables increased as a function of hypnotizability levels; for the LH group $M = 100.58$; $SD = 9.44$, for the medium hypnotizable group $M = 104.93$; $SD = 9.61$, and for the HH group $M = 108.08$; $SD = 8.98$.

Memory Data

Outlier Analyses

Univariate outliers were identified by obtaining standardized values on all memory variables (number of REMEMBER, KNOW, and GUESSING responses, and number of TARGET and LURE words following a 15 minute delay; and number of REMEMBER, KNOW, and GUESSING responses, and number of TARGET, LURE, and NEW words following a one-week delay) grouped by conditions. Values in excess of $Z = \pm 3.00$ were considered as outliers. Case #27 in the full attention group was identified as an outlier on the number of KNOW responses for the one-week delay recognition task. The subject's raw score on this variable was changed for a score one unit larger than the next larger score in the full attention group. No other outlier cases were found.

Multivariate outliers were examined in each condition using Mahalanobis distance from SPSS regression analysis (residual) with a dummy dependent. Number of REMEMBER, KNOW and GUESSING responses for the 15-minute delay task were examined as a first group; number of REMEMBER, KNOW, and GUESSING responses for the one-week delay recognition task as a second group; number of TARGET and LURE words for the 15-minute delay task as a third group, and number of TARGET, LURE, and NEW words for the one-week delay task as a fourth group. No outlier cases were found.

Examination of bivariate scatter plots and normal probability plots for the 15 –minute delay recognition task (REMEMBER, KNOW and GUESSING variables) and (TARGET and LURE words) indicated that the assumptions of linearity and

normality were reasonably met for these variables combined. Univariate normality was assessed by the examination of Kurtosis and Skewness coefficients. Tests for Kurtosis and Skewness significance revealed that all dependent variables had coefficients within acceptable range (Stevens, 1992). Boxs M tests for multivariate homogeneity of covariance were significant for number of REMEMBER, KNOW and GUESSING responses combined. The determinant of covariance matrix was 1.5 time greater in the full attention group, suggesting that the multivariate assumption of homogeneity of variance was not respected. Inspection of univariate homogeneity of variance tests indicated that for two of the variables (REMEMBER and GUESSING) the variance was heterogeneous. The consequences of violating this assumption for equal groups (in this case both groups are equal (n = 45) on the Type I error however, have been found to be minimal (Tabachnick & Fidell, 1996).

Graphical examination of normal probability plots and bivariate scatter plots for the number of REMEMBER, KNOW and GUESSING responses, and for TARGET, LURES and NEW words for the one-week delay recognition task also confirmed that assumptions of linearity and normality were respected. Skewness and kurtosis values for each dependent variable were obtained to assess univariate normality. Such values were all within acceptable range according to sample sizes (Stevens, 1992). Boxs M and Bartlett-Box tests confirmed homogeneity of variance and covariance across groups.

Recognition Data (Short Delay)

The proportion of positive recognition responses was first examined in both conditions. The difference in amount of "yes" responses by study conditions was not significant F (1,91) = 3.19, p = .08. Subjects in the full attention condition responded positively to 44% of the words in the recognition task and to 40% of the words in the divided attention condition.

To examine whether study conditions had an effect on types of recognition following a15 minute delay, the data was entered in a 2 X 3 multivariate analysis of

variance with conditions (full attention and divided attention) as a between subject factor and types of recognition (REMEMBER, KNOW, GUESSING) as within- subject variables. The results of the multivariate analysis of variance for types of recognition combined revealed a significant effect of conditions; $F(3, 86) = 11.52, p < .0001$. Univariate tests further indicated that subjects in the full attention condition reported a higher number of REMEMBER responses: $F(1, 88) = 31.70, p < .0001$, and subjects in the divided attention condition reported a higher number of GUESSING responses $F(1, 88) = 11.86, p < .001$. The means and standard deviations for each type of recognition responses for the full attention condition were $M = 25.62$; $SD = 12.14$ for remember, $M = 8.53$; $SD = 6.89$ for know; and $M = 9.84$; $SD = 6.56$ for guessing responses. For the divided attention condition, the means and standard deviations for each type of recognition responses were $M = 13.51$; $SD = 7.80$ for remember, $M = 9.98$; $SD = 5.36$ for know, and $M = 15.73$; $SD = 9.41$ for guessing responses. The sources for the univariate analyses of variance are reported in Table P1, Appendix P. Figure 1 illustrates the effect of conditions on types of recognition.

The effect of study conditions on accuracy was examined using a 2 X 2 multivariate analysis of variance with TARGET and LURE words as within subject variables and conditions as a between subject factor. The results indicated a significant effect of conditions; $F(2, 87) = 16.63, p < .001$ for both variables combined. Univariate tests revealed that the number of TARGET words was significantly higher in the full attention group $F(1, 88) = 20.51, p < .001$, and the number of LURE words was significantly higher in the divided attention group $F(1, 88) = 4.91, p < .03$. The means and standard deviations were: $M = 36.51$; $SD = 8.89$, $M = 28.58$; $SD = 7.69$ for TARGET words in the full and divided attention conditions respectively; and $M = 7.60$; $SD = 6.71$, $M = 10.73$; $SD = 6.71$ for LURE words in the full and divided attention conditions

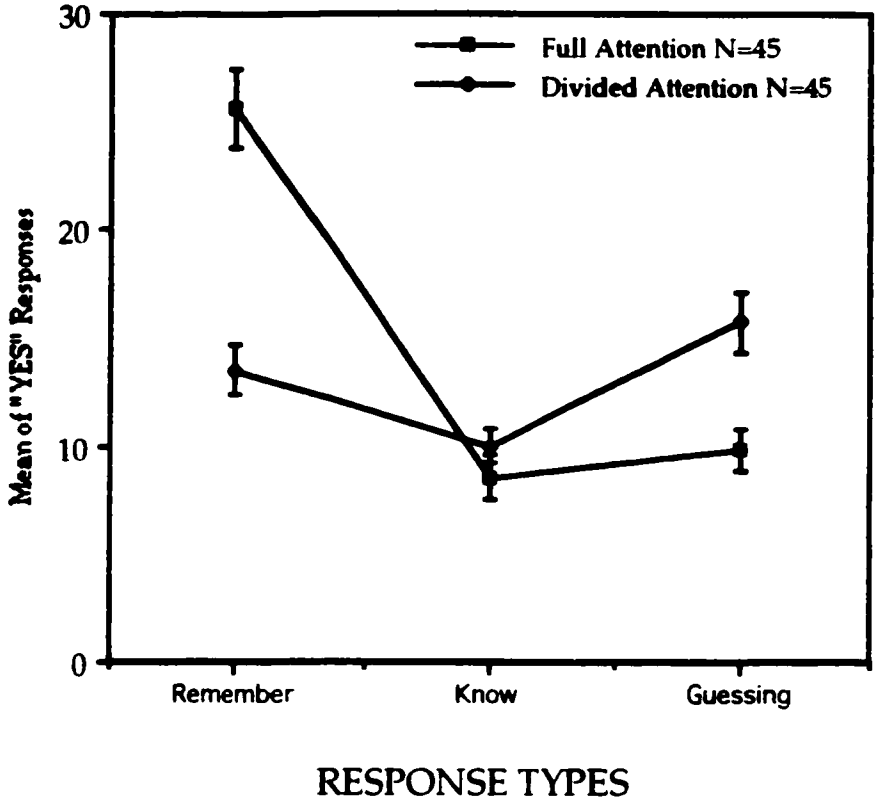

Figure 1. Mean of Recognition Responses by Types as a Function of Study Conditions Following a 15-Minute Delay.

respectively.

The sources for univariate analyses of variance are reported in Table P2, Appendix P. A subsequent one-way ANOVA was performed using an overall accuracy variable (TARGETS - LURES). The results of this procedure indicated that subjects in the full attention condition were more accurate in recognizing words from the study list after the number of errors was controlled for $F(1, 88) = 33.24, p < .0001$. Figure 2 illustrates the effect of study conditions on the number of TARGET and LURE words recognized from the study list. Proportions of lure words by response types for the full attention condition were .02 for remember, .04 for know, and .10 for guessing. For the divided attention condition, the proportions of lure words by response types were .02 for remember, .06 for know, and .14 for guessing. No difference was found in terms of proportion of remember responses for lure words by conditions. Although the proportion of know responses for lure words was slightly higher in the divided attention condition, the difference was not significant $F(1,91) = 3.73, p = .06$. The proportion of lure words guessing responses was significantly greater in the divided attention condition $F(1,91) = 4.49, p < .05$.

Recognition Data (Long Delay)

Both types of recognition as well as accuracy were analyzed for the second recognition task administered approximately a week a later. Only data from subjects who came back after a delay between 6 to 8 days were considered (59% of total sample). The mean number of days between the study phase and the second recognition test was 6.92 days for the full attention group and 7.11 days for the divided attention group. The proportion of affirmative responses was first examined for both study conditions. No difference in terms of proportions of "yes" responses by conditions was found $F(1,53) = .011, p = .92$. Subjects in both study conditions responded affirmatively to 47% of the words in the one-week delay recognition task.

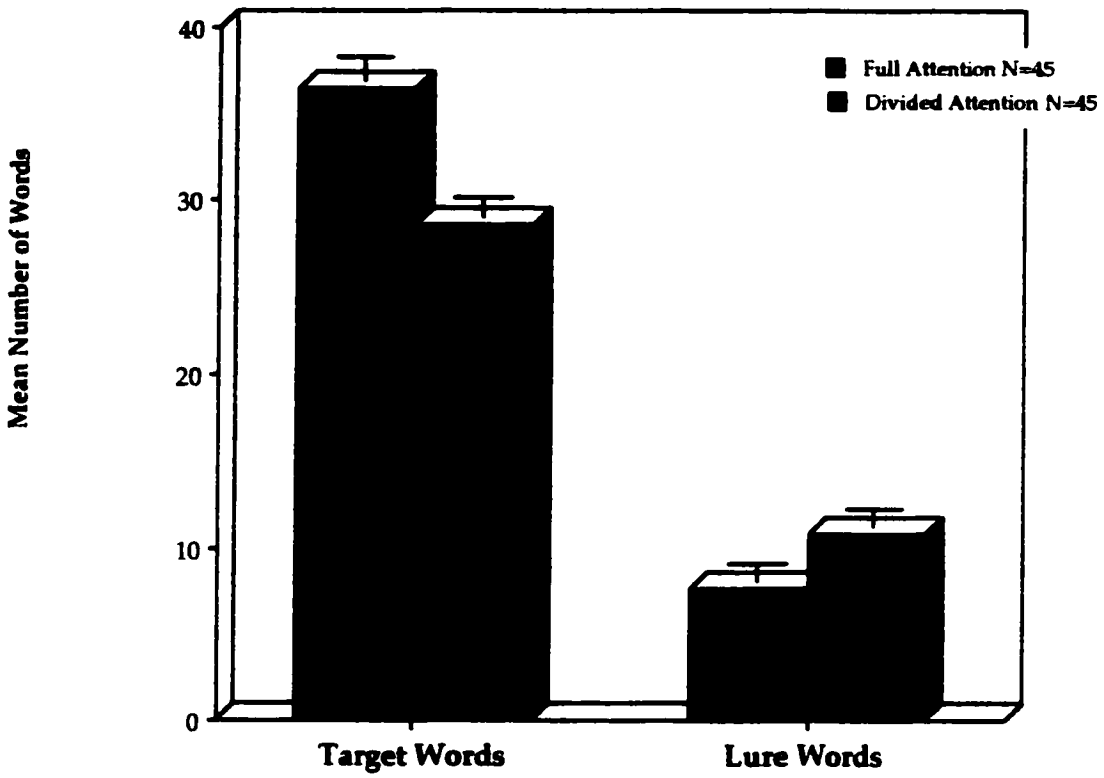

Figure 2. Mean Number of Target and Lure Words Recognized as a Function of Study Condition.

The number of responses by types (REMEMBER, KNOW, and GUESSING) were analyzed in a 2 X 3 MANOVA with conditions as a between subject factor. The results indicated that there was no significant difference between study condition groups on types of recognition responses combined after a one-week delay $F(3, 49) = 2.14$, $p = .10$. The results of univariate tests were also non-significant; for number of REMEMBER responses $F(1, 51) = 3.10$, $p = .08$, for number of KNOW responses $F(1, 51) = 1.84$, $p = .18$, and for number of GUESSING responses $F(1, 51) = 1.58$, $p = .22$. Source Tables for univariate tests are reported in Table Q1, Appendix Q. Measures of central tendency and variability for the three dependent variables were for the full attention condition, $M = 13.88$,;$SD = 9.06$ for remember, $M = 7.77$; $SD = 5.54$ for know, and $M = 12.54$; $SD = 9.09$ for guessing responses. For the divided attention conditions, measures of central tendency and variability were $M = 9.93$; $SD = 7.23$ for remember, $M = 10.19$; $SD = 7.26$ for know, and $M = 15.63$; $SD = 9.17$ for guessing responses. Figure 3 displays the effect of study conditions on types of recognition responses following a one-week delay.

Accuracy variables following a one-week delay were analyzed in a 2 X 3 MANOVA with conditions as a between subject independent variable and number of TARGET, LURE and NEW words as dependent variables (within-subject). The results of the multivariate analysis of variance revealed a significant difference between groups on the three variables combined $F(3, 49) = 5.72$, $p < .002$. Univariate tests indicated that the groups did not differ significantly on the mean number of LURE words, $F(1, 88) = 1.33$, $p = .25$, and on the mean number of NEW words $F(1, 88) = 2.88$, $p = .10$ following a one-week delay. Subjects in the full attention condition, however, recognized a higher number of TARGET words: $F(1, 88) = 4.06$, $p < .05$. Measures of central tendency and variability for the number of TARGET, LURE and NEW words in

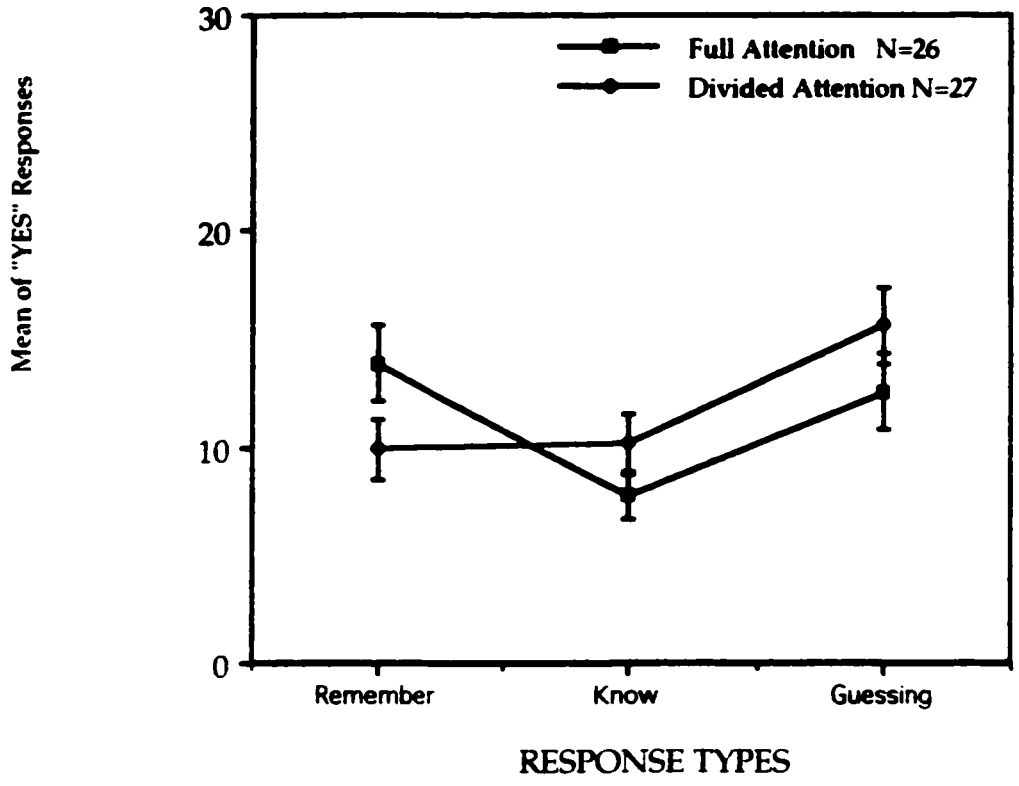

Figure 3. Mean of Recognition Responses by Types as a Function of Study Conditions Following a One-Week Delay

each group were for the full attention condition $M = 19.04$; $SD = 4.50$ for target words, $M = 10.31$; $SD = 5.16$ for lure words, and $M = 5.08$; $SD = 3.84$ for new words. For the divided attention measures of central tendency and variability for target words $M = 16.82$; $SD = 3.49$, for lure words $M = 11.93$; $SD = 5.04$, and for new words $M = 6.85$; $SD = 3.78$. A one-way ANOVA using an overall accuracy variable (HITS-LURES-NEW) revealed that subjects in the full attention group remained more accurate at recognizing words from the study list following a one-week delay after errors were subtracted. Source tables for analysis of variance are displayed in Table Q2, Appendix Q. Figure 4 illustrates the number of TARGET, LURE and NEW words recognized as a function of study conditions.

The proportion of lure words by type of responses for the full attention condition were .09 for remember, .11 for know, and .23 for guessing. For the divided attention condition the proportion of lure words were .11 for remember, .14 for know, and .23 for guessing. Differences between study groups in terms of proportion of lure words recognized by type of responses were not significant. The proportion of new words by type of responses for the full attention condition were .02 for remember, .01 for know, and .08 for guessing. For the divided attention condition, the proportion of new words recognized by error were .01 for remember, .04 for know, and .12 for guessing. Study groups differed significantly on the proportion of know responses for new words $F(1,53) = 5.21$, $p = .03$.

Hypnotizability and Recognition Memory Hypotheses

Pearson Product Moment correlation coefficients (pairwise) were performed first between hypnotizability (SHSS score) and types of recognition (REMEMBER, KNOW and GUESSING) responses following a 15-minute and a one-week delay respectively. For the 15-minute delay in the full attention group, a significant correlation was observed

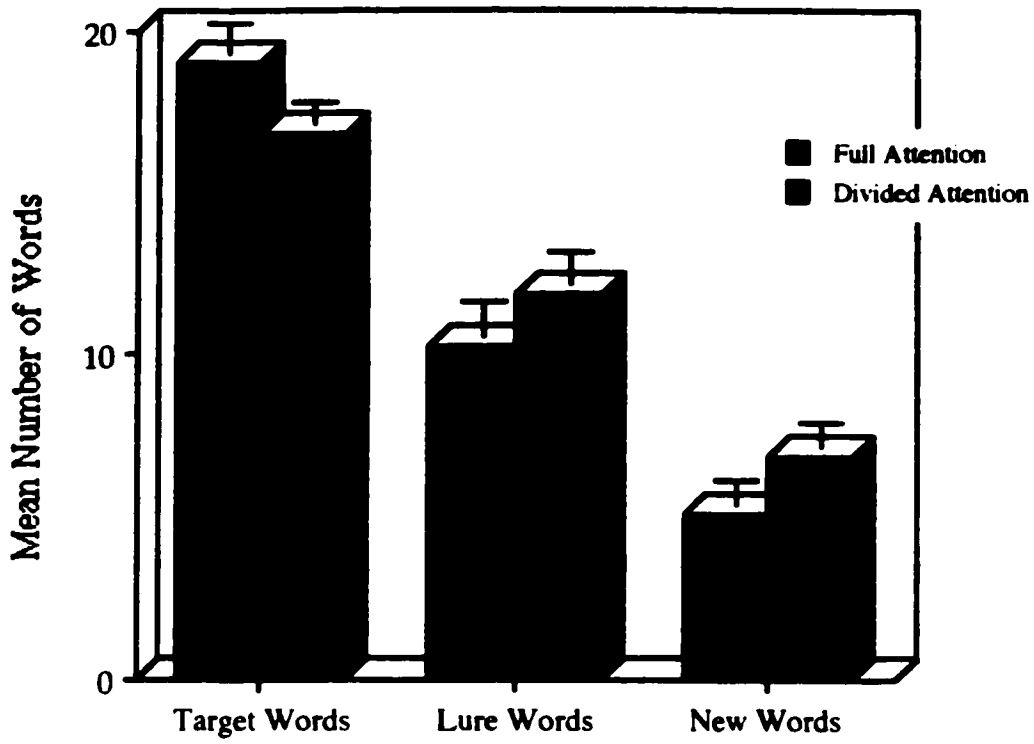

Figure 4. Mean Number of Target, Lure and New Words Recognized as a Function of Study Conditions.

between hypnotizability and the number of REMEMBER responses ($r = .42, p < .001$). For the divided attention group a significant correlation was found between hypnotizability and the number of GUESSING responses ($r = .49, p < .001$). A complete correlation matrix is provided in Table R1, Appendix R. Following a one-week delay, no significant correlation coefficients were observed for the three types of recognition responses in neither of the study condition groups. The correlation matrix for the one-week delay responses is reported in Table R2, Appendix R.

Pearson Product Moment correlation coefficients (pairwise) were also performed between hypnotizability and accuracy variables; number of TARGET and LURE words as well as overall accuracy for the 15-minute delay recognition task, and number of TARGET, LURE, NEW words and overall accuracy for the one-week delay recognition task. For the full attention group after a 15-minute delay, a significant correlation was observed between SHSS score and number of TARGET words recognized from the study list ($r = .37, p < .01$), the correlation between hypnotizability score and the overall accuracy score (TARGETS-LURES) however, was not significant ($r = .25, p < .09$). For the divided attention group, significant correlation coefficients were found between SHSS score and number of LURE words ($r = .51, p < .001$), and number of TARGET words ($r = .29, p < .05$). Overall accuracy score for the divided attention group did not correlate significantly with hypnotizability ($r = -.15, p = .34$). Hypnotizability was found to be related to a higher proportion of know responses for LURE words ($r = .30, p < .05$) in the full attention condition and a higher proportion of guessing responses for LURE words in the divided attention condition ($r = .55, p < .001$). The correlation matrix for accuracy variables and hypnotizability score is reported in Table R3, Appendix R. For the full attention group following a one-week delay, hypnotizability score did not significantly correlate with number of TARGET, LURE or NEW words recognized as part of the study list. For the divided attention group, a significant correlation between hypnotizability and the number of LURE words was observed ($r = .49, p < .01$). Overall

accuracy rate did not correlate with hypnotizability in neither of the groups, following a one-week delay. Hypnotizability in the full attention condition was found to still be related to a higher proportion of know responses for LURE words even after a one-week delay ($r = .45, p < .05$). For the divided attention group, a trend towards greater proportions of remember and guessing responses was observed for more hypnotizable subjects ($r = .32, p = .10$ for remember, $r = .35, p = .08$ for guess). Matrices of correlation coefficients for the full attention and divided attention group are reported in Table R4 and R5, Appendix R.

Discussion

The first part of Experiment I examined performances on frontal and non-frontal neuropsychological tests in relation with hypnotizability. A link between higher performance on four out of seven frontal measures gave support to the hypothesis of pre-existing superior frontal abilities[4] in more hypnotizable subjects as measured by neuropsychological tests. WCST standardized scores for the number of errors, number of perseverative errors and an overall measure of conceptual processing positively correlated with hypnotizability. These results are in line with Ray et al. (1998) findings. However, in contrast to what was found in Ray et al.'s study, Verbal Fluency (VF) did not correlate with hypnotizability, and subjects' performance on this test did not correlate with WCST variables. Demographic factors may have influenced performance on the VF test (more than 60% of the sample spoke a second language other than English). The VF score poorly correlated with other frontal measures as well.

The third frontal test (SOPT) was found to correlate negatively with standardized scores on WCST errors. The correlation coefficient (r= -32) was similar to the validity coefficient reported by Daigneault (1992). With regards to hypnotizability, SOPT perseverative errors were found to be associated with hypnotizability. The more hypnotizable subjects were the more they tended to point to the same design consecutively when they felt short of strategies and lost track of the previously chosen designs. It is important to note that hypnotizability was not related to general performance on this test. This tendency may be described as a preference to rely on familiarity of more recent events, when everything else fails.

The link between the Stroop and hypnotizability clearly pointed towards faster processing of stimuli. The more hypnotizable subjects were the faster they responded to stimuli regardless of the condition (congruent, incongruent and neutral). These results are in line with the report of faster processing at the level of frontal lobes in an ERP study conducted by Baribeau et al (1994) using a Stroop like task. Faster processing may also

explain why greater facilitation and interference were found in Dixon & Laurence, 1990;1992 when color words were presented for very short delays before color patches. LH subjects may have been less affected by the masking procedure precisely because the degree of information processing was more superficial. Evidence supporting that HH subjects have shorter latencies for somatosensory and auditory event-related potentials has been reported by Crawford (1998). In light of these findings, it seems plausible that hypnotizable subjects have shorter latencies for visual information as well. Errors on the Stroop task were not found to correlate with SHSS, indicating that the faster speed of hypnotizable subjects did not affect their accuracy. Considering that the highest correlation coefficient for the Stroop task was found between SHSS and reaction time on incongruent trials, the current findings are suggesting that hypnotizability is related to speed of processing and better frontal inhibition of automatic responses.

The D2 Target detection test was the only attentional variable that was related to hypnotizability. This test measured visual search and selective attention. A link between hypnotizability and speed of processing has been observed on this task however, greater speed performance caused hypnotizable subjects to make more omission errors. In Slako (1995), hypnotizability was found to correlate with D2 accuracy while speed was not. This discrepancy may be due to the fact that subjects may choose to put more emphasis on speed vs. accuracy or vice-versa depending on the testing context. In the 1995 experiment, the D2 target detection task was administered in combination with other memory tasks that did not involve speed. In contrast, this experiment involved a series of tests in which speed was measured consistently across several tasks. Therefore, hypnotizable subjects may have perceived that speed was a more important goal than accuracy.

Performance scores on the Trail Making tests and the CPT were unrelated to hypnotizability. Trail Making tests measured visual search and visual-spatial sequencing. Although response time on the Trail Making tests correlated with other tasks involving

speed such as Stroop measures and D2 reaction time, and with the SOPT errors as well, it did not correlate with hypnotizability scores. Trail Making tasks are very short and perhaps too simple to be valid discriminating measures reflecting higher executive functioning in healthy subjects. The CPT on the other hand, measured sustained attention and inhibition. Subjects often commented on this task, describing it as long and tedious. In fact, subjects sat passively in front of the computer waiting for the letter "X" to appear to press a key. Variables measured on the CPT (reaction time, omission and commission errors) did not correlate with the WCST. Some variables, mainly commission errors and reaction time however, correlated with the Stroop and the SOPT score. The CPT involved no reasoning and the nature of this test left little room for the use of strategies to improve performance. Therefore, subjects in this sample appeared to have experienced a lack of challenge, and considering HH subject's sensitivity to the context, motivational factors may have affected their overall performance on this task. The lack of correlation between CPT variables and hypnotizability also indicated that HH subjects' faster response time on STROOP trials was not simply due to higher motor speed. In summary, findings from this study offered little evidence to support greater attentional abilities in hypnotizable subject.

Non-frontal tasks as expected, did not correlate with hypnotizability. The absence of correlation between SHSS and indexes of general intellectual abilities (Vocabulary and Raven) confirmed that higher frontal abilities are distinct from and unrelated to, general intellectual functioning. In fact the more hypnotizable subjects were in this sample, the worst was their performance on the Raven, a task measuring deductive reasoning. A non-significant but noticeable link ($r = .20$; $p = .06$) between SHSS and the Digit Symbol (DS) task was observed. Based on the finding of a consistent pattern of faster processing observed on other tasks, it is reasonable to infer that the correlation is likely to be based on a common speed component.

The standard regression analysis allowed one to examine whether results on the

four frontal tests added incremental validity to the prediction of hypnotic susceptibility over and above that of known predictors. The joint contribution of the frontal tasks explained 14% of additional variance beyond the 15% accounted for by established predictors. After ABSOPTION, IMAGERY and ATTITUDE were entered into the regression equation, only SOPT perseverative errors and D2 omission errors were significant predictors. The SOPT test has a working memory component and strongly relies on organizational skills. Hypnotizable subjects did not perform worst on this test but displayed a pattern of errors influenced by familiarity and a stronger tendency to relate to previous experience.

The correlation coefficient between the D2 omission error variable and SHSS suggested that hypnotizable subjects were more likely than less hypnotizable subjects to miss targets, perhaps as a result of going too fast. The D2 reaction time measure was thus contaminated by errors, and since it was entered following the omission error variables, the remaining variance accounted for was small. The WCST did not emerge as a significant predictor, mainly because a large part of the variance accounted for by this variable was shared with ATTITUDE. Although attitude may be viewed as a factor that is linked to goal-directed behavior, the measure is based on more than one factor which includes positive beliefs about hypnosis, fearlessness and a non-judgmental attitude towards hypnotizable people. Absorption and imagery are also self-reported multi-factorial measures. It may be argued that neuropsychological measures should be entered first in the regression analysis as predictors of hypnotizability because they represent objective measures of subject's cognitive processing abilities[5]. In fact when such measures were entered first, none of the established predictors remained significant.

Interestingly, subjects with high performance on the WCST in this sample, were not necessarily hypnotizable however, all HH subjects except one had considerably high standardized scores on all WCST variables. These results suggested that although LH subjects may be cognitively predisposed to experience hypnosis, fear and a more negative

view of hypnosis may have stopped them from "letting go" and becoming engaged in the hypnotic process. Although as a whole, performance on frontal tasks accounted for 25% of the variance of hypnotizability, further examination of correlation coefficients by hypnotizability groups suggested that the contribution of executive functions differed as a function of hypnotizability levels.

Although means of standardized WCST scores declined in parallel with hypnotizability levels, a closer examination of predictors revealed the presence of heterogeneity of predictors across hypnotizability groups. This observation suggested that frontal abilities might contribute to hypnotizability at varying degrees based on the nature and the difficulty of hypnotic suggestions. Hypnotizability scores in the LH group ranged from zero to 4. Subjects in the LH group generally passed a few suggestions involving a motoric component such as arm lowering due to heaviness, or feeling a force moving the subject's hands apart. A total absence of hypnotic response to this type of suggestions appeared to differ from a higher hypnotizability score in the Low range group on the basis of the subject's self-report capacity for absorption. Thus, the more LH subjects became absorbed in the process the more likely they were to experience motor suggestions.

Subjects in the medium hypnotizability group were able to experience more cognitively difficult suggestions such as age regression, and having a dream. ATTITUDE and reaction time on the STROOP predicted the difference in response between medium hypnotizable and HH subjects. Therefore, speed of processing and frontal inhibition of automatic responses appeared to be more involved in suggestion that required subjects to mentally travel in time and to relive past experiences. Finally, HH subjects passed difficult items involving sensory and perceptual experiences such as taste, sound and visual hallucinations, as well as more cognitively complex items such as hypnotic amnesia. Hypnotic amnesia requires subjects to inhibit recall of events that happened during the hypnosis session. Hypnotic amnesia is similar to hypnotic analgesia

in terms of complexity since both suggestions require subjects to inhibit automatic responses that are quite difficult. For the HH group, WCST performance emerged as the strongest predictor followed by reaction time on the STROOP, and ATTITUDE. Faster processing may equip HH subjects with more mental resources for executive functions and consequently more successful inhibition of automatic responses.

The ATTITUDE scale assessed subjects' beliefs about hypnosis and hypnotizable individuals in general. Although this scale is not a measure of subjects' motivation, it represents a good indicator of the subject's readiness to engage in the hypnotic context, and an index of goal-directed behavior. Subjects may be quite motivated to perform well and may fail to engage in the context because of fear or negative views about hypnotizable individuals. On the other hand, it is not uncommon to find highly motivated LH subjects who end up feeling considerable disappointment because they were unable to respond to suggestions. In fact, Labelle (1994) reported that LH subjects' motivation was reduced as a result of low performance on the SHSS. LH subjects in this study displayed lower reaction time on the STROOP when the task was given following the assessment of hypnotizability. Therefore, poor response to hypnosis had a significant influence on subjects' subsequent motivation to perform in the same context. To control for this confounding effect, subjects in the current study were tested prior to being hypnotized, and were not informed about hypnosis until the end of the neuropsychological assessment session.

Another important point worthy of discussion concerns the validity of current frontal measures to assess executive functions. A major aspect of executive functions involves self-regulation of behavior to attain goals in unstructured situation where one must set the goals to determine the appropriate path. According to Levine (2000) patients with damage from traumatic brain injury to the ventral portion of the frontal lobes perform very poorly in such situations, and their impairment is not well captured by current neuropsychological tests measuring executive functions. Based on Levine's

description of everyday life situations that are problematic for frontal lobe patients, hypnosis appears to be a good example of a complex situation corresponding to self-regulatory behaviors and executive functions. Rules and procedures in hypnosis are clearly stated and easily understood. The subject has an overall goal of becoming hypnotized. The path towards this goal is not explicitly stated but needs to be determined by the subject, and certain features of the task oppose goal attainment requiring inhibition for efficient performance to occur. Levine argued that unlike the WCST test where the subject is adjusting his/her response on the basis of feedback, non-routine situations involve regulation of behaviors that is largely dependent on autonoetic (self) consciousness and memory of past experiences. These observations suggested a strong link between hypnotizability and experiences of autonoetic consciousness .

In summary, the results of the neuropsychological testing part of this experiment provided little support for greater attentional abilities in more hypnotizable subjects. Faster processing however, is likely to free the subject's mental resources and may result in better control of executive functions (planning, inhibition, shifting, and application of strategies). Although the WCST is capturing some aspect of executive functions, the test is limited in its ability to measure a combination of cognitive processes involved in self-regulatory behaviors. Executive functions are known to play an important role in situations involving implicit rules, and in the achievement of goals where a clear way of attaining them is not defined. Hypnosis appears to be a non-routine situation fulfilling these requirements. Current results also suggested that higher executive functions are likely to be required for a positive response to more difficult hypnotic suggestions involving the inhibition of automatic responses, while the response to easier items may be more dependent on the subjects' capacity for absorption.

The second part of Experiment I involved measurements of subjective experiences of recognition after studying words under full and divided attention conditions using the R/K paradigm. The results indicated that when subjects were asked

to recognize words after a 15-minute delay, study conditions had no significant effect on the probability of making a positive recognition judgment. Although subjects in the divided attention condition produced a slightly lower amount of "yes" responses to words in the recognition test, the difference was not significant ($p = .08$). Given that subjects had the opportunity to guess, attention at study did not have an effect on the overall probability of making recognition judgments.

The findings replicated those of Gardiner and Parkin (1990). The effect of attention at study significantly impaired remember responses for word recognition while the number of know responses remained stable across conditions. Attention at study also had an effect on accuracy and the effect was still significant after the number of errors was controlled for. The proportion of lure words in the remember response category was small and similar to proportions observed in other studies using the R/K paradigm. Gardiner and Parkin (1990) found a higher rate of false alarm for know responses in the divided attention group. Although the number of lure words for know responses in the current study was also higher in the divided attention group, the between group difference did not reach statistical significance ($p = .06$). The groups differed significantly on the number of guessing responses, confirming that subjects in the divided attention group chose to guess words more often and as a result of this choice, they produced a higher rate of false alarms. The difference in false alarm rate as a function of response type may be explained by the fact that in Gardiner and Parkin's 1990 experiment, the guessing response option was not available. The proportion of know responses in the first study is likely to have been inflated as a result of subjects using the know response as a residual category when they were unsure and felt that the words were familiar. The addition of a guessing response choice was truly important to ensure that both remember and know responses pertained to types of recall involving a conscious experience. Data from the current study confirmed that the guessing response option was predominantly used by subjects in the divided attention group, and that subjects used this category when they

were unsure about their responses.

In the current study, an untraditional version of the recognition test was used after a one-week delay to examine the robustness of remember responses over time. Including distracter words from the previous recognition test allowed to also examine the effect of proactive interference. Subjects were not informed regarding the proportion of words from the study list included in the recognition task, however, as the task progressed most of them realized that the second recognition task involved both target words and lure words from the initial task. Therefore, most subjects were aware that they had to try to distinguish between the two learning episodes. In the second recognition task, one word out of three was a target word therefore subjects were expected to produce a lower rate of "yes" responses on this task. Contrary to expectations, the subjects' proportion of affirmative responses was slightly higher than the proportion observed for the short-delay task. The proportion of affirmative responses was also equal for both study conditions. The results suggested that an increase of affirmative responses was likely to have resulted from recognition of target words and lure words combined. In fact, the maximum proportion of correctly recognized words for the target words and lure words combined was 66%, as opposed to a 50% target word probability in the first recognition task.

With respect to distribution of recognition responses after a one-week delay, the findings of the current study replicated that of Gardiner, Java & Rosalind (1991). The one-week retention interval caused a sharp decline in remember responses, while the amount of know responses remained relatively unaffected. The effect of study conditions on types of responses was no longer significant after a week. Gardiner et al. (1991) found a larger rate of false alarms after longer retention intervals and a larger amount of false positives for know responses. The current experiment differed on several factors. Firstly, Gardiner et al. (1991) did not include guessing responses as a possible option. Secondly the original experiment did not include repeated measures, and finally attention at study was not manipulated. Despite these differences, the findings were comparable in

terms of a lasting effect of accuracy and on a greater sensitivity of know responses to false alarms. The current findings indicated that subjects in the full attention group remained more accurate at identifying target words after a week. The groups did not differ however in terms of rates of false alarms for lure or new words regardless of response types. A significantly higher proportion of false alarms for lure words confirmed that repeated testing interfered with subjects' ability to recognize words from the study list. Attention at study affected subjects during the encoding process of target words however both groups were equally exposed to repeated testing and consequently equally affected by interference of lure words. Proportions of false alarms for new words and particularly a greater amount of false positives for know responses in the divided attention group were similar to those observed by Gardiner et al. (1991).

The hypothesis that more hypnotizable subjects would display a higher number of remember responses in the full attention condition was supported. The findings were in line with superior performance on explicit memory task found for HH subjects in previous studies (Slako, 1995; Tremblay, 1996). For the short delay recognition task in the full attention group, remember responses increased as a function of hypnotizability. For the divided attention group, hypnotizability was related to a higher number of guessing responses. Greater amount of positive recognition responses for hypnotizable subjects appeared to have been maintained across study conditions. Due to constraints on level of processing, higher rates of yes responses for more hypnotizable subjects shifted from more remember responses to more guessing responses. This pattern of behavior is consistent with a more goal-directed approach to the task and adopting strategies that are more adaptive to maximize performance. Another possibility is that faster processing of information during the encoding phase may be responsible for a larger amount of words being recognized by more hypnotizable subjects in the divided attention condition. Reducing attention, however, clearly limited the depth of processing and the encoding of contextual details required for episodic retrieval.

Hypnotizable subjects in the full attention group recognized a higher number of target words, however the relation between accuracy and hypnosis disappeared when the number of errors were subtracted from the total number of correctly recognized words. Therefore, hypnotizable subjects were more likely to give affirmative responses to words in the recognition task however their performance did not result in overall superior accuracy. Based on earlier findings that suggestibility is a predictor of memory creation and memory distortions, it was also hypothesized that more hypnotizable subjects would be more vulnerable to false alarms in a divided attention condition. For the divided attention group hypnotizability as expected, was strongly related to higher false alarm rates. The pattern in both conditions indicated that hypnotizability was associated with a higher probability of making recognition judgments also resulting in a higher rate of false alarms. This pattern may also result from a more goal-directed approach resulting from a strong executive function system. The central goal being that of recognizing as many words as possible, more hypnotizable subjects may have lowered their decision criterion in order to maximize chances of recognizing words. Hypnotizable subjects in the full attention group produced more false alarm using know responses, while hypnotizable subjects in the divided attention group produced a higher number of false alarms for guess responses. Due to poor attention at study, more hypnotizable subjects in the divided attention group were more skeptical about judgments based on familiarity, while HH subject in the full attention group, tended to relate familiarity to past experiences.

After a one-week delay, hypnotizability was no longer related to types of responses in neither attention conditions. However, hypnotizable subjects in the divided attention condition remained more sensitive to interference from words included in the previous recognition task. Subjects were more likely to respond affirmatively to lure words from the first recognition task and had more difficulty discriminating between learning episodes. More hypnotizable subjects may differ in terms of encoding strategies that is, they may be more reliant on relating information to their personal experience in

order to improve subsequent recall. As such, when more hypnotizable subjects are encoding information in a context where deeper processing is possible, the overall performance may be enhanced, however when deeper processing is hindered, they may become more vulnerable to memory distortions.

Remember responses are viewed as an index of autonoetic consciousness. According to Tulving's theory of episodic memory greater autonoetic consciousness translates into a more developed ability to mentally travel in time and to recreate past experiences (Wheeler, Stuss & Tulving, 1997; Tulving & Lepage,2000). Autonoetic consciousness as measured by the R/K paradigm, appears to be a better predictor of hypnotizability than performance on frontal tasks. Since autonoetic consciousness is also known to be dependent on frontal lobe processing, relations between frontal tasks and types of responses on the recognition task were examined. Further examination of correlation coefficients revealed that the SOPT score was the only variable found to correlate with remember responses in this sample, most probably due to the fact that the task involves a strong memory component. Studies conducted with samples of healthy adults have found that frontal tests performance predicted the amount of remember responses only for older adults over 80 years of age (Parkin & Walter,1992; Perfect & Dasgupta, 1997).

In a recent PET study conducted by Grady, McIntosh,Beig, & Craik,(2001), right frontal lobe activation was observed when subjects were engaged in an episodic retrieval mode, regardless of the accuracy of recall. Interestingly, the results of ERP studies have also reported that HH subjects displayed greater left hemispheric activation during the initial phase of hypnosis followed by inhibition and a shift of activation to the right as they became hypnotized (Crawford, 982; Crawford & Gruzelier, 1992). The similarity of frontal activation between the episodic retrieval mode and the experience of hypnosis is suggesting that the capacity to travel in time and to relive past experiences may play an important role in more complex hypnotic suggestions.

In suggestions of auditory hallucination for instance, the hypnotized subject is told that there is an intercom in the room and that a person will be asking them questions to which they will have to answer out loud. In order to pass this suggestion, the subject is required to travel back in time and rely on past experiences of hearing voices through an intercom to recreate the experience. Next, the subject has to plan for the event to take place in a near future and then relive the event mentally. Most hypnotizable subjects know very well that there is no intercom in the room, or at best they are skeptical about it. The automatic response is one of reality monitory that the hypnotizable subject chooses to inhibit in favor of a behavior that is in accordance with that of a hypnotizable subject. Visual hallucinations are likely to be based on similar processes. An example of visual hallucination in hypnosis consists in telling the subject while his/her eyes are closed, that two boxes and nothing else, are been placed to his/her right side. In reality, three boxes are placed near the subject. In order to pass this suggestion the subject is required to experience a visualization of two boxes prior to opening his/her eyes, and after opening them, he/she must continue to focus exclusively on the two boxes while inhibiting (ignoring) the third.

Experiencing easier items involving a motoric component, on the other hand, may be more based on an experience created in the present. Hypnotized subjects are instructed to feel their arm as becoming increasingly rigid. Once they are able to create the physical experience, they are given the suggestion that they will want to bend their arm but will not be able to do so. The last part of the suggestion involves inhibition of the automatic response of bending the arm. The simple suggestion requires less abilities to travel back in time and to experience the suggestions through autonoetic consciousness, because the physical experience is produced in the hypnotic context, and it is based on "here an now". More difficult items on the SHSS scale appear to be relying on more developed frontal abilities. The results of neuropsychological tests indicated that HH subjects have such frontal abilities and that hypnotizability may be activated by a

facilitation to rely on past experience. The current findings supported that more developed frontal abilities were linked to more subjective experience of autonoetic consciousness as demonstrated by a higher frequency of remember responses on a short delay recognition task, as well as a greater tendency to integrate recognized information as part of a past experience. This latter tendency may also be due to a stronger tendency to engage in "self" retrieving mode, thus increasing the subject's vulnerability to associate familiarity with one's past, and consequently to integrate semantic information to one's narrative of a particular episodic event.

These conclusive findings raised two additional research questions. The first one concerned whether more hypnotizable subjects' tendency to rely on past experiences would be manifested in more purely episodic tasks that is, tasks involving the production of narratives of personal events. Findings derived from experiments using word lists have been often criticized for being detached and unrelated to real memories of personal events. Therefore a second experiment aimed at observing if the tendency for greater "self" retrieval information would carry over in the production of true episodic memories.

A second empirical question concerned the validity of the "weakening of executive function" hypothesis as proposed by the Dissociated Control Theory of hypnosis (Woody & Bowers, 1994) to account for non-volition and memory distortions. Although the theory acknowledges the contribution of frontal processes to the hypnotic experience, it failed to consider that variability in hypnotic response might be related " a priori" to individual differences in frontal abilities. According to the Dissociated Control theory executive functions are weakened by the hypnotic process, and taken over by hypnotist who becomes in control of the subject's behaviors. The loss of control on the subject's part explains HH subjects subjective experience of non-volition. When hypnotized, subject's memories are resulting from direct activation of contention scheduling schemata that cannot be modulated and monitored by the Supervisory Attentional System. Frontal patients have deficits in executive functions and like them

hypnotized subject's executive system is weakened. Like frontal patients, hypnotized subjects are expected to be more vulnerable to confabulation, to require more cognitive effort to produce personal memories, and to be more inclined to produce narratives on the basis of stereotypical memories than true personal events when they are in hypnosis. Experiment 2 attempted to test these assumptions.

EXPERIMENT 2

Method

The purpose of the second experiment was to maximize individual differences in terms of combined measures of frontal abilities and hypnotizability, and to observe if HH subjects' pattern of subjective experience in memory as suggested by the results obtained from the recognition tasks, would also be observed in the context of episodic narratives triggered by cue words. A second purpose was to investigate the presence of greater cognitive effort, reduced vividness, and more stereotypical details in HH subjects when episodic memories were produced in hypnosis as opposed to a normal control condition. This pattern of behaviors was expected to parallel that of frontal lobe patients and give support to the Dissociated Control theory of hypnosis (Woody & Bowers, 1994).

Based on results from the recognition task of Experiment 1, HH- high frontal (HF) subjects were expected to display a higher number of self-reference and vividness details in their narratives outside of hypnosis. This pattern would be consistent with a tendency for subjective experience of memory and autonoetic consciousness. A second set of hypotheses aimed at testing the "weakening of executive function". According to the Dissociated Control theory, HH subjects should display greater cognitive effort in the elicitation and production of episodic memories in hypnosis. Episodic memories of HH subjects should also contain less vividness and self-reference details in hypnosis, while episodic memories of LH subjects should remain unaffected in both content and effort across hypnosis and normal conditions.

Subjects

Twenty subjects from Experiment 1 were selected on the basis of their scores on the hypnotizability scale and the WCST. Subjects were contacted by phone and invited to participate in a second study involving episodic memories. Participants received $10 for the session.

Subjects were assigned to the HIGH or LOW groups based on higher or lower scores on SHSS and WCST combined. The subjects were first categorized based on their hypnotizability group. Subjects with scores ranging from 0 to 4 on the SHSS were assigned to the LH group and subjects with scores ranging from 9 to 12 were assigned to the HH group. Following this procedure, subjects in the HH group were ranked based on the highest WCST conceptual standardized score to the lowest score in the group. Subjects in the LH group were ranked from the lowest to the highest standardized score on the WCST conceptual measure. The mean SSHS score was $M = 9.5$; $SD = 0.71$ for the HH-HF group and $M = 2.3$; $SD = 1.49$ for the LH-LF group, respectively. The mean WCST conceptual standardized score was $M = 110.20$; $SD = 8.12$ for the HH-HF group and $M = 96.50$; $SD = 7.43$ for the LH-LF group.

Materials and Procedure

Subjects were tested individually and the session's duration was approximately 45 minutes. All subjects were asked to formulate episodic memories in response to six cue-associative words presented in the following order: BREAK , DOG, ANGRY , LETTER , STORM and LOST . The word TEACHER was used as a substitute when

subjects rejected any of the six initial words. Three words were given in a control condition and three words were given in hypnosis. The order of control and hypnosis conditions was counterbalanced across groups.

Subjects were prompted when they referred to general information and failed to refer to a particular episode of their lives, and when the memory was incomplete in terms of details concerning timing, location, and the presence of others (complete instructions are provided in Appendix G). Subjects' verbal responses were audiotaped and transcribed verbatim by the experimenter (see Appendix I for examples of transcripts). After all six episodic memories were collected, subjects were asked to rate the emotional significance of each memory on a "Likert " format scale with anchor points ranging from 1 to 10, (e.g. 1= not at all significant, 5= moderately significant, 10= very significant). A copy of the emotional rating scale is provided in Appendix N.

Cognitive Effort Variables

Three measures of cognitive effort were examined: (1) Mean reaction time required to produce the episodic memory was measured using a stop watch for each conditions (2) Frequency counts of prompts and number of words rejected summed in each conditions. (3) Frequency counts of repeated statements, inferences, and unsure statements were summed in each conditions.

Quality Variables

Three measures of quality of content for episodic memories were based on frequency counts summed in each conditions: (1) Self-reference was defined as details referring directly to the subject which included information regarding when the event took place in the subject's life, where the subject was located at the time of the event

(geographically and physically), and statements referring to the subject's current or past affect in conjunction with the event (4) Number of statements referring to affect of others involved in the event and (5) Details over and above the event giving it a character of a life experience (vividness). The scoring protocol is described in Appendix J.

Interrater Reliability

Pearson's correlation was used to compare the frequency scores obtained by the Experimenter and an Independent Rater for the content and the cognitive effort measures: frequency of repetition, inferences and unsure statements, as well as for the three quality measures. The Independent Rater was blind to the subjects' identity, demographic attributes, hypnotizability level, scores on neuropsychological tests, and experimental conditions.

The Independent Rater scored the complete transcripts of all odd-numbered subjects (n =10) and Pearson Product Moment correlation coefficients were computed. For the content cognitive effort variables the correlation coefficients were:.97 for repetition, .95 for inferences, and .89 for unsure statements. For the quality variables the interrater reliability coefficients were: .94 for self-reference details related to timing, .97 for subject's location, .98 for subject's affect, .92 for other's affect, and .91 for vividness details.

Results

The main research questions concerned the investigation of possible differences in cognitive effort and quality of content of episodic memories between HH-HF and LH-LF subjects, and between control and hypnosis conditions. First, group differences on both SHSS and WCST scores were examined statistically. Second, data obtained from the emotional rating scale for each episodic memory were compared across groups and conditions to verify for a potential effect of emotional significance, and hence the necessity to consider this variable as a covariate in subsequent analyses. Finally, cognitive effort variables (REACTION TIME, PROMPTS and CONTENT EFFORT) and quality variables (SELF-REFERENCE, OTHER'S AFFECT and VIVIDNESS) were analyzed separately using multivariate repeated measures analyses.

Group Comparability

Independent-sample t-tests were conducted to examine statistical differences between subject groups on SHSS and WCST scores. The groups significantly differed on both categorical variables $t\ (18) = 13.77$; $p < .0001$ for the SHSS score, and $t\ (18) = 3.94$; $p < .001$ for the WCST score. This analysis confirmed that the groups differed significantly on both variables and that the matching procedure was successful at creating significant differences on the variables of interest.

Emotional Significance Rating Scale

Standardized values from the Emotional Rating Scale in each group and condition were examined for possible outliers. None of the values were in excess of $Z = \pm 3.00$. Examination of skewness and kurtosis values revealed that the distribution of emotional significance ratings obtained in the hypnosis condition for LH-LF subjects, was

leptokurtic and moderately skewed. Since kurtosis is known to have a considerable impact on the alpha level in small samples, the data was transformed using natural log. Variable transformations improved the distribution of the critical variable.

Emotional significance ratings were entered in a 2 X 2 repeated measure analysis of variance with groups as a between subject factor and conditions as a within subject factor. The analyses were conducted with both untransformed and transformed variables. Since final results of the analysis did not differ, and because untransformed variables are easier to interpret, only the results of the analysis with untransformed variables are reported. The mean ratings for LH-LF and HH-HF subjects in the control condition were: M= 6.37; SD = 1.15, and M = 7.53; SD = 1.67 respectively. The mean ratings for the LH-LF and HH-HF subjects in the hypnosis condition were: M= 6.05; SD = 1.56, and M = 6.28; SD = 2.34, respectively. The results revealed no effect of groups; F (1,18) = 1.87, p < .19, and no effect of conditions; F (1, 18) = 1.83, p < .19, or interaction: F (1, 18) = .64, p < .43. The source table for the repeated measure analysis of variance on Emotional Significance Ratings is displayed in Appendix S. Based on the above results, the emotional significance variable was discarded and was not used for subsequent analyses.

Cognitive Effort Variables

The data for the three cognitive variables (REACTION TIME, PROMPTS and CONTENT EFFORT) in both control and hypnosis conditions were screened for univariate outliers in HH-HF and LH-LF groups. Examination of standard scores obtained for each variables by condition by group indicated that none of the raw scores were outliers (none were in excess of $Z = \pm 3.00$). Skewness and kurtosis coefficients

were examined to assess univariate normality. Two of the variables (PROMPTS) in the hypnosis condition for HH subjects, and (CONTENT EFFORT) in the normal condition for HH subjects were found to be leptokurtic (coefficients were 2.93 and 3.88 respectively). Skewness values were all within acceptable range. The effect of kurtosis on power has been reported to be substantial in small samples. In the case of leptokurtosis the actual alpha level is less than .05, therefore the *F* test is more stringent (Stevens, 1992). In order to detect the presence of an effect which may not be apparent because of a peaked distribution, the variables PROMPTS and CONTENT EFFORT were submitted to logarithmic transformation (Natural Log).

The data were also submitted to multivariate outlier analyses. For each group, Mahalanobis distance values were obtained using the SPSS regression residual command. No multivariate outlier cases were detected using this procedure. Normal probability plots and residual scatterplots indicated that the assumption of multivariate normality was reasonably met.

To investigate whether subjects' degree of cognitive effort differed in and out of hypnosis, or on the basis of hypnotizability, cognitive effort variables were entered in a 2 X 2 multivariate repeated measure analysis with groups as a between subject factor, and REACTION TIME, PROMPTS and CONTENT EFFORT scores as repeated measures dependent variables. The analyses were conducted twice, with transformed and untransformed variables. The results of the analyses with transformed variables yielded identical findings, therefore because transformed variables are more complex to interpret, only the results of the analysis with untransformed variables are reported. Test of

univariate and multivariate homogeneity of variance were non-significant, thus confirming that both univariate and multivariate assumptions were respected.

The results indicated that the groups did not differ on cognitive variables combined; F (3, 16) = 2.41, p = .10. The multivariate effect of interaction (group by condition) was non-significant; F (3, 16) = .34, p < .80. A multivariate effect of condition was found; F (3, 16) = 6.95, p < .003. Univariate tests revealed that the mean of REACTION TIME in the hypnosis condition was higher for both LH-LF and HH-HF subjects; F (1,18) = 20.09, p < .0001 (see Figure 5). A trend was observed towards an effect of hypnotizability for the number of prompts. LH subjects required a larger number of prompts, however the difference did not reach statistical significance; F (1, 18) = 3.11, p < .10. Subjects regardless of their hypnotizability level seemed to have required somewhat less prompts to produce narratives in the hypnosis condition, however the effect was too weak to reach statistical significance; F (1, 18) = 1.41, p < .25. Measures of central tendency and variability for the cognitive variables are presented in Table 3. Source Tables for univariate tests are reported in Appendix T.

Quality Variables

Data obtained from the three quality variables (SELF-REFERENCE, OTHER'S AFFECT and VIVIDNESS) in both control and hypnosis conditions were screened for univariate outliers in HH and LH groups. Examination of standard scores obtained for each variables by condition by group indicated that none of the raw scores were outliers (none were in excess of $Z = \pm 3.00$). Skewness values and kurtosis coefficients were all within acceptable range, confirming that the assumption of univariate normality was not violated.

Table 3

Measures of Central Tendency and Variability for Cognitive Effort Variables by Recall Conditions and Hypnotizability Groups

	Low Hypnotizable $n = 10$				High Hypnotizable $n = 10$			
Variables	Control		Hypnosis		Control		Hypnosis	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Reaction Time	11.59	(5.86)	14.94	(5.16)	11.60	(6.39)	14.66	(5.61)
Number of Prompts	8.50	(3.31)	8.10	(4.28)	6.90	(2.77)	5.10	(3.78)
Content Effort	10.80	(7.15)	9.50	(7.25)	9.20	(7.27)	6.40	(4.25)

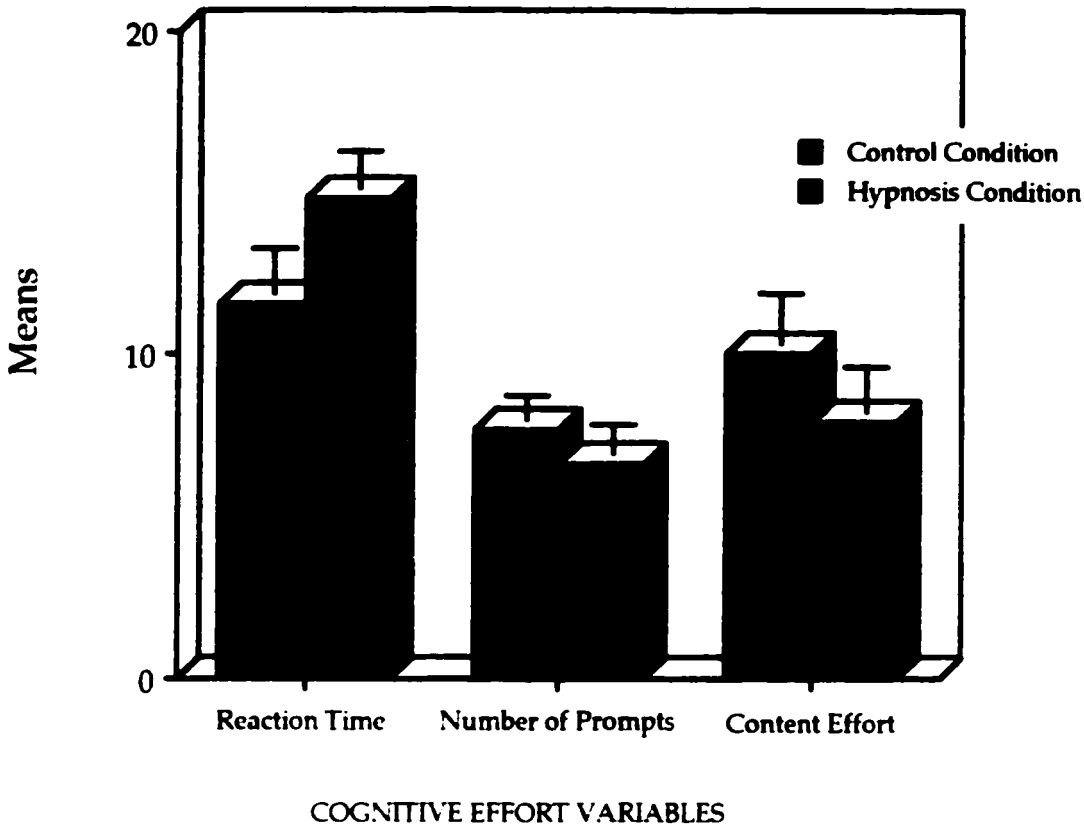

Figure 5. Mean Scores on Cognitive Effort Variables by Recall Conditions (mean reaction time is in seconds, and mean scores for content effort represents the mean number of statements referring to effort in the content of episodic memories).

The variables were also screened for multivariate outliers. For each group, Mahalanobis distance values were obtained using the SPSS regression residual command. No multivariate outlier cases were detected using this procedure. Normal probability plots and residual scatterplots indicated that the assumption of multivariate normality was reasonably met.

The next goal was to examine whether episodic memories from LH-LF and HH-HF subjects collected in and out of hypnosis differed in terms of quality of content. To examine this hypothesis, the quality variables were entered in a 2 X 2 multivariate analysis of variance with hypnotizability group as the between subject factor and quality variables (SELF-REFERENCE, OTHER'S AFFECT, and VIVIDNESS) as repeated measures dependent variables.

The results of the analysis revealed a main effect of hypnotizability group: F (3 ,16) = 8.72, $p < .01$. Both the effect of interaction (group by condition) F (3 ,16) = .64, $p = .60$ and the effect of condition F (3, 16) = .51, $p = .68$ were not significant. Examination of univariate tests showed a significant group difference on the SELF-REFERENCE variable. No other significant univariate main effect or interaction effect was found. Source Tables for the three quality variables are presented in Appendix U. Measures of central tendency and variability for the quality variables are reported in Table 4. Figure 6 illustrates mean scores on quality variables summed across conditions by hypnotizability group.

Table 4

Measures of Central Tendency and Variability for Quality Variables by Recall Conditions and Hypnotizability Groups

Variables	Low Hypnotizable (n =10)				High Hypnotizable (n = 10)			
	Control		Hypnosis		Control		Hypnosis	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Self-Reference Details	20.00	(5.27)	17.80	(5.29)	27.30	(7.92)	26.10	(9.28)
Other's Affect	4.40	(4.40)	2.10	(2.51)	2.70	(2.26)	3.10	(3.64)
Vividness	13.40	(7.52)	12.20	(6.11)	14.70	(5.62)	16.30	(7.36)

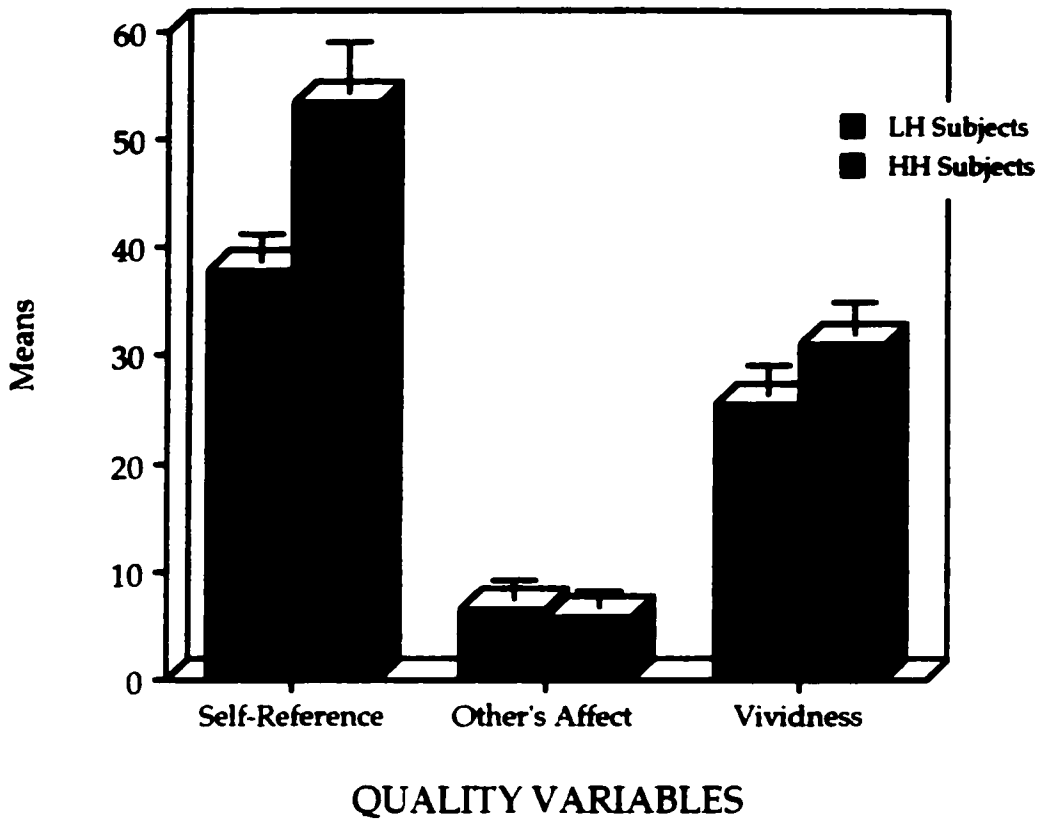

Figure 6. Mean Scores on Quality Variables by Hypnotizability Group (Mean scores refer to the number of details in the content of episodic memories for each category: self-reference, other's affect, and vividness).

Discussion

Pre-existing higher frontal abilities in hypnotizable subjects were further investigated in Experiment 2 in the context of real episodic memories. Differences on WCST and SHSS variables were maximized and subjects were asked to produce complete episodic memories in response to cue words. Grouping variables were also maximized in order to test assumptions of greater effort and poorer content of HH subjects' episodic memories in hypnosis as predicted by the Dissociated Control theory (Woody & Bowers, 1994).

Subjects from experiment 1 were ranked on the basis of their performance on the WCST: low frontal (LF) versus high frontal (HF) and SHSS scale (LH-HH). Ten subjects with the highest performance on both variables and ten subjects with the lowest performance on both variables were contacted for participation in Experiment 2. The ten HH-HF contacted accepted to participate in a second experiment. Four out of ten LF-LH, on the other hand, refused to participate on the basis of a variety of personal reasons (working, not interested, away on vacations). The four LH-LF subjects were replaced with the next four subjects based on the ranking procedure. Thus it is possible that LH-LF subjects' motivation to participate on subsequent tasks following the assessment of hypnotizability may have been lower than that of HH-HF subjects. Lower motivation, at least for the four subjects who refused to participate in Experiment 2 is likely to be resulting from experiencing failure in relation to performance on the hypnotic suggestibility scale.

At the end of experiment 1, great care was given to explain to the participants that performance on the hypnosis scale and on frontal tasks were unrelated to general

intellectual abilities. This step was important to eliminate the possibility that LH-LF subjects walk away with negative feelings. Feelings of failure and disappointment in relation to test performance could have affected subsequent motivation to perform in the same context. Thus, although the ten LH-LF subjects in this sample all belonged to the low hypnotizable category, they were not the lowest performers of the sample. It may be important to add that the majority of subjects in the entire sample of Experiment 1 were healthy university students, and standardized scores on the WCST were, with the exception of a few subjects, within the average range or above. Therefore, although the sample in experiment 2 was composed of truly HH subjects with higher frontal abilities, the reverse is not true for the LH group. Despite this problem, between group differences on both variables were statistically significant.

Due to the nature of dependent variables being measured, emotional significance of memories triggered by cue-words could have been responsible for differences in degree of cognitive effort and in quality of content. Highly emotionally significant memories are more easily retrieved, are likely to include more salient details, and involve stronger affect. To control for this potential confounding variable, subjects were asked to rate each of their episodic memory on the basis of personal emotional significance. Statistical tests revealed no effect of emotional significance across groups of subjects, across conditions as well as no interaction. Therefore, the effect of emotional significance was assumed to be equally distributed across all levels of the independent variables.

According to the Dissociated Control theory of hypnosis and the "weakening of executive functions" hypothesis, HH-HF subjects were expected to take more time to

produce episodic memories, to need more prompts to produce the narrative of a personal event, and to display greater effort in the elicitation and narration of episodic memories. Effort in content was assumed to be manifested in several ways; through the rejection of words (the word did not trigger any memories despite the experimenter's suggestions of possible events), through repetition (recalling the same information more than once without adding anything new, and through the addition of details that were not remembered but inferred on the basis of logic (i.e. it must have happened during Winter, because I remember seeing snow on the ground).

Subjects took longer to produce episodic memories in the hypnosis condition regardless of their hypnotizability level. These results were consistent with slower reaction time observed on neuropsychological tests administered after hypnotic induction in Kallio's et al., 2001 study. In this recent experiment, hypnosis produced longer reaction time on all tasks regardless of subjects' level of hypnotizability. Slower reaction time appeared to be an indication that subjects adapted to the hypnotic context that is, they slowed down in response to relaxation suggestions and to the slow pace of the hypnotist's speech. The slower response time in the hypnosis condition cannot be interpreted as evidence to support that the hypnotic process is weakening executive functions because the theory implies that only hypnotizable subjects should respond to this effect. In fact, previous findings supporting the Dissociated Control theory of hypnosis have found that the performance of LH subjects on neuropsychological tasks improved when tests were administered in hypnosis (Gruzelier, 1998). Therefore, slower reaction time to produce episodic memories regardless of hypnotizability level is not compatible with the hypothesis of weaker executive functions in HH subjects.

Although a trend towards a greater number of prompts required to produce the narration of past personal events was observed for the LH-LF group, the difference was not large enough to reach statistical significance ($p = .10$). For both groups of subjects, there was a slight decrease in the number of prompts for the hypnosis condition ($p = .25$), therefore hypnosis appears to have facilitated the production of personal memories regardless of subjects' hypnotizability level. Subjects did not differ in terms of effort manifested in the content of their episodic memories, whether the memories were produced under normal or hypnosis condition. Hypnosis was not associated with greater cognitive effort in episodic memory content of HH-HF subjects. In contrast, the results were suggesting a trend towards a facilitation effect on the production of episodic memories due to the hypnosis condition ($p = .18$), and the interaction between conditions and hypnotizability groups was not significant

A second hypothesis based on the assumption of weaker executive functions, predicted that the content of episodic memories of HH-HF subjects would be more stereotypical, and less vivid in the hypnosis condition, while that of their less hypnotizable counterparts would not be affected by this condition. The content of episodic memories was screened for possible differences on three variables; self-reference details, other's affect, and vividness. Self-reference details included information pertaining to timing, location, and affect in relation to the subject. Vividness was scored in terms of details giving the memory the flavor of being reexperienced.

The results revealed that HH-HF subjects included a greater number of self-reference details in their episodic memories under both testing conditions. Hypnotizability groups did not differ in terms of details concerning the affect of others.

HH-HF subjects also tended to include more vividness details in their episodic memories than did LH-LF subjects however, the difference was marginal and did not reach statistical significance ($p = .29$). LH-LF subjects often produced very detailed description of the setting where the personal event took place however, the details were more semantic in nature, whereas HH-HF tended to formulate description of themselves in relation to the setting. Hypnosis had no significant effect on any of the quality variables being measured regardless of subject's hypnotizability level. The absence of an interaction between hypnotizability groups and conditions confirmed that the hypothesis of weaker executive functions in hypnosis is unfounded.

The findings of Experiment 2 supported that higher frontal abilities are linked to a greater tendency to relate information from past experiences to personal identity. These results are in agreement with Tulving's theory of autonoetic consciousness, and are also in line with the higher number of remember responses produced by more hypnotizable subjects in the recognition task of Experiment 1. The results of both experiments suggested a cognitive pattern of hypnotizable subjects that was manifested across different memory tasks. A preference for personal experiences and greater autonoetic consciousness may also foster a more positive attitude towards phenomenological experiences such as the ones that hypnosis has to offer. Greater autonoetic consciousness may also facilitate the experience of hypnotic suggestions. Correlation coefficients between SHSS and remember responses in Experiment 1 suggested that the more prevalent pattern of autonoetic consciousness of hypnotizable subjects was also associated with an increased vulnerability to distortions in the sense that semantic information and proactive interference may be more easily integrated into past personal

experiences. The preference for personal experiences and greater autonoetic consciousness of HH subjects also parallels the pattern of frontal activation observed during the hypnotic process (Gruzelier, 1998) and the "retrieval mode" set produced by instructions in episodic tasks as reported by Tulving (1999).

As far as the role of frontal abilities in hypnosis is concerned, the current findings do not support a hypothesis of weaker executive functions in hypnosis as proposed by the Dissociated Control theory of hypnosis (Woody & Bowers, 1994). In contrast, the results of Experiment 1 suggested that superior frontal functions and greater autonoetic consciousness are likely to facilitate the hypnotic responses. Therefore the weakening of executive functions hypothesis appears to be more grounded in a myth that the hypnotist has special powers and is able to control the hypnotized subject's mind, than on empirical evidence. Earlier views of hypnosis tended to overestimate the role of the hypnotist and to attribute hypnotic responsiveness to the hypnotist's special qualities. Findings from this study are suggesting that HH subjects have better frontal abilities, thus greater executive control to achieve central goals, and that this greater control is precisely what may facilitate the experience of hypnotic suggestions.

General Discussion and Conclusion

The main findings of this study can be summarized as empirical evidence supporting pre-existing higher frontal abilities and faster processing in HH subjects. Hypnotizability has also been found to be associated with greater autonoetic consciousness, more vulnerability to memory distortions, and the production of more self-reference details in episodic memory. Episodic memory measures derived from the R/K paradigm in Experiment 1, were found to be stronger predictors of hypnosis than measures obtained from performance on frontal neuropsychological tests. The findings clearly suggested that episodic memory is playing an important role in the experience of hypnotic suggestions. Hypnosis is a very complex situation where cognitive flexibility and the ability to mentally travel in time from the past to the present and to the future, may lead to a facilitation to reproduce past experiences and to respond to hypnotic suggestions. In conclusion, the findings of pre-existing frontal abilities in HH subjects supported the idea that hypnosis is a goal-directed activity and that it is also likely to involve the activation and retrieval of episodic memories leading to autonoetic experiences.

The discovery of superior frontal abilities in HH subjects has an impact on future theories of hypnosis. The Dissociated Control theory implies that the higher control supervisory attentional system (SAS) is bypassed by hypnotic suggestions. Since the subject's SAS is no longer involved in the modulation of schemas, automatic responses are activated by hypnotic suggestions, and the ensuing subjective experience is one of non-volition. The findings of this experiment suggested that the Dissociated Control theory of hypnosis has serious flaws. Firstly, the finding that pre-existing higher frontal

abilities in HH subjects are present at baseline and facilitate the hypnotic experience contradicts the reduction of executive functions hypothesis. Furthermore, analogies between the performance of HH subjects and frontal patients on memory tasks as predicted by Woody and Bower's (1994) theory are unfounded. No evidence has been found to substantiate the manifestation of behaviors associated with frontal deficits in HH subjects in hypnosis, such as increased cognitive effort and more stereotypical episodic memories.

Secondly, neuropsychophysiological studies of hypnosis have claimed that HH subjects' ability to engage in hypnosis and to experience suggestions involves frontal inhibition and thus, these findings are also in contradiction with a theory of impoverished executive functions. Superior performance on the STROOP suggested that HH subjects were able to respond faster to incongruent stimuli. The STROOP clearly places demands on cognitive flexibility by requiring subjects to shift their perceptual set in accordance with external demands, however, proper responses on incongruent trials were dependent on successful inhibition of a habitual response in favor of a more adaptive one.

Thirdly, although the results of Experiment 2 indicated that hypnosis produced longer reaction time on the production of memories, the effect affected LH subjects equally. Support for the "weakening of executive functions" hypothesis has been largely based on the administration of frontal neuropsychological tests in and out of the hypnotic context and the observation of a reduced performance in hypnosis for HH subjects and an improved performance for LH subjects (Gruzelier1993; Kallio et all. 2001). An alternative explanation for this pattern of response implies that hypnosis, as stated by White (1941), creates a state of light drowsiness where performance demanding alertness

is reduced and internal images and experiences are enhanced due to the narrowing of the subject's frame of reference induced by suggestions. Therefore, poorer performance on frontal tests following hypnotic induction, cannot be interpreted as evidence of weakened executive functions. Considering the fact that hypnosis is a goal-directed activity, becoming engaged in the hypnotic process and thus behaviors that are congruent with the achievement of this state are more likely to be adopted than vigilance on cognitive tasks. In contrast, LH subjects may be less goal-directed and consequently less prone to adopt behaviors of hypnotizable subjects and in this context, the relaxation is likely to improve their concentration and performance on frontal tasks.

The finding of superior frontal abilities in more hypnotizable subjects is in agreement with White's (1941) view of hypnosis as a goal-directed activity in which subjects are actively engaged and are striving for the general goal of behaving like hypnotized subjects. The higher frontal abilities results also supported cognitive social theories in the sense that everyday automatic responses in hypnosis are triggered intentionally, but not necessarily consciously. Social cognitive theories on the other hand, have failed to provide a comprehensive explanation of mental processes involved in the hypnotic process and the subjective experience of non-volition. Higher frontal abilities in hypnotizable subjects suggested that non-volition is likely to be resulting from the inhibition of automatic responses in combination with experiences of autonoetic consciousness, and that this pattern of cognitive abilities is antecedent to the constructions of beliefs and expectancies.

Accounting for the unusual experience of non-volition has been, and remains the central goal of hypnosis theories. To explain this phenomenon, it is necessary to first

consider the unusual aspect of the hypnotic experience. The peculiar quality of hypnotic anesthesia, for instance, is not related to an automatic reaction of pain, but to the absence of it. Feeling pain when one's arm is in icy cold water for an extended period of time is the automatic reaction that is being inhibited. In the same manner, the odd component of hypnotic amnesia is not automatic recall, but the absence of it. Recalling events that took place a few minutes earlier is the automatic response that is inhibited. Finally, for suggestions involving a motoric component, what is peculiar about the phenomenon is not that the subject's arm is rigid, rather it is its lack of flexibility. Therefore, bending your arm is the automatic response that is inhibited. The fact that HH subjects have pre-existing superior frontal abilities suggested that they have greater control. Suggestions are experienced as non-volitional because the hypnotized subject's executive system is overriding and modifying contention-scheduling schemata that are in conflict with the general goal of behaving as hypnotized, in favor of more adaptive behaviors. Such behaviors are clearly suggested by the hypnotist and the subject is not required to remain conscious of the central goal at all time during the hypnotic process. Monitoring, inhibition and shifting of behaviors are all adaptive responses of the subject's SAS leading to goal achievement and the inhibition of automatic behaviors which are directly in conflict with more adaptive behaviors thus giving rise to an experience of non-volition. The adaptive aspect of the SAS can also be applied to self-hypnosis, in the sense that in non-routine situations, the system causes a person to monitor progress towards a self-determined central goal. Monitoring in this case is likely to cause the subject to become aware that some automatic behaviors may be in conflict with the central goal.

The identification of pre-existing cognitive differences in hypnotizable subjects

and how they operate in non-routine situations, have interesting clinical implications and may explain unfortunate outcomes such as the development of "false memories" in the context of psychotherapy. Hypnotizable subjects engaging in psychotherapy are very likely to be goal-directed, their central goal being related to a desire to "feel better". Sub-goals may include, behaving like a good client, attending psychotherapy sessions regularly, reading books or articles recommended by the therapist, and following the therapist's instructions. Assuming that the therapist is convinced that the current psychological distress experienced by the client is directly related to repressed memories of abuse, the therapist may suggest that some traumatic event has happened at some point earlier in the client's life. The client's automatic response may be that of contemplating the absence of memories of abuse (reality monitoring). However, the automatic response is likely to be inhibited and dismissed by the client's executive system in favor of the activation of more adaptive schemata associated with the behaviors of a good client and hence, maximizing chances of achieving the central goal (feeling better). Considering the fact that the client is likely to be engaged in an episodic retrieval mode, this process may ultimately increase vulnerability to memory creation and the inclusion of semantic information into the client's memories of past experiences.

Current advances in neuroimaging techniques are likely to bring considerable progress in scientists' ability to link cognitive individual differences to specific types of subjective experiences. Findings from this study indicated that using different memory tasks were necessary to examine how individual differences in cognitive processing are operating at different levels, and in different contexts. This experimental approach allows researchers to observe a pattern of consistency and to gain a clearer understanding

of cognitive processes. The results of neuropsychological tests indicated that frontal inhibition may be a key factor in hypnotic suggestibility and future studies should further investigate this ability. Replication of memory experiments using the R/K paradigm as well as studies examining episodic memories in relation to hypnosis are likely to lead to a new and improved synergistic theory of hypnosis extending to a better understanding of the interaction between cognitive abilities and social factors.

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Footnotes

1. Gender differences on the Digit Sysmbol subtest have been found previously for subjects over 19 years of age (Kaufman, 1990).

2. An effect of education on the Stroop Task has been documented elsewhere. The SOPT however, is relatively new and little data is available for this test at the present time.

3. Performance on neuropsychological tests can also be viewed as more proximate to the subject than self-reported measures. For this reason, a standard multiple regression analysis was also conducted with the known predictors (Absorption, Imagery and Attitude) entered last. When the five frontal variables were entered together in a first block, WCST conceptual and SOPT perseverative errors emerged as significant predictors. β values were .22, $p < .03$ for WCST conceptual; .25, $p < .01$ for SOPTPE; -.19 , $p < .07$ for Stroop incongruent; -.12, $p < .26$ for D2 reaction time; and .18, $p < .07$ for D2 omission errors. When absorption, imagery and attitude were entered in a second block, none of the established predictors remained significant predictors.

4. Although frontal abilities is a term referring to functions other than executive ones, the term here refers to executive functions and is used interchangeably.

5. Discussion pertains to the analysis described in footnote # 3.

APPENDIX A

Consent Forms

CONSENT FORM FOR RESEARCH PARTICIPATION
Doctoral Thesis Research Project
Department of Psychology, Concordia University

Today's experiment will involve your participation in a variety of tests requiring perception, attention, concentration, planning and memory. In the experiment, you will be asked to perform several tasks using words, letters, symbols and color. Please take time to carefully read your rights and be informed regarding your involvement in this research project.

I understand that I may ask any questions about the experiment prior to signing this consent form.

I understand that my participation in this experiment is voluntary, and that if I refuse to participate, it will not prejudice my potential participation in other experiments in the Department of Psychology.

I understand that my participation in this experiment is anonymous and that my data will remain confidential even though the results of the experiment may be published.

I understand that this experiment is part of a program of studies and that I may be invited to participate in future studies. I understand that I may accept or refuse future invitations at my own discretion without prejudice.

I understand that I am participating in this research to advance the understanding of human psychology.

I understand that the present experiment will last approximately two hours including a short break and that I am free to discontinue my participation at any time.

I have understood this agreement, and I freely consent to participate in the present experiment conducted by France Slako, M. Ed.

Signature. _____ Date: _____

CONSENT FORM FOR RESEARCH PARTICIPATION
Doctoral Thesis Research Project
Hypnosis Laboratory, Department of Psychology, Concordia University

The second part of the research project you are about to participate in is concerned with understanding more about the nature of hypnosis and various hypnotic phenomena. The success of this research strongly depends upon the assistance of volunteers like yourself and we are grateful for your participation.

Today's experiment will involve the administration of a combination of hypnotic test items. Examples of such items include: hand lowering which will be tested by holding your arm out and seeing if it moves downwards; arm rigidity, where you will be asked to imagine that you cannot bend your outstretched arm; and arm immobilization, where you will be asked to imagine that you arm is getting heavy. Your participation will also involve answering questionnaires concerning your experience of hypnosis. Please take a moment to read the following information concerning your rights and involvement in this study:

I understand that I may ask any questions about the experiment prior to signing this consent form, that my participation is voluntary, and that I may refuse or discontinue my participation at any time without prejudice.

I understand that this experiment is part of a larger project and that I may be asked to participate in a future session involving memory about personal events. I understand that my data will remain confidential even though research results may be published.

I understand that today's experiment will last approximately one hour thirty minutes (90 minutes).

I have understood this agreement, and I freely consent to participate in the present experiment conducted by France Slako, M.Ed.

Signature: _____ Date: _____

APPENDIX B

Words Used in Study List

STUDY LIST

1.	POOL	26.	PLEASING
2.	LOCATION	27.	PARTICLE
3.	THROAT	28.	SHRIMP
4.	SMART	29.	CARROT
5.	EXTREME	30.	GLOVE
6.	ARGUMENT	31.	REGRET
7.	BALD	32.	DIAGONAL
8.	DRAG	33.	SURVIVAL
9.	RECTANGLE	34.	CLING
10.	LAMB	35.	ATHLETE
11.	HOWL	36.	MAGNETISM
12.	REGARD	37.	ALARMED
13.	ALCOHOL	38.	DOUBTFUL
14.	ILLNESS	39.	SUMMIT
15.	RESTAURANT	40.	FATIGUE
16.	KINDNESS	41.	COOKIE
17.	WARM	42.	SCALP
18.	FICTION	43.	FUNERAL
19.	EXPLAINING	44.	ELASTIC
20.	BLANK	45.	PEACE
21.	CAB	46.	MOTEL
22.	GOLF	47.	CRUSHING
23.	ROBOT	48.	STEAK
24.	JAIL	49.	STARVE
25.	ROOSTER	50.	SWIMMER

APPENDIX C

Words Used for the First Recognition Task
(15 minute Delay)

RECOGNITION LIST

(* Indicates a target word)

1.	INSTRUMENT	35.	SNAKE
2.	SHADOW	36.	PROJECT
3.	POOL*	37.	EXPLAINING*
4.	STRANGER	38.	REWARD
5.	LOCATION*	39.	BLANK*
6.	TOY	40.	CAB*
7.	GLANCE	41.	GOLF*
8.	THROAT*	42.	ROBOT*
9.	MOISTURE	43.	JAIL*
10.	CLUE	44.	PARKING
11.	SMART*	45.	ROOSTER*
12.	CIRCUIT	46.	ACTOR
13.	EXTREME*	47.	PLEASING*
14.	ARGUMENT *	48.	SYMPATHY
15.	DRAG *	49.	DENTIST
16.	FLESH	50.	PARTICLE*
17.	RECTANGLE*	51.	COMMENT
18.	AGENT	52.	INNOCENT
19.	USELESS	53.	SHRIMP*
20.	LAMB*	54.	FLUID
21.	SOCIETY	55.	CARROT*
22.	REGARD*	56.	GLOVE*
23.	ALCOHOL*	57.	BUMP
24.	ILLNESS*	58.	REGRET*
25.	GRASP	59.	DISTINCTION
26.	RESTAURANT*	60.	ENTERTAIN
27.	BOIL	61.	DIAGONAL*
28.	COMB	62.	TRUMPET
29.	SATISFY	63.	SHACK
30.	JUDGMENT	64.	SURVIVAL*
31.	KINDNESS	65.	BIRD
32.	WARM*	66.	ONION
33.	FICTION*	67.	CLING*
34.	PATIENCE	68.	MUSHROOM

69. ICEBERG
70. SCRAP
71. ATHLETE*
72. CUPBOARD
73. MAGNETISM*
74. PERFECTION
75. CALENDAR
76. ALARMED*
77. DOUBTFUL*
78. INFORMAL
79. SUMMIT*
80. RIVAL
81. FATIGUE*
82. MODE
83. COOKIE*
84. SCALP*
85. SNEEZE
86. FUNERAL*
87. ELASTIC*
88. DUMP
89. PEACE*
90. MOTEL*
91. SUSPENSE
92. CRUSHING*
93. STEAK*
94. TRAP
95. STARVE*
96. RAILING
97. PINCH
98. SWIMMER*
99. BALD*
100. HOWL*

APPENDIX D

Words Used for Second Recognition Task
(One Week Delay)

RECOGNITION LIST

Word category is indicated in parentheses: (T) = Target, (L) = Lure, (N) = New

1. INSTRUMENT (L)
2. POOL (T)
3. STRANGER (L)
4. UNITED (N)
5. TOY (L)
6. FIREMAN (N)
7. GRAVITY (N)
8. ABDOMEN (N)
9. CLUE (L)
10. ELEGANT (N)
11. ERASER (N)
12. POSTURE (N)
13. ARGUMENT (T)
14. FAILURE (N)
15. DECIMAL (N)
16. FLESH (L)
17. TENNIS (N)
18. AGENT (L)
19. TRUTH (N)
20. LAMB (T)
21. SOCIETY (L)
22. REGARD (T)
23. PAIN (N)
24. GRASP (L)
25. ILLNESS (T)
26. LOCK (N)
27. BOIL (L)
28. DISK (N)
29. SATISFY (L)
30. FOAM (N)
31. KINDNESS (T)
32. TICK (N)
33. PEEL (N)
34. SWAN (N)
35. SNAKE (L)
36. EXPLAINING (T)
37. REWARD (N)
38. BLANK (T)
39. CAB (T)
40. ROBOT (T)
41. JAIL (T)
42. ROCKET (N)
43. ACTOR (L)
44. GLOWING (N)
45. DENTIST (L)
46. PARTICLE (T)
47. CLOUDY (N)
48. SHRIMP (T)
49. FLUID (L)
50. GLOVE (T)
51. EXPORT (N)
52. SALAD (N)
53. ENTERTAIN (L)
54. DIAGONAL (T)
55. ARREST (N)
56. SURVIVAL (T)
57. BIRD (L)
58. PEACE (T)
59. ATHLETE (T)
60. PERFECTION (L)
61. CALENDAR (L)
62. INFORMAL (L)
63. RIVAL (L)
64. SNEEKE (L)
65. FUNERAL (T)
66. ELASTIC (T)
67. DUMB (L)
68. MOTEL (T)
69. SUSPENCE (L)
70. STEAK (T)
71. TRAP (L)
72. STARVE (T)
73. RAILING (L)
74. SWIMMER (T)
75. BALD (T)

APPENDIX E

Experiment 1 – Session 1

Instructions for Study List, Neuropsychological Tests, And Recognition Task

Thank you for coming today. My name is France Slako and I am a Ph.D. student in psychology working under the supervision of Dr. Jean-Roch Laurence. As I have mentioned before, the study that you are about to participate in is concerned with neuropsychological testing. Before we begin, please take a moment to read and sign the consent form. Do you have any question?

PRESENTATION OF STUDY LIST:

(INSTRUCTIONS ALL SUBJECTS)

A list of words will be presented one at the time at a rate of one word per 3 s. on the computer screen right in front of you. Your task will be to do your best to memorize these words since you will be tested later on some form of memory task. Do not worry too much if you find it difficult because the list is long, you are simply expected to do your best.

(ADDITIONAL INSTRUCTIONS FOR DIVIDED ATTENTION CONDITION)

While attending to the words presented on the computer screen, you will have to listen to a string of digits ranging from 1 to 4 played on a tape. Your task is to detect the occurrence of a specific target sequence that I will describe to you shortly, and to raise your hand in order to indicate to me that you have identified the sequence. To make sure that you understand the task, I will give you a short practice trial. Please listen to the tape and raise your hand every time the target sequence 3-2-2 will occur. Are you ready?

TURN ON TAPE RECORDER TO PLAY FOR 90 S.

So your task is to pay attention and try to memorize each word presented on the

computer screen and second, simultaneously listen to the tape in order to detect the target sequence 3-2-2 and raise your hand accordingly. Do you have any questions? Are you ready to begin?

TURN ON TAPE RECORDER – Record clock time end of list presentation

DIGIT-SYMBOL TEST:

Under each number from 1 to on this sheet, there is a specific symbol. Your task is to fill each empty square with the proper symbol and to complete as many squares as possible in 90 s. You may fill in the sample part up to this tick line, to ensure that you understand the task.

The squares must be completed in a sequence, that is, you cannot complete all number 2, all number 3 and so on. Once you completed a line you must continue on the second one without stopping. You begin here when I say; "Go" and you are to stop immediately when I say "Stop". Are you ready to begin?

REY COMPLEX FIGURE (COPY):

(Give subject a plain sheet of paper placed vertically on the table)

I am going to show you a card on which there is a design that I would like you to copy on this sheet of paper. Please copy the figure as carefully as you can.

(Begin timing. Maximum 5 min. Minimum 2.5 min. exposure. When drawing completed, write down clock time for 30-minute recall).

STROOP INTERFERENCE TEST:

Here as it says on the instructions presented on the computer screen, you will see either a word or a series of XXXXs appearing at the center of the screen printed in one of 4 colors: RED, BLUE, GREEN or YELLOW. Your task is to identify the color of the print as quickly as possible by pressing one of the corresponding color keys located on the keyboard. The first part is a practice trial. If you make a mistake during the practice trial the computer will beep. It has been programmed to ensure that you learn the task correctly before you do the experimental part that comes after. Are you ready for the practice trial? Click the mouse when you are ready to begin.

Now you are about to begin the experimental part. You will get no feedback this time if you make a mistake so be careful and remember to respond as quickly as you can. Are you ready? Click the mouse to begin.

RECOGNITION TEST:

In this test you will see a series of words, presented one word at a time. Some of the words are those that you saw on the list you studied a while ago, others are not. For each word, press " Y " for " YES " on the keyboard if you recognize the word as one you saw on the list or press " N " for " NO " if you do not think the word was on that list. Additionally, as you make your decision about recognizing a word, you should keep in mind the following: Often when "REMEMBERING" a previous event or occurrence, we consciously recollect and become aware of some aspects of that previous experience. For instance, if you think about a movie you've seen, you can consciously recollect some of the scenes and perhaps some of the dialogue. At other times, we simply " KNOW " that

something has occurred before, but we are unable to consciously recollect anything about its occurrence. In other words, although we know (and are completely confident) that we experienced an event, we cannot recollect what we experienced. I'm interested in looking at which items you " REMEMBER " and which items you " KNOW" without remembering.

In this task, each time you say "YES" to a word you will be asked whether you " REMEMBER" the item or if you just " KNOW" it was on the list. You should press the " R" key for " REMEMBER" only if you can consciously recollect seeing the word in the list. You can tell if you " REMEMBER" such things as its image, physical appearance, how it was presented, what you thought of when saw the word, or perhaps something you noticed in the room as you saw the word. Any specific memory of the event will do. If, on the other hand, you have a strong feeling and are quite sure that a word was on the list, but you cannot remember anything about its presentation (where or when), press " K " for " KNOW". You just know that you've seen it. Finally if you have a strong feeling that a word was on the list, but are not sure at all about whether it was on it or not, press " G " for "GUESSING". With a guessing response, you think it was possible that the word was presented earlier but you are not sure that it was. For some reason, you think there was a chance that the word was on the list. There is no time limit to make a decision. Do you understand the instructions? Would you like to go over them again?

(ADDITIONAL INSTRUCTIONS IF REQUIRED)

The "REMEMBER" response should bring back to mind a particular association, image, or something more personal from the time of study, or something about its

appearance or position (i.e., what came before or after that word). KNOW is when you are certain of recognizing the word but the word fails to evoke any specific conscious recollection from the study list. GUESSING is when you feel that the word was on the list but are not sure.

(After test completion, choose 3 words from the list and ask the subject to justify "R K G" choices to insure that instructions were followed adequately).

TARGET DETECTION TASK (D2):

Timer required to record reaction time:

(HAND SUBJECT PART A SHEET)

On the sheet that I gave you, a target is shown in the example at the top. Your task is to find this target among other similar symbols of line 1 and to cancel them out (by making a vertical line with a pencil). You have to start when I tell you, and you must stop and wait before you begin the next line. Let's do these lines. Are you ready to begin the first one?

(HAND SUBJECT PART B SHEET)

On this new sheet, there is a new target shown in the example. Your task is to locate the target and cancel it out, just like you did before. Let's do these lines. Are you ready to begin the first one?

(HAND SUBJECT PART C SHEET)

This time the new target has three symbols. Your task is to perform the same as before but to cancel out any of these three targets. You may use this strategy: Remember that the targets are all characters with two marks (*Show subject*). Let's do these two

lines. Are you ready to begin the first line?

Now, we will repeat this task for the next six lines. Are you ready to begin the first line?

REY COMPLEX FIGURE - DELAYED RECALL:

(HAND BLANK SHEET OF PAPER PLACED VERTICALLY)

Do you remember the design I had you copy a while ago? Now I would like you to draw the figure from memory as carefully and completely as you can on this sheet of paper. If you make a mistake do not erase, just correct whatever you think is wrong. (No time limit).

VOCABULARY SUBTEST (Short form):

(TAKE OUT CARD WITH WORDS *Turn on tape recorder*).

In this next test, I want you to tell me the meanings of some words. Now listen carefully and tell me what each word I say means. Are you ready? Tell me what_____means. (Winter, repair, yesterday, consume, confide, ponder, tranquil, designate, colony, ballad, plagiarize, evolve, fortitude, audacious, encumber). *(Cue when appropriate* - ***Discontinue after six consecutive scores of 0)***

FAS- VERBAL FLUENCY TEST:

Now, I will say a letter of the alphabet. Then I want you to give me as many words that begin with that letter as quickly as you can. For instance, if I say "B", you might give me "bad, battle, bed... and so on..." I do not want you to use words which are proper names such as "Boston. Bob or Buick". Also, do not use the same word again with

a different ending such as "eat" and "eating". Any questions? Begin when I say the letter. The first letter is F. Go ahead. *(Begin Timing)*

(Allow 1 minute for each letter F, A and S. Say "Fine" or "Good" after each one minute performance. If discontinuation prior to 1 minute encourage subject to think of more words).

(TURN OFF TAPE RECORDER).

RAVEN PROGRESSIVE MATRIX SECTION E:

Look at this (point out upper square). It is a pattern with a portion taken out. Each of these bits below (point to each in turn) may or may not be the right shape to fit the space to complete the pattern. I want you to point at the piece, which you believe, is the right one to complete the pattern. The first few ones are quite simple; however, they get harder as you go on. Don't worry if you are unable to solve them all, most people don't. When I tell you to stop just tell me your best guest even if you are unsure. You have a maximum of 2 minutes to solve each problem. Are you ready? Here is the first one.

TRAIL MAKING TEST:

(HAND SUBJECT PART A SHEET AND PENCIL)

On this page are some numbers (point). Begin at number 1 and draw a line from one to two, two to three, three to four and so on, in order until your reach the end. Draw the lines as fast as you can. Do not lift the pencil from the paper. Ready! Begin!

(Correct any mistake the subject makes).

(HAND SUBJECT TEST A)

On this page are numbers from 1 to 25. Do this the same way as the example. Remember; work as fast as you can. Ready! Begin! *(Begin timing)*

(HAND SUBJECT PART B - SAMPLE)

On this page are some numbers and letters. Begin at number one and draw a line from one to A, A to two, two to B, B to three and so on, in order until you reach the end. Draw the lines as fast as you can. Ready! Begin!

(Correct any mistake)

(HAND SUBJECT TEST B)

On this page are both numbers and letters. Do this the same way as the example you just did. Remember, first you have a number, then a letter and the next number and so on. Do not skip around, but go from one circle to the next in the proper order. If you make a mistake do not erase, go over what as all ready been done. Draw the lines as fast you can. Ready! Begin! *(Begin timing)*

SELF-ORDERED POINTING TEST (SOPT):

(BINDER OPEN TO FIRST PAGE- 10-ITEM SET)

Look, here are ten abstract designs, I have pages with the same designs on them but they change places. See this one is up here (point), but now it is down here (point on second page). I want you to point at one design on each page. I want you to point to a different picture each time. Once you point to a design, you cannot choose it again. Do you understand? Point to a design on this page. *(If subject keeps pointing at the same place, do not allow it for the next trial).*

(BLANK PAGE START FROM BEGINNING AGAIN)

Now we are going to do it again beginning with a different one than last time. **Remember that once you point at one design you cannot choose it again. Point to a design on this page.**

(REPEAT SAME INSTRUCTIONS WITH 12 ITEM SET)

BREAK - 10 minutes:

We have two more tests to do on the computer. They will take another half-hour. Since we have been working for over an hour, I'd like you to take a 10-minute break before we do these last tests.

CONNER'S CONTINUOUS PERFORMANCE TEST (CPT):

This test is an attention test that will last for 14 minutes. During the test I will leave the room to avoid any distraction. Take a few minutes to read the instructions on the computer screen. (*Wait until instructions are read).* So you are to pay attention to the letter than will appear at the center of the screen and press the bar for every letter except the letter "X". Do you have any question before I leave the room? At the end of the test I'll be at the door and you will get a message that tells you to come and get me. As soon as I'm out, press the bar to begin the test.

WISCONSIN CARD SORTING TASK (WCST):

This test is a little unusual because I am not allowed to tell you very much about how to do it. You will be asked to match each of the cards that appear her (*point to bottom center of screen*) to one of these four key cards (*point to cards at the top*). This is a pointer that can move from key card to key card *(Press the left arrow key to activate the arrow pointer*). You can move the pointer by pressing the left or right arrow key (*point to keys*). You try it.

You are to match the cards that appear here to the key card that you think this card matches by moving the pointer beneath the key car and them pressing "ENTER". The computer will place your card under the key card you select, and a new card will appear at the bottom of the screen. I cannot tell you how to match the cards, but the computer screen will display a word that will tell you each time whether you are right or wrong. If you are wrong, simply try to match the next card correctly, and then continue matching the cards correctly until the test is over. There is no time limit on this test. Are you ready? Let's begin. (*Activate the test by pressing ALT F10)*

End of Session 1 (Debriefing and invitation to second session):

The neuropsychological testing part of the experiment is over. Most of tests that you have done today are assessing frontal lobe functions and we are interested in the relationship between performance on these tests (strengths and weaknesses) and episodic or personal memory as well as hypnotizability. We think that similar cognitive processes at the level of the frontal lobes may play a role in phenomenological experiences of memory and hypnosis. In the next session, I would like to measure how

hypnotizable you are. This will take about 35 to 45 minutes and I will be the person hypnotizing you. It is very important that you come back for the next session, because all the tests that we have done are interpreted in relation to hypnosis. However, I'm aware that you were not informed about hypnosis prior to the end of this session, therefore, if you refuse to continue, you will not be penalized in any way and will have access to the results of the tests you have done today. Do you have any questions about hypnosis?

APPENDIX F

Experiment 1 – Session 2

Instructions for Second Recognition Task

and SHSS Protocol

Thank you for coming today. As I mentioned to you during at the end of last session, we will today measure your level of hypnotizability or degree of response to hypnotic suggestions. First, I would like you to take a few minutes to do a recognition test like the one you did last week. First you indicate whether the word was on the study list or not by pressing "Y" or "N" on the keyboard. If "YES" you have to further indicate whether you "REMEMBER", "KNOW" or you are "GUESSING". Would you like me to repeat the instructions that I gave you last week?

(Invite subject to change room)

(HAND IN CONSENT FORM AND QUESTIONNAIRES)

Before we begin the hypnosis session, I need you to read and sign the consent form and to fill a few short questionnaires.

(After completion of questionnaires)

I am a graduate student and I have been working in hypnosis research in this lab since 1991. I have quite a bit of experience in this domain. Now what about you, have you ever been hypnotized before? *(If yes, ask when and inquire about subject's experience)*

(If no, proceed with the following instructions)

What we are doing today is a version of the Stanford Hypnotic Susceptibility Scale. It is a standardized scale largely used to assess individual differences in terms of response to hypnosis. It begins with a relaxation induction, followed by a series of suggestions ranging from easy to somewhat more difficult. Some people have been found to respond to all or almost all of the suggestions, while others have been found to

respond to few or none. These are not the most common patterns of responses. Most of the people's level of response is somewhere in between.

I'd like to mention an important distinction between an "instruction" and a "suggestion". For example, an instruction would be "Hold your arm out in front of you." A suggestion would be " Now think about your arm getting heavier and heavier." When you are given an instruction, just do it voluntarily to "set up" for the suggestion which will follow. Many people expect that their arm should just float up into position just because they're in hypnosis.

Hypnosis has to do with the process of how just thinking about an action can lead to the tendency to perform that action. During the session, you may find that you respond to a couple of suggestions in a row and then not to the next 1 or 2 or 3. Don't assume that you've stopped responding you may respond to others later on. If by any chance during the session you find that you're not responding at all, just try to enjoy the relaxation. Do you have any question?

If subjects are nervous or uncomfortable give them both academic information and emotional reassurance. In fact, whatever comes to mind is appropriate to their concerns.

(HAVARD AS A PRIOR EXPERIENCE)

This scale is very similar to the Harvard scale, it begins with relaxation and it is followed by suggestions. I will be hypnotizing you therefore the procedure is more interactive. The suggestions are similar, but some are different. There is a dream which I will ask you to tell me about in hypnosis. There is also a part on regression, I will ask you to go back to a nice day at school in grade 2 or 3 (*take the opportunity to ask subjects*

which they would prefer) and again you will speak to me about your experience.

Do you have any questions? Tell me how was your previous experience with hypnosis?

INTRODUCTION:

Before hypnosis begins, mention a few important details:

If at any time during the session you feel you want to adjust your position in the chair, need to cough, sneeze or scratch, just go ahead and do so. This will not disturb your hypnosis; in fact, you are more likely to be disturbed by staying in an uncomfortable position.

If you hear any peripheral noises (such as people coming in and out of the lab, sound through the wall, chairs moving upstairs, etc....) use these noises as cues to become more deeply relaxed and let them be part of your experience (this can really work).

You'll have your eyes closed for about 40 minutes; you may need to remove your glasses or contact lenses if they are likely to bother you.

STANFORD HYPNOTIC SUSCEPTIBILITY SCALE: FORM C PROTOCOL

RELAXATION:

First of all, just make yourself comfortable in the chair ... just move around until you find a comfortable position ... notice that the back of the chair is adjustable ... just get comfortable and relaxed...

Unclasp your hands and let them just rest loosely on your lap, or the arm of the chair ... and uncross your legs and let them find a comfortable position on the footrest of the chair ... and if at any time during the session you find that this position is uncomfortable you can simply adjust it to a more comfortable one without in any way

disturbing the hypnosis...

I'd like you to look at a dot on the door ... and focus your vision on it. I will refer to the dot as the target. In the meantime, I'm going to give you some simple instructions that will help you to experience hypnosis. You will find the instructions easy to follow in that you will be able to experience the things I describe to you.

Indeed you will probably find that you will be able to experience these things with great vividness ... with great intensity...

As you stare at the target, you may find that occasionally your gaze may wander or that your vision may even blur ... If this happens, simply refocus your vision and continue staring evenly at the target...

Now take a deep breath in and hold it ... then ... just let it out very slowly ... You find that you start to experience a comfortable feeling ... a feeling of well being begins to develop as you continue to rest in the chair ... looking at the target ... listening to my Voice...

Focus your attention closely on feelings of warmth and relaxation in various parts of you body ... in your head and in your neck ... in your arms and in your legs ... in your chest and in your back ... and just breathe freely and evenly and deeply ... freely ... evenly ... and deeply ... not too quickly ... not too slowly ... just at a comfortable rate for you to notice that the relaxation increases gradually ... as you breathe out ... and just rest there for a moment experiencing the sensations ... Continue relaxing your chest so that feelings of warmth and comfort spread to your back ... your shoulders ... and your neck ... and your arms ... and your legs ...

You're probably starting to notice some changes in the target ... changes that

occur from staring at it for so long ... sometimes the target may look as though it's moving up and down or from left to right ... at times it may appear very distinct and clear, at other times it may appear fuzzy and blurred ... and it may change color ... you may see one of these things or even all of these things ... whatever you see just continue staring at the target ... continue listening to my voice ... continue to become more deeply relaxed ... more deeply relaxed ...

IF EYES STILL OPENED: Read *entire paragraph*

(IF EYES CLOSED READ BRACKETS ONLY)

And as you watch the target your eyelids become heavier ... your eyes become tired from staring ... your eyelids start to feel very tired and heavy ... as you sit there breathing freely and evenly ... and deeply ... breathing in ... breathing out... freely and evenly and deeply ... (Your eyelids are becoming (feel) so heavy ... so tired) ... that soon they will just close of their own accord ... (as if they were coated with lead paste ... as if there were magnetic fields in the eyelashes) ... drawing your eyelashes together ... (Concentrate now ... even more carefully ... on feelings of relaxation and comfort in various parts of your body ...)

First of all think of relaxation in the muscles of your left leg ... the left foot ... the toes of your left foot ... the left calf ... the left thigh ... and then relax the muscles of the right leg ... the right foot ... the toes of your right foot ... the right calf ... the right thigh...

Think of relaxation in each of these areas ... and as you think of relaxation, the muscles become progressively more relaxed ... and then relax the muscles of your back ... your chest ... your neck ... relax each of these muscle groups ... the back ... the chest ...

and the neck...

And then relax the muscles of your left arm ... your left hand ... the fingers of your left hand ... your left forearm ... your left upper arm ... your left shoulder ... And then relax the muscles of your right arm, your right hand ... the fingers of your right hand ... your right forearm ... your right upper arm ... your right shoulder...

And as you relax these muscles ... your facial muscles will also relax and loosen of their own accord...

Just thinking about relaxation in each of these areas causes the muscles to become more relaxed ... and you may even find and interesting thing happening ... that the feelings of relaxation you feel in each of these areas of the body start to spread... and you feel a deep feeling of overall relaxation ... of contentment ... and of well being ... permeating the whole of your body ...

IF EYES NOT CLOSED

And you have concentrated well on the target and your eyes have become tired and strained from staring ... there is no longer any need to strain them anymore ... they would soon close of their own accord ... but you can just close your eyes now.

With your eyes closed ... you're ready to experience hypnosis ... to experience it more profoundly ... but you'll find that no matter how deeply relaxed you ever feel ... no matter how deeply in hypnosis you ever feel ... your mind is always clear ... you're always aware of my voice and what I'm saying to you ... you're always aware of what is happening to you ... even though you are deeply relaxed ... deeply in hypnosis...

And you will be able to speak to me when I speak to you ... to open your eyes ... and to move around while remaining deeply hypnotized ... whatever you experience or do ... you will remain deeply hypnotized ... deeply in hypnosis...

You can now go even deeper in hypnosis ... say to yourself, just by thinking it, "Now I'm going deeper and deeper ". Think it to yourself ... (PAUSE) ... and imagine yourself standing at the top of an escalator ... Visualize the scene of the escalator ... of the steps moving down ... and picture the moving hand rail...

In a moment I'm going to ask you to count backwards to yourself, slowly from 10 to 1, imagining as you count, that you are stepping onto the first step of the escalator and standing with your hand on the railing while the steps move down ... carrying you deeper and deeper ...into hypnosis. You can plan it so that you reach one just as you reach the bottom and step off the escalator: and to indicate to me that you have reached one, the index finger of your LEFT hand will lift up slowly ... and I'll know that you have reached one ... more and more deeply relaxed as you start counting backwards to yourself ... from 10 to 1...

(Wait for finger to lift)

You can just relax your finger now ... deeply relaxed ... deeply hypnotized...

(BEGIN SUGGESTIONS)

1. HAND LOWERING

Now hold your right arm out at shoulder height, with the palm of your hand up, there that's right ... Attend carefully to this hand, how it feels, what is going on in it. Notice whether or not it is a little numb, or tingling: the slight effort it takes to keep from bending your wrist. Pay close attention to your hand now ... Imagine that you are holding

something heavy in your hand ... may be a heavy baseball or a billiard ball ... something heavy ... Shape your fingers around as though you were holding this heavy object that you imagine is in your hand.

That's it ... now the hand and arm feel heavy, as if the weight was pressing down ... and as it feels heavier and heavier the hand and arm begin to move down ... as if forced down ... moving ... moving ... down ... down ... more and more down ... heavier ... heavier ... the arm is more and more tired and strained ... down ... slowly but surely ... down, down ... more and more down ... the weight is so great, the hand is so heavy ... You feel the weight more and more ... the arm is too heavy to hold back ... it goes down , down , down ... more and more down ...

Wait at most 10- seconds

IF NOT ALL THE WAY DOWN

That's good ... now let your hand go back to its original position, and relax. You probably experienced much more heaviness and tiredness in your arm than you would have if you had not concentrated on it and had not imagined something trying to force it down. Now just relax ... Your hand and arm are now as they were, not feeling tired or strained ... All right, just relax.

IF ALL THE WAY DOWN

That's good ... now let your hand return to its original position. Just let it rest there, and relax. Your hand and arm are now as they were, not feeling tired or strained. All right ... relax.

2. MOVING HANDS APART

Now extend your arms ahead of you, with palms facing each other, both hands close together but not touching ... Both arms, straight out in front of you with palms facing each other. (IF SUBJECT DOES NOT UNDERSTAND) Let me show you ... (TAKE SUBJECT'S HANDS AND PLACE THEN INTO POSITION). That's right, hands close together but not touching...

I would like you to imagine a force acting on your hands to push them apart, as though one hand was repelling the other ... You are thinking of your hands being forced apart and they begin to move apart ... separating ... separating ... moving apart ... wider apart ... more and more away from each other ... more and more...

Wait at most 10 seconds

That's fine. You notice how closely thoughts and movement are related. Just put your hands back on the arms of the chair and relax.

3. MOSQUITO HALLUCINATION

You have been listening to me very carefully, paying close attention. You may not have noticed a mosquito that has been buzzing, singing, as mosquitoes do ... Listen to it now ... hear it's high pitched buzzing as it flies around your left hand ... It is landing on your hand ... perhaps it tickles a little ... (PAUSE) there, it flies away again ... you hear its high buzz ... it's back on your hand tickling ... it might bite you ... you don't like this mosquito ... you'd like to get rid of it ... Go ahead, brush it off ... get rid of it if it bothers you...

Wait at most 10 seconds

It's gone ... you are no longer bothered ... the mosquito has disappeared. Now relax, relax completely.

4. TASTE HALLUCINATION

A. SWEET TASTE

This time, I would like you to think of something sweet in your mouth. Imagine that you have something sweet tasting in your mouth, like a little sugar ... and as you think of this sweet taste... you can actually begin to experience a sweet taste ... It may be faint at first, but it will grow ... and grow ... (PAUSE) Now you begin to notice a sweet taste in your mouth ... the sweet taste is increasing ... sweeter and sweeter...

Wait 10 seconds

Tell me, how much of a sweet taste is there in your mouth? (IF SUBJECT INDICATES THAT S/HE TASTES SWEET, DETERMINE HOW STRONG THE TASTE IS). How strong is the taste?

(IF MODERATELY STRONG, GO ON TO PART B; IF NO TASTE OR VERY WEAK, CONTINUE AS FOLLOWS:)

It will get stronger ... it often takes a few moments for such a taste to reach its full strength ... It is now getting stronger ... stronger ... (PAUSE) There ... how is it now? Stronger? (NOTE REPLY, AND GO ON WITH B. SOUR TASTE, STARTING WITH a or b, DEPENDING UPON THE EXPERIENCE WITH SWEET).

B. SOUR TASTE

a. (IF LITTLE OR NO PERCEPTION OF SWEET TASTE)

That's all right. Some hypnotized persons can experience this sort of taste well and others can not. Let's see how you do with another taste (GO ON WITH C.)

b. (IF SUBJECT REPORTS DISTINCT TASTE OF SWEET)

Now notice that something is happening to this taste ... it is changing (GO ON WITH C.)

c. You are now beginning to have a sour taste in your mouth ... an acid taste, as if you had some lemon in your mouth ... the taste in your mouth is getting more and more sour, more and more sour...

Wait 10 seconds

Do you have that sour taste in your mouth now? (NOTE REPLY: IF "YES", ASK) How strong is it? How does it compare in strength with the sweet taste you experienced earlier?

d. (IF SOUR TASTE NOT EXPERIENCED)

Not everyone can experience tastes like this when hypnotized. Your mouth feels quite normal ... Just relax and don't think about tastes anymore ... Just continue to relax...

e. (IF SOUR TASTE EXPERIENCED)

That's fine ... but note the sour taste is going away and your mouth feels just as it did before I mentioned any tastes at all ... there, it's quite normal now ... and you just

continue to relax ... more and more relaxed...

RECORD (+) IF BOTH TASTES EXPERIENCED, AND EITHER (a) ONE IS ACCOMPANIED BY OVERT SIGNS, SUCH AS LIP MOVEMENTS OR GRIMACING, OR (b) ONE IS REPORTED AS STRONG.

5. ARM RIGIDITY

Please hold your right arm straight out, and fingers straight out too ... That's it, right arm straight out... Think of your arm becoming stiffer and stiffer ... stiff ... very stiff ... as you think of it becoming stiff, you will feel it becoming stiff ... more stiff and rigid as though your arm was in a splint so the elbow cannot bend ... (PAUSE) stiff ... held stiff... so that it cannot bend. A tightly splinted arm cannot bend ... Your arm feels stiff as if tightly splinted ... Test how stiff and rigid it is ... Try to bend it ... Try...

Wait at most 10 seconds

(IF ARM BENDS)

That's fine. You will have an opportunity to experience many things. You probably noticed how your arm became stiffer as you thought of it as stiff, and how much effort it took to bend it. Your arm is no longer at all stiff. Place it back into position, and relax.

(IF ARM DOES NOT BEND)

Relax ... don't try to bend your arm anymore ... It is not stiff any longer ... Let it relax back into position. Just relax.

6. DREAM

We are very much interested in finding out what hypnosis and being hypnotized means to people. One of the best ways of finding out is through the dreams that people have while they are hypnotized. Some people dream directly about the meaning of hypnosis, while others dream about this meaning in an indirect way, symbolically, by dreaming about something which does not seem outwardly to be related to hypnosis, but may very well be. Now, neither you nor I, know what sort of dream you're going to have, but I am going to ask you to rest for a little while and you are going to have a dream ... a real dream ... just the kind you have when you are asleep at night. When I stop talking to you very shortly, you will begin to dream. You will have a dream about hypnosis. You will dream about what hypnosis means. ... Now you are falling asleep ... deeper and deeper asleep ... very much like when you sleep at night ... soon you will be deep asleep, soundly asleep. As soon as I stop talking, you will begin to dream. When I start talking to you again you will stop dreaming if you still happen to be dreaming, and you will listen to me just as you have been doing. If you stop dreaming before I speak to you again, you will remain pleasantly and deeply relaxed ... Now sleep and dream...

(*PAUSE 2 MINUTES*)

The dream is over now; if you had a dream you can remember every detail of it clearly. Did you have a dream? (IF YES) The dream is over, and you can remember every detail of it clearly. (IF YES OR NO) You do not feel particularly sleepy or different from the way you felt before I asked you to fall asleep and to dream, and you continue to remain deeply hypnotized. Whatever you dreamed, you can remember quite

clearly, and I'd like you to describe it to me from the beginning.

(IF SUBJECT HAS NO DREAM)

That's all right ... not everyone dreams in hypnosis. (IF S/HE HESITATES, OR REPORTS VAGUELY, PROBE FOR DETAILS)

(IF SUBJECT HAS A DREAM)

That's all for the dream now.

7. AGE-REGRESSION

Continue to go deeper and deeper in hypnosis ... I'm going to give you a pad and pencil ... Let's see, which hand do you write with? ... (GIVE A PAD AND PENCIL IN APPROPRIATE HAND). Now please write you name ... and while you are at it, can you write your age and the date. That's fine ... Keep the pad and pencil in your hands and listen closely to me (IF NEEDED, TELL SUBJECT TO ONCE AGAIN CLOSE EYES AND REST HEAD ON BACK OF CHAIR) ... I would like you to think about when you were in the second or third grade of school ... which would you prefer? (WAIT FOR ANSWER). That's fine ... In a little while, you will find yourself once again a little (BOY/GIRL) on a nice day sitting in class in the (2nd or 3rd) grade ... Writing or drawing on some paper ... I shall now count to 5 and at the count of 5, you will back in (APPROPRIATE 2nd or 3rd) grade ... 1. You are going back into the past ... it's no longer the year 2000, 1999, 1998, 1997, but much earlier ... 2. You are becoming increasingly younger and smaller ... Soon you will back in the (2nd or 3rd) grade, on a

very nice day ... 3. Getting younger and younger, smaller and smaller all the time. Soon you will be back in (2nd or 3rd) grade, and you will feel an experience exactly as you did once before on a nice day when you were sitting in class, writing or drawing ... 4. Very soon you will be there, once again a little (BOY/GIRL) in (2nd or 3rd) grade. You are nearly there now ... in a few moments you will be right back there ... 5. You are now a small (BOY/GIRL) in a classroom in school...

(PAUSE)

(WRITE DOWN FOLLOWING ANSWERS IN BOOKLET)

1. What is your name?

2. How old are you?

3. What are you doing?

4. Who is your teacher?

6. You have a pad and pencil ... I would like you to write your name on the pad with the pencil ... Open your eyes now... just enough to see the pad (PAUSE UNTIL NAME IS WRITTEN) ... That's fine ... Now please write down your age ... and now the date ... and if you can, the day of the week ...

(REGARDLESS OF RESPONSES)

That's fine ... and now you can grow up again and come right back to the year 2000 in the hypnosis lab at Concordia University. You are no longer a little (BOY/GIRL) but a grown up person of (STATED AGE) sitting in a chair, deeply hypnotized.

How old are you?

And what is the date?

Where are you?

That's right ... today's date is _____ and you are (STATED AGE) and this is the hypnosis lab at Concordia.

Fine, everything is back as it was. Now I'll take the pad and pencil.

(*PICK UP PAD AND PENCIL*)

DUALITY QUESTION

Could you tell me what it felt like, just now, being age (REGRESSED AGE). DON'T PROBE FOR DETAILS - KEEP QUESTION OPEN ENDED.

That's fine, now let's go on to something else.

8. ARM IMMOBILIZATION (LEFT ARM)

You are very relaxed and comfortable, with a feeling of heaviness throughout your body. I would like you now to think about your left arm and hand. Pay close attention to them. They feel numb and heavy, very heavy. How heavy your left hand feels ... even as you think about how heavy it is, it grows heavier and heavier ... Your left arm is getting heavier ... heavy ... heavy ... Your hand is getting heavier, very heavy. You might like to find out, a little later, how heavy your hand is ... it seems much too heavy to move ... but in spite of being so heavy, maybe you can move it a little, but maybe it is too heavy even for that ... Why don't you see how heavy it is ... Just try to lift your hand up, just try.

Wait at most 10 seconds

(IF HAND LIFTS)

That's fine. You see how it was harder to lift than usual because of the relaxed state you are in. Now place your hand back in its original position. Your hand and arm feel normal again. They are no longer heavy. Just relax ... relax all over.

(IF HAND DOES NOT LIFT)

That's fine ... Stop trying ... just relax. Your hand and arm now feel normal again. They are not heavy anymore. Just relax ... relax all over.

9. HALLUCINATED VOICE

I forgot to mention to you a while ago that there is someone in the lab who wants to ask you some questions about yourself for our records, such as how old you are, where you were born, how many brothers and sisters you have, and a few other factual questions. I hope you don't mind answering these questions. The questions will be asked over a loud speaker microphone combination, which is on the wall to your right. Please talk good and loud when you answer so that you can be heard clearly. The loud speaker has just been turned on ... Here's the first question ... Remember to answer good and loud so that you can be heard clearly...

Wait at most 10 seconds

(IF SUBJECT DOES NOT ANSWER)

Didn't you hear the question?

(IFS/HE HEARS NOTHING)

That's fine ... Let's go on to something else. There is no voice asking questions

.

(IF SUBJECT HEARS QUESTIONS BUT DOES NOT ANSWER ALOUD)

I could not hear what you said. Please answer so that I can hear you too.

(*REPEAT IF NECESSARY*).

(IF SUBJECT HEARS AND RESPONDS)

That's fine. I think you have answered enough questions and we had better go on to something else. There is no longer any voice asking questions.

10. NEGATIVE VISUAL HALLUCINATION: THREE BOXES

In a little while, I am going to ask you to open your eyes and look to your left, remaining as hypnotized as you are now. I have placed two boxes next to you, on your left side. In fact, that is all there is, just two boxes. Two small boxes and nothing else (PAUSE) ... All right, open your eyes slowly, and look at the two boxes. Do you see them? ... Do you see anything else?

(IF S/HE REPORTS THREE BOXES)

That's right ... there really are three boxes. Now close your eyes and relax, as I take away the boxes. (GO TO POST-HYPNOTIC AMNESIA)

(IF S/HE REPORTS TWO BOXES)

That's right. You see just two boxes. Now I would like you to tell me what these boxes look like. Are they large? Are they alike? (RECORD COLORS)

That's right, they are (NAME COLORS). By the way, is the (COLOR OF ONE BOX) on the right or on the left of the (COLOR OF THE OTHER BOX)? That's right.

But now look hard ... Aren't there really three boxes? There really are three boxes ... What is the color of the third box? ... That's right ... Now close your eyes and relax as I take away the boxes.

11. POST-HYPNOTIC SUGGESTION & AMNESIA

Listen carefully to what I tell you next. In a little while I shall begin counting from 1 to 10. You will awaken gradually, but you will still be in your present state for most of the count. When I reach 7 you will open your eyes, but you will not be fully awake. When I get to 10 you will be entirely roused up, in your normal state of wakefulness. You will have been so relaxed; however, that you will have trouble recalling the things I have said to you and the things you did or experienced. It will prove to cost so much effort to recall that you will prefer not to try. It will be much easier just to forget everything until I tell you that you can remember. You will forget all that has happened until I say to you: "Now you can remember everything" ... You will not remember anything until then. After you wake up you will feel refreshed ... and relaxed. In a little while I will count from 1 to 10. At 10, you will be fully awake... after you wake up you will feel a sudden urge to cough and clear your throat before talking... You will do this, but you will forget that I told you to do so, just as you will

forget the other things, until I tell you: "Now you can remember everything"...

Wait one minute

Are you ready now? 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - 10.

(IF SUBJECT HAS EYES OPEN)

How do you feel? ... Do you feel wide-awake? (IF FEELINGS OF DROWSINESS) ... The feelings will go away soon. Now you feel wide-awake...

(IF HE/SHE KEEPS EYES CLOSED)

Wake up now ... Wide-awake ... How do you feel? (IF DROWSY) ... The feelings will go away soon. Now you feel wide awake ... (PAUSE)

Now, I want to ask you a few questions about your experience.

(GO TO POST-HYPNOTIC INTERVIEW)

APPENDIX G

Experiment 2

Instructions and Protocol

INSTRUCTIONS FOR CONTROL CONDITION (AB):

For BA condition (substitute with words in parentheses):

Thank you for coming. What we are going to do today is quite simple. I am interested in getting some samples of your memory for personal events that will come to your mind in response to words. Your responses will be audio taped but to insure confidentiality, your name will not be on the tape. Do you have any questions or concerns about this?

As I mentioned before, I will ask you to share with me some memories of personal events. That is, I would like you to think of an experience from your own life that you are reminded of, when presented with a word. The memory can be of something recent or remote, whichever you think of first, but it must be something that you experienced, not something that happened to a friend or a relative. I would like you to be as specific as possible when referring to an event by giving me as much detail as you can. For example, if I give you the word PRACTICE, telling me that you used to attend football practice or piano practices once a week is not sufficient. I would like you to tell me about one specific practice, with as much detail as possible. Do you have any questions?

The first word is "BREAK":

Record response time.

(IF SUBJECT DOES NOT RESPOND AFTER ONE MINUTE)

That's fine. Sometimes it takes a while for such memories to come back to mind. Perhaps you broke a bone, an object, or a relationship in the past... Try to think about the

word "BREAK" again. (LETTER)

Wait at least 30 seconds

(IF STILL NO RESPONSE MOVE ON TO THE NEXT WORD)

That's fine. Sometimes nothing comes to mind with that particular word. Let's take another one. *(Give substitute word)*

(IF SUBJECT RESPONDS BUT PROVIDES INSUFFICCIENT DETAILS USE PROMPT(S))

Can you tell me anything else? *(Always use this one first)*

Who else is there with you?

What time of day or what year is it?

What are you were wearing?

What is the weather like?

Where are you exactly?

(IF SUBJECT RESPONDS BUT DOES NOT TALK ABOUT A SPECIFIC EPISODE)

Prompt *(use only once)*: Say: "Yes, but can you think about a specific time where...

RECORD AMOUNT OF PROMPT (S) REQUIRED:

That's fine. Let's take a new word. This time the word is: " DOG" (STORM)

(IF SUBJECT DOES NOT RESPOND AFTER ONE MINUTE)

That's fine. Sometimes it takes a while for such memories to come back to mind. Perhaps you had a dog or played with a dog in the past? ... Try to think about the word "DOG" again.

Record response time and amount of prompts

That's fine. Let's take another the word. This time the word is: "ANGRY" (LOST)

(IF SUBJECT DOES NOT RESPOND AFTER ONE MINUTE)

Perhaps you got angry once for some reason, or made someone else angry? ... Try to think about the word "ANGRY" again.

INSTRUCTIONS FOR HYPNOSIS CONDITION:

Thank you for coming. During this session I will hypnotize you again much in the same way as I did the last time. (INQUIRE ABOUT LAST EXPERIENCE) However, when you are going to be in hypnosis, I will ask you to share with me some memories of personal events in response to particular words. Your responses will be audio taped but to insure confidentiality, your name will not be on the tape. Do you have any questions or concerns about this?

When we will get to the memory part, I will ask you to think of an experience from your own life that you are reminded of when presented with a word. The memory can be of something recent or remote, whichever you think of first, but it must be something that you experienced, not something that happened to a friend or a relative. I would like you to be as specific as possible when referring to an event by giving me as much detail as you can. For example, if I give you the word PRACTICE, telling me that you used to attend football practice or piano practices once a week is not sufficient. I would like you to tell me about one specific practice, with as much detail as possible. Before we begin, do you have any questions?

RELAXATION

First of all, just make yourself comfortable in the chair ... just move around until you find a comfortable position ... just get comfortable and relaxed...

Unclasp your hands and let them just rest loosely on your lap, or the arm of the chair ... and uncross your legs and let them find a comfortable position on the footrest of the chair ... and if at any time during the session you find that this position is uncomfortable you can simply adjust it to a more comfortable one without in any way disturbing the hypnosis...

I'd like you to look at a dot on the door ... and focus your vision on it. I will refer to the dot as the target As you stare at the target, you may find that occasionally your gaze may wander or that your vision may even blur ... If this happens, simply refocus your vision and continue staring evenly at the target...

Now take a deep breath in and hold it ... then ... just let it out very slowly ... You find that you start to experience a comfortable feeling ... a feeling of well being begins to develop as you continue to rest in the chair ... looking at the target ... listening to my voice ...

Focus your attention closely on feelings of warmth and relaxation in various parts of you body ... in your head and in your neck ... in your arms and in your legs ... in your chest and in your back ... and just breathe freely and evenly and deeply ... freely ... evenly ... and deeply ... not too quickly ... not too slowly ... just at a comfortable rate for you to notice that the relaxation increases gradually ... as you breathe out ... and just rest there for a moment experiencing the sensations ... Continue relaxing your chest so that feelings of warmth and comfort spread to your back ... your shoulders ... and your neck ... and your arms ... and your legs ...

You're probably starting to notice some changes in the target ... changes that occur from staring at it for so long ... sometimes the target may look as though it's

moving up and down or from left to right ... at times it may appear very distinct and clear, at other times it may appear fuzzy and blurred ... and it may change color ... you may see one of these things or even all of these things ... whatever you see just continue staring at the target ... continue listening to my voice ... continue to become more deeply relaxed ... more deeply relaxed ...

IF EYES STILL OPEN: Read entire paragraph

(IF EYES CLOSED READ BRACKETS ONLY)

And as you watch the target your eyelids become heavier ... your eyes become tired from staring ... your eyelids start to feel very tired and heavy ... as you sit there breathing freely and evenly ... and deeply ... breathing in ... breathing out... freely and evenly and deeply ... (Your eyelids are becoming (feel) so heavy ... so tired) ... that soon they will just close of their own accord ... (as if they were coated with lead paste ... as if there were magnetic fields in the eyelashes) ... drawing your eyelashes together ... (Concentrate now ... even more carefully ... on feelings of relaxation and comfort in various parts of your body ...)

First of all think of relaxation in the muscles of your left leg ... the left foot ... the toes of your left foot ... the left calf... the left thigh... and then relax the muscles of the right leg ... the right foot ... the toes of your right foot ... the right calf ... the right thigh...

Think of relaxation in each of these areas ... and as you think of relaxation, the muscles become progressively more relaxed ... and then relax the muscles of your back ... your chest ... your neck ... relax each of these muscle groups ... the back ... the chest ... and the neck...

And then relax the muscles of your left arm ... your left hand ... the fingers of your left hand ... your left forearm ... your left upper arm ... your left shoulder ... And then relax the muscles of your right arm, your right hand ... the fingers of your right hand ... your right forearm ... your right upper arm ... your right shoulder ... And as you relax these muscles ... your facial muscles will also relax and loosen of their own accord...

Just thinking about relaxation in each of these areas causes the muscles to become more relaxed ... and you may even find and interesting thing happening ... that the feelings of relaxation you feel in each of these areas of the body start to spread... and you feel a deep feeling of overall relaxation ... of contentment ... and of well being ... permeating the whole of your body ...

IF EYES NOT CLOSED

And you have concentrated well on the target and your eyes have become tired and strained from staring ... there is no longer any need to strain them anymore ... they would soon close of their own accord ... but you can just close your eyes now.

With your eyes closed ... you're ready to experience hypnosis ... to experience it more profoundly ... but you'll find that no matter how deeply relaxed you ever feel ... no matter how deeply in hypnosis you ever feel ... your mind is always clear ... you're always aware of my voice and what I'm saying to you ... you're always aware of what is happening to you ... even though you are deeply relaxed ... deeply in hypnosis ...

And you will be able to speak to me when I speak to you ... to open your eyes ... and to move around while remaining deeply hypnotized ... whatever you experience or do

... you will remain deeply hypnotized ... deeply in hypnosis...

You can now go even deeper in hypnosis ... say to yourself, just by thinking it, "Now I'm going deeper and deeper ". Think it to yourself ... (PAUSE) ... and imagine yourself standing at the top of an escalator ... Visualize the scene of the escalator ... of the steps moving down ... and picture the moving hand rail...

In a moment I'm going to ask you to count backwards to yourself, slowly from 10 to 1, imagining as you count, that you are stepping onto the first step of the escalator and standing with your hand on the railing while the steps move down ... carrying you deeper and deeper... into hypnosis. You can plan it so that you reach one just as you reach the bottom and step off the escalator; and to indicate to me that you have reached one, the index finger of your LEFT hand will lift up slowly ... and I'll know that you have reached one ... more and more deeply relaxed as you start counting backwards to yourself ... from 10 to 1...

(Wait for finger to lift)

You can just relax now ... deeply relaxed ... deeply hypnotized ... Now; I want you to listen to me carefully. In a little while I will give you a word and you will remember an event of your own life related to this word, whichever event comes back to your mind ... When you are ready tell me about this personal event, be as specific as you can and give as much detail as you can ... The first word is: "LETTER". (BREAK)

Record Response time

Wait for one minute

(IF SUBJECT DOES NOT RESPOND) That's fine. Sometimes it takes a little while for such memories to come back to mind ... Perhaps received a letter or sent a letter to

someone in the past... Try to think about the word "LETTER" again.

Wait for at least 30 seconds

(IF STILL NO RESPONSE)

That's fine. Sometimes nothing comes to mind. Let's try another word. This time the word is: *(Give substitute word)*

(IF SUBJECT RESPONDS BUT PROVIDES INSUFFICIENT DETAILS USE PROMPT(S))

Can you tell me anything else? *(always use this one first)*

Who else is there with you?

What time of day or what year is it?

What are you were wearing?

What is the weather was like?

Where are you exactly?

(IF SUBJECT RESPONDS BUT DOES NOT TALK ABOUT A SPECIFIC EPISODE)

Prompt *(use only once):* Say: "Yes, but can you think about a particular time where...

RECORD AMOUNT OF PROMPT (S) REQUIRED:

That's fine. Let's take a new word. This time the word is: " STORM" (DOG)

(IF SUBJECT DOES NOT RESPOND AFTER ONE MINUTE)

That's fine. Sometimes it takes a while for such memories to come back to mind ... Perhaps you experienced a storm in the past... Try to think about the word "STORM" again.

RECORD RESPONSE TIME AND AMOUNT OF PROMPTS

That's fine. Let's take another word. This time the word is: "LOST" (ANGRY)

(IF SUBJECT DOES NOT RESPOND AFTER ONE MINUTE)

That's fine. Sometimes it takes a while for such memories to come back to mind... Perhaps you remember getting lost at some point in your life or lost an object... Try to think about the word "LOST" again.

RECORD RESPONSE TIME AND AMOUNT OF PROMPTS

We have done enough words for now. Listen carefully to what I tell you next. In a little while I shall begin counting from 1 to 10. You will awaken gradually, but you will still be in your present state for most of the count. When I reach 7 you will open your eyes, but you will not be fully awake. When I get to 10 you will be entirely roused up, in your normal state of wakefulness. After you wake up you will feel refreshed ... and relaxed. At 10, you will be fully awake ... Take a few moments now to enjoy the warm and pleasant feelings of being in hypnosis and in a few moments I will ask you if you are ready to come out of hypnosis.

Wait one minute

Are you ready now? 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - 10.

(IF SUBJECT HAS EYES OPEN)

How do you feel? ... Do you feel wide-awake? (IF FEELINGS OF DROWSINESS) ... The feelings will go away soon. Now you feel wide-awake...

(IF SUBJECT KEEPS EYES CLOSED)

Wake up now ... Wide-awake ... How do you feel? (IF DROWSY) ... The

feelings will go away soon. Now you feel wide awake ... (PAUSE)

This is the end of the session. I want to thank you for your participation. As you know we are interested in the relationship between frontal lobes, episodic memory and hypnosis. We are looking at individual differences in the process of reconstructing memory for personal events in and out of the hypnotic context. To achieve this we need to examine the content of different samples of episodic memories from a range of subjects with various level of hypnotic susceptibility and you have made it possible for us to collect such memories. I hope you have enjoyed participating in this research as much as I have enjoyed the opportunity to work with you.

APPENDIX H

SHSS: C Scoring Booklet

Scoring Booklet (Stanford)

Name: _____ Date: _____

Subject #: _____ Experimenter: _____ Score: _____

Summary of scores

	+ or –
0. Eye closure	XXXXXXXXXX
1. Hand lowering	
2. Moving hands apart	
3. Mosquito hallucination	
4. Taste hallucination	
5. Arm rigidity	
6. Dream	
7. Age regression	
8. Arm immobilization	
9. Hallucinated voice	
10. Negative hallucination	
11. Post-hypnotic suggestion	
12. Post-hypnotic amnesia	

Duality: Yes No Total: _____

Order of Post-hypnotic recall

	Amnesia	Reversal
1. Hand lowering		
2. Moving hands apart		
3. Mosquito hallucination		
4. Taste hallucination		
5. Arm rigidity		
6. Dream		
7. Age regression		
8. Arm immobilization		
9. Hallucinated voice		
10. Negative hallucination		
11. Post-hypnotic suggestion		
12. Post-hypnotic amnesia		

0. Response to induction

Eyes do_____ do not_____close without forcing.

Remarks: _____

Score + if eyes close before subject is instructed to do so deliberately_____

1. Hand lowering (right hand)

Extent of movement during suggestion: _____

Extent of movement after 10 seconds: _____

Remarks: _____

Score + if hand has lowered at least six inches by the end of 10 seconds _____

2. Moving hands apart

Extent of movement during suggestion: _____

Extent of movement after 10 seconds: _____

Remarks: _____

Score + if hands are six inches or more apart at the end of 10 seconds _____

3. Mosquito hallucination

Response during suggestion: _____

Response during 10 second interval: _____

Remarks: _____

Score + for any grimacing, movement or acknowledgment of effect _____

76. Taste hallucination

a. initial taste of **sweet**

none _____ vague _____ weak _____ strong _____

Subject's description:_____

Overt signs: _____

After reinforcement: none _____ vague ____ weak _____ strong _____

Subject's description: _____

Overt signs: _____

b. Taste of **sour**

none _____ vague _____ weak _____ strong _____

Subject's description: _____

Comparison to sweet: _____

Overt signs: _____

Remarks: _____

Score + if BOTH tastes are experienced and EITHER one strong or with overt movements _____

77. **Arm rigidity (right arm)**

Extent of bending during suggestion: _____

Extent of bending during 10 seconds: _____

Extent of effort: none _____ some _____ much _____

Remarks: _____

Score + if there is less than two inches of arm bending in 10 seconds _____

6. Dream Time begins _____ Time ends _____

Record dream below, if any, or report any of passing thoughts, fantasies, etc...

Subject shifts position: _____

Score + if subject dreams well (i.e. has an experience comparable to a dream-not just vague, fleeting experiences or just feelings or thoughts without accompanying imagery. It is possible to obtain a plus score, even though the subject may insist it was not a real dream, provided that the hypnotist notes that the imagery and action are not under voluntary control: _____

7. Age regression

Note the present age: _____

Second grade _____ Third grade _____

What is your name? _____

How old are you? _____

Where are you? _____

What are you doing? _____

_____

Who is your teacher? _____

Other information: _____

Change to childlike voice, vocabulary, if any: _____

_____

Speech: present tense _____ past tense _____ mixed _____

Hand writing: no change _____ some change _____ striking change _____

Remarks: _____

<u>During hypnosis duality assessment</u>

Could you tell me what it felt like, just now, being age _____?

_____

_____

_____

_____

_____

Score + if subject reports reliving the regressed age _____

8. Arm immobilization (left arm)

Extent of movement during suggestion: _____

Extent of movement during 10 seconds: _____

Extent of effort: none _____ some _____ much _____

Remarks: _____

Score + if arm rises less than one inch in 10 seconds _____

9. Hallucinated voice

Orients toward loud speaker: _____

Record conversation, if any.

Score + if subject answers realistically at least once _____

10. Negative visual hallucination (three boxes)

Subject reports three boxes: _____

Subject hesitates _____ changes report _____ other _____

Subject reports two boxes: _____

Colors: _____, _____, and _____

After termination, color of 3rd box: _____

Remarks: _____

Score + if hallucination is present, whether or not sustained. Sometimes the third box is perceived as a colored spot or shadow. The score is still + _____

11. Post hypnotic suggestion

Score as + if subject coughs and clears his/her throat after the cue _____

12. Post hypnotic amnesia:

a. "Now, please tell me, in your own words, everything you can remember since the beginning – when you first began looking at the target." (Write down items in the order in which the subject reports them):

_____

_____

_____

_____

"anything else?" _____

_____

"Take a few moments to see if you can remember anything else": _____

_____

b. "Now listen carefully to my words, "NOW YOU CAN REMEMBER EVERYTHING". Now please tell me again, everything that has happened since you first began looking at the target":

_____

_____

"Anything else?" _____

_____

"Take a few moments to see if you can remember anything else:" _____

_____

Remind subject of items not recalled. Score + if less than 3 items are recalled before reversal cue AND more than 2 items are recalled after reversal _____

Duality

1. General questions about hypnosis:

How did you find the session?

How did your experience compare to the group hypnosis session?

(For question #2, other questions may be substituted as needed).

2. Tell me about your experience when I suggested the mosquito?

_____

_____

How about the suggestion about your arm becoming rigid?

_____

_____

3. In your own words, how did the experience of being asked to go back to the (2^{nd} or 3^{rd}) grade feels like? _____

_____

_____

_____

4. Did you really feel like you were the younger age? (Allow the subject sufficient time to elaborate. If he/she appears uncertain of the response, probe for more details in an indirect manner, while avoiding asking leading questions. For example, you could say, "Could you tell me more about that?" Don't cue for specific answers:

_____

_____

_____

_____

_____

5. Did you have ANY sense of being an adult at any moment during your experience of the suggestion? (Probe for details as needed): _____

_____

_____

_____

6. (ONLY if subject answered YES to question #4).

I'd like to ask you just a few other questions, some of which may be relevant but others may not be relevant, about when you said that you felt the younger age.

How did the experience feel emotionally? _____

_____

_____

How did the experience feel physically? _____

_____

_____

Did it feel like you were really there? _____

_____

_____

Is there anything else you would like to tell me about the experience? _____

_____

_____

Score + if duality experienced _____

APPENDIX I

Experiment 2

Transcripts of Word-Cued Episodic Memories

Transcript Subject #4

Experimental group: LH
Condition: Control (A)

E: The first word is **BREAK**...

S: Break... oh boy, I'm thinking about... the Spring break I guess... that's the only break I had.

E: Can you think about a specific event during the Spring break?

S: I studied. Anything specific... oh boy... Spring break, I studied and rented movies... that's about it... A specific Friday night... we went to the movies... God... Mars Attack and it was probably the worst movie I've ever seen so far, in the theatres. Not Mars Attack... Return of... Oh God! I can't even remember the name... and then... we went for coffee after... with my boyfriend George...

E: Can you tell me anything else?

S: I was supposed to go out after that. It was the only Friday I guess during the... I'd be able to go out and it ended up not working out because nobody wanted to go out, nobody was able to go out, and I ended up getting upset, went home, went to bed at 11.30 earlier than I do when I usually study. So it was a pretty... disappointing Friday night.

E: What are you wearing?

S: Wearing? Oh yeah! I was wearing black pants, blue... baby blue tank top and a black shirt over it and black boots. I remember being complimented on my tank top.

E: What is the weather like?

S: Pretty chilly... I guess... it was still late winter so... gray, gray rainy mild day.

E: Let's take a new word. This time the word is **DOG**...

S: Dog... oh... reminds me of... I used to live with a friend of mine and she has a dog named Abe and Abe ripped her ligament a few weeks ago and she had to be operated and there was a chance that she may not survive the operation so... this was a big... thing... and then I guess I lived with the dog for a year... so I felt bad. She... she survived... so she's okay... she lives in a cage now.

E: Can you tell me anything else?

S: My friend called me from Ottawa to tell me about the surgery... and I called... my friend's mother... to comfort her...because

she's retired and the dog is like a baby to her so... I remember talking to my friend's mother for a long time.

E: Where are you?

S: I was at my parent's house when I got the news from the dog... but when I called the mother I was at my boyfriend's house.

E: Who is there with you?

S: At my boyfriend's house... my boyfriend and his mother.... and at my parent's house... I guess... both my parents were there. It was early Saturday morning... when she told me... I was studying.

E: When was it?

S: A month... a few weeks ago... also... may be two weeks ago... two Saturdays ago...

E: Let's take a new word. The new word is **ANGRY**…

S: Angry...angry... oh boy... there is a lot of that... just last Friday... I got into a big... argument with my boss... and I pretty much told him everything I thought about him ... I might get fired because of that... so ... I'm very angry at him and he is very angry at me... but I'm right... so...

E: Can you tell me anything else?

S: It was something about a mistake he did that he wouldn't admit and he blames something that happened at work... on me... and I already had something I wanted to tell him... so... when he blamed me for... losing money and losing clients... and things like that when it wasn't my fault.... I didn't take it and I told him off... I told him...everything I thought about him... I was crying... I was coming out of theshower... I was on my bed when I talked to him... and we spoke for about an hour... over the phone... I didn't have time to see him...

E: Is there anyone else with you?

S: No... I was by myself...

E: When is it happening?

S: In the afternoon... I remember looking at the clock... it was maybe between 2 and 3 o'clock... in the afternoon... Looking at my watch I remember seeing 2 o'clock... something around 2 o'clock... so it was between 2 and 3 o'clock in the afternoon when I talked to him

Condition: Hypnosis (B)

E: The first word is **LETTER**...

S: Letter... all I remember is writing a letter... an email to a teacher... about a paper...

E: Can you tell me anything else?

S: I used my.... boyfriend's computer... that's when I wrote the email...

E: Where are you?

S: I'm sitting next to the computer.

E: Who else is there with you?

S: My boyfriend...

E: When is this happening?

S: It's in the month of February... in the evening...

E: What are you wearing?

S: Blue jeans... and a blue turtleneck.

E: Let's take a new word now...The word is **STORM**...

S: Storm... I'm thinking about the ice storm... The first day of the ice storm... I've been here... my boyfriend was coming back from Greece... we went to see Titanic... the first time... I went with him and my friend Katia... to the 7 o'clock show.

E: Can you tell me anything else?

S: I came back home... and there was no ... electricity...

E: When is this happening?

S: I think it was 96... I'm not sure... it was January 5Th...

E: What is the weather like?

S: It was wet... slippery... freezing rain... warm for January...

E: Let's take a new word now.... The new word is **LOST**....

S: For New Year's ... for the year 2000... we wanted to go to Nolton and we got lost... on our way there because the friend we were following was going too fast... and we are in my boyfriend's car... with his coworker David... my best friend Kathleen was sleeping in the car... and a friend of ours ... Andrea... and we are going on those little roads of the country... it was really dark... on December 1st.... 31st...

E: Can you tell me anything else?

S: We were listening to dance music... and I was eating salt and vinegar Lays chips... on my way back...

.....

Transcript Subject #11

Experimental Group: LH
Condition: Hypnosis (B)

E: The first word is **BREAK**...

S: I remember... I went to make a sandwich and ... I was little... I was smaller then... and there was a big mayonnaise jar... and my mom was on the phone so I took the jar over to her... but on my way there... I dropped it and it broke and I started to cry...

E: Can you tell me anything else?

S: No... I just remembered.... breaking it...

E: Where are you?

S: I was in my old house... my first house... It was because my mom was on the phone... downstairs in the basement so I had... which is why... there was a pretty long track I suppose from the kitchen all the way downstairs to the basement... and a ... I was walking by the washing machine and the dryer... and ... because there was like a hallway... and walking through there... that is when I dropped it... It was like a really big jar... It was everywhere...

E: Who is there with you?

S: Ah... just my mom and I...

E: When is this happening, in what month or year?

S: I believe it was in the evening... year? no.. I must of been at least may be seven...

E: Let's take a new word now...The next word is **DOG**...

S: Hum... I remember a friend of ours brought over her two... I think they were puppies... I think they were... I think they were Cocker Spaniels... I'm not sure... they were really pretty... but they were puppies at the time anyway... we took pictures... I have picture of it... and I think... but I'm not positive... within... I remember taking pictures in the backward... and I was wearing a ... it was in the summer... because I remember like I had only a sweater on over a sun dress or something... and I have pictures...

E: Can you tell me anything else?

S: No... that's all I can recall...

E: Who is there with you?

S: My mom was present and... the lady who brought her dogs over... I think she worked at the same hospital as my mom did...

E: Let's take another word... The word is **ANGRY**...

S: Hum... a couple of weeks ago... at my work... ah... I work at a home for actually physically disabled clients... and right now I'm having trouble with one of the client who is really aggressive towards me periodically... and a... he has I think... two weeks ago... I remember... there was just another staff and I and we were working and he started... to be aggressive towards me... it was basically five hours of just relentless harassment... and I was becoming extremely upset and angry... because there wasn't much I could really do... about the situation... because when he is aggressive... he doesn't basically listen at all... and I was extremely exhausted, it was a long... it was a seven hour shift over all... plus I had to do that and then... also do the sleep over as well... so basically I wouldn't be gone until the next day... and... but during the five hours... he was continuously scratching me... and the other staff, I remember, couldn't do much...because he would listen only for a little while and then be back to his... whatever he was doing which was harassing me...

E: Can you tell me anything else about that event?

S: No.

Condition: Control (A)

E: ...and the first word is **LETTER**...

S: Ah... I... I... couple months ago... 2-3 months ago... I wrote a letter to my best friend... because earlier we had gotten in... there was a conflict... and I know I resolved the conflict... so we stopped talking for 3 weeks... so I wrote a letter telling my best friend this is how I feel and apologizing for what I had said and sent it to him...

E: Can you tell me anything else?

S: No... it was at night when I wrote it ... and it took a long time to finish it...

E: Where are you?

S: I was in my bedroom...

E: Who else is there with you?

S: Just me ... I know I called one of my friend earlier for advice... whether I should write the letter or not...

E: Let's take a new word... This time the word is **STORM**

S: Ah... two weeks ago... when I went to look for an apartment... during the day... it was kind a... it was raining... and a... basically we only had two weeks to find an apartment... because we needed one for May 1st .... and so... we had to go out and look... and we walked around for like ...2-3 hours... in the rain... we got soaked and I was trenched... and then... we had to go out again... because we picked out the numbers and stuff like that... and then we had to call ... and so we could go back outside again to look at the apartment and stuff like that so... it wasn't really like... really stormy... but it was raining... and I was soaked by the time... we all basically finished... I was with my roommate... and it was in NDG on Sherbrooke and Monkland...

E: Can you tell me anything else?

S: It was during the day... in the morning...

E: What are you wearing?

S: Black socks... because they got soaked... bad shoes, they soaked right through... my suede black shoes... I was wearing my blue jacket... I was wearing a pair of jeans... and a sweater... a turtle neck sweater...

E: Lets take another word... the word is **LOST**...

S: I remember in elementary school... it was... ah... fifth grade... I lost... we had a performance... it was a talent contest.... and the best performers... there were three of us... three or five of us... we got to perform at the Junior High School... I guess... it's a reward... and we performed and stuff like that... and I lost a friend of mine's tennis shoes... because I had borrowed them for the performance... and I just remember feeling panic, when I realized that I had lost them... and I was like " Oh... my gosh... what am I going to do?" and stuff like that and... I think... that maybe the next day they were found... and turned into the lost and found... so... it was kind of panicky because I remember praying to God and... I think this... I don't remember ... what Saint it was... that help to keep and find lost thing... he helps you find things... I don't remember what Saint that was but... I think it's St-Andrew... but... so I was just praying a lot... and it's a catholic school... I was just praying... and they turned up ...

E: Can you tell me anything else?

S: No... I was worrying... because I was like... "Where am I going to find the money... to go buy tennis shoes for someone..."

E: When is this happening?

S: I think it was fifth grade... so it was 19... may be 85... or something... or sometime in 193C... The performance was in the evening... and ah... I know... I think it was this time... after December... may be February... cr April... because it was ... I don't think it was... it was sunny I know that... I'm pretty sure... so I think it must of been Spring time or something... yeah... it was an evening performance... but the sun was still out... yeah ...so like it was like daytime...

E: Who is there with ycu?

S: I borrowed the shoes from Nicole... and I performed with Maya and Jackie and me and there was four of us and Season.... her name was Season... hum ... then there were just other performers and their parents and families and... people from the Junior High... just a whole bunch of people... and that's all I remember... It was a big stage in the gym...

Transcript Subject #6

Experimental Group: HH
Condition: Hypnosis (H)

E: The first word is **BREAK**...

S: I remember when I was about... 14... and it was a really hot day outside and I ran into the house... and I bumped into a buffet that we had in the dining room... and a vase of my mother's fell off and broke... It was a... a vase that had texture in it, it was purple and pink... it was really beautiful... and her mom had given it to her... as a wedding gift... in her first marriage. As much as she tried not to be angry with me... she was... and so I had the silence treatment for the next two days...

E: Can you tell me anything else?

S: I remember her in fact, sweeping it up... and then vacuuming the dining room... and then she just... she went upstairs and she didn't talk to me for the rest of the day.

E: Let's take a new word... this time the word is **DOG**...

S: We have a.... a dog at home now with my parents... her name is Cinder, she is a black little Shiatsu ... mixed... and she is the funniest dog... she is a person in the family... she smiles... and she is always happy. We got her on... she was born on New Year's 3 years ago... we got her on February from one of our friend Emily. Her puppy... her dog had puppies and I convinced my mom to get a dog after not having a dog for like 5 years... and... she's my mom's best friend and she is a great addition to the family... she is really funny.

E: Can you think of a specific event with the dog?

S: With the dog... ah... this winter when... we had a huge snow fall we went up into the back woods... and there was a lot of snow... and I forgot to put her... little jacket on... because she is a little small dog... and ... we were walking up into the woods to go sliding, its about a kilometer into the woods... and me and my sister Laura and... the dog was freezing by the time we got to the woods... so we had to carry her all the way back from the house... ah.. from the cabane back to the house ... and she shivered for about 2 hours when we got back to the house...

E: Can you tell me anything else?

S: I never went outside ... without putting a coat on her again... because she was so cold, I felt really bad.

E: Lets take another word… the word is **ANGRY**...

S: Angry... I was really angry one time at my... brother... my step-brother actually... ah... it's kind of a personal experience but... he is involved with somebody that is really close to me... that's in my family... and ...I... I was really angry at him. He had said something about this other person... and... I threatened him... I said: "If you ever hurt this person..." that I would... it was a big secret that they were together... that I would... I would blow their secret... I did it out of complete anger... I'd never been so angry in my life... and ... our relationship has really changed since then... he treats me with a lot more respect... he is a lot older than I am... and he never... I was never involved in that relationship again... I just a... I kind of stayed a far and watched it happened... but I was really angry at him that day. My mom came around the corner just as I was talking to him about it... and my mom doesn't know... well she does now... but she didn't then... I remember my brother being really scared...

E: Can you tell me anything else?

S: I remember where we were standing... we were standing right in the entrance of the house...

E: When is this happening, in what year or month?

S: Year... it must have been 5 or 6 years ago. Time of the day... I think it was in the evening after supper because we were on our way out to go somewhere but... I can't tell you specifically what time of the day it was.

Condition: Control (A)

E: The first word is **LETTER**...

S: I remember meeting some guys from Sweden.... it was around Xmas time... in 90... it was 90... the Xmas of 94... and we spent about a month skiing with them and stuff... in Vermont... and the night before they left... one of his friends... I can't remember his name... let me know that he had a girl friend back home... and so I wrote him... the worst letter ever... ever...I... I still to this day regret... because we ended up going to Europe that summer and we were going to hook back up somehow... just to meet up with them... because we were friends with them... but I wrote him a terrible letter... and never met him again... so it was kind of a bad experience.

E: Can you tell me anything else?

S: Ah... I wrote in the letter that I hoped his girl friend found the letter... hum... that was kind of funny... I wrote it in front of my friend Ginette... she is pretty connive... so...

E: Where are you?

S: Ah... we were in her apartment in Montreal on ...a... just close to Lambert Closs Street... and ah... it was... we wrote the letter couple of weeks after they left and I knew that he wouldn't be arriving back in Sweden because they were on the Noram Circuit for a while. So we wrote the letter it was couple of weeks after they left and I sent it... it took me a lot to send the letter... because I didn't really want to ...but there was a whole girl... there... feeling like 17... so...

E: Lets take another word... the word is **STORM**...

S: Storm... ah... a couple of weeks ago... in the big a... winter storm... I was... I work at a group home and it was like ah... it wasn't... was it snowing when I got to work? I don't remember... anyway... it was terrible and I finished work at midnight... and I live about 15... 10-15 minutes from work... and it took me... like I was so nervous driving... like I couldn't see... like there was afoot of snow on the ground... It was Sunday night... there was a foot of snow on the ground... they hadn't plough... nothing... all the contracts are gone... I remember driving home and being really scared... and I was at the top of a big hill... and I was in my mom's car... which is automatic... and I was driving... and I got at the top of the hill and I started crying... I was like: "I'm home, good!" you know... and I walked in the house... and I remember parking the car on the street... where... we couldn't get up on the drive way because the plough had gone by at the top of our hill... like hours before... but it still made up a big bank... so I couldn't get up the drive way... and I remember going in... my dad was still awake... I said: "Go check and see if there is still enough room for the plough to go by if not they'll tow the car"... so... that was the worst storm conditions I had ever driven in... It was two weeks ago... Sunday...

E: Where were you exactly?

S: Where... am I... like my town... in Cowansville... and I was working at the group home... I always work from 4 to 12 and it was 12 o'clock and it was really bad out.

E: ... and the last word is **LOST**...

S: Lost... I have a general fear of getting lost... that's my...

E: Can you think about a specific event?

S: I was ... I must of been four... it was before we moved to Calgary... and I decided to take a ... because my dad was like a woods man... and ah... we had like a 190 acres or something... and I walked down to the woods... and my mom was baking or doing something, she wasn't paying attention to me... It was a nice summer day and I had this little... little spot that I used to go to... where there was some brooks and stuff and I decided to

venture off past that... and like there is no trails and I was four years old... I was wearing a little Strawberry Short Cake dress... it had little strawberries on it... and I got lost in the wood... and my mom... I remember her telling me ... "If you ever get lost like in the malls..." it was my fear when I was younger to get lost in malls ... I would always stay really close to her... she would say "Stay at the same place". And she knew the little place where I used to go... but I had taken the wrong turn... I turned left... instead of right... or something like that... back to the road... and so... I just stayed there and she came looking for me... I was in the woods for about 2 and a half hours when my mom found me... she was crying...she was like: "I can't believe we found you... you know... my bread is burning in the oven... you know..." But I remembered I had that little dress on because it was filthy... because you know I was crying... and it was muddy... and you know... I was in the woods by myself.

Transcript Subject #12

Experimental Group: HH
Condition: Control (A)

E: The first word is **BREAK**...

S: Break.... I broke my toe during a... dance rehearsal in 1992... and my foot became big and blue and I was in crutches and I couldn't compete for a month.

E: Can you tell me anything else?

S: Ah... everybody was laughing at me... that was for sure... I put on a little Fred Flinstone band when I broke my toe... that's about it...

E: Where are you?

S: In Valleyfield...

E: Who else is there with you?

S: All the staff, the choreographers and the members.... the dancers... we were 12.

E: When is this happening?

S: It was a Saturday... but time of day no.... late in the day... not in the morning...

E: What are you wearing?

S: Yeah... I was... yeah...I know... of course when I broke my toe... it was just a big prop was coming over another prop and it fell over my toe... that's how it happened.

E: Let's take a new word...the word is **DOG**...

S: Ah.... I had a dog named Cannelle... That was my favorite dog... I had it for nine years...she's brown... only I could approach her... she was a one master dog only... I did everything I wanted to do with her... everything... she would wait on the street corner... didn't need any leash... but we had to put her down... hum... when my parents got divorced and I moved out... so... that was sad... she was nine years old...

E: Can you think of a specific event?

S: Hum... well when I would.... I remember my father when he came to pick me up from dance practice with the dog... and during the summer we danced outside... so he'd let the dog loose... and the dog... Cannelle would come right in the middle of the show... in the show... and jumped in my arms... so we had to stop the show. That was funny.

E: Can you tell me anything else?

S: The show... I don't even remember in what year it was... I think it was in 90-91...It was 91... and the show was Woodside Story... it was Woodside story... no, no, no... it was Jesus Christ Super Star... that's what it was... That was the show... and we were practicing... where were we practicing?... à St-Bruno... yeah... it was in St-Bruno...

E: Who else is there with you?

S: Oh... a hundred other kids... because there are live musicians as well... the whole staff... and few parents... including my dad...

E: What was the weather like?

S: Hot... very hot...

E: When is this happening?

S: It was during the summer... It was probably... I think it was probably during June... and it was right before suppertime...

E: Lets take another word... this time the word is **ANGRY**...

S: Angry... lots of things pop into mind... Let's see... Well... okay let's choose this one... I was quite angry when my boyfriend cheated on me and I found out by an ex-boyfriend of mine 2 years later. Very... oh... I was more sad then angry... no I wouldn't call it angry... angry...ah... I was quite angry when I ... for my application for a computer loan... they made me run around everywhere... yes... I wasn't nice to people during that time...It took something like 3 months or 4 months instead of one... so I was really angry about that...

E: Can you tell me anything else?

S: Oh well... I asked for an application... I asked him: "Is there anything else I have to do?" he said: "No"... so I send the application... I thought I had to bring it to the computer... no I had to bring it to the bank... I go to the bank... the bank lost it... and then... it was supposed to be sent here... it wasn't sent here... they... I don't even remember where they sent it... I had to go... they made me run around so many times... it was ridiculous... ridiculous... yes... I wasn't really happy... I gave the little lady at the bank a little doggie doo... bag... very politely...but... I let her know how I felt...

E: When is this happening?

S: Ah... I applied right after Xmas... and I got it... last month...

Condition: Hypnosis (B)

E: .. and the word is **LETTER**...

S: Hum... I wrote a letter recently to... my ex partner... which I'm very proud of writing... stating everything I feel... and revealing things to myself as well... ah... yes... that permitted me to let go and move on... to do better in my life...

E: Can you tell me anything else?

S: I wrote... it was probably a month ago... I wrote it here at the Concordia lab... computer lab... and I felt like everybody was staring at me... because I was crying like a baby... but... it felt good... I wrote it... it was about... a whole big page full... and I sent it... and that was that... I left and I felt like a big weight had been lifted off my shoulders.

E: When is this happening?

S: Wednesday... 5.30...

E: Lets take another word...the word is **STORM**...

S: Ah... I was on tour... and I was in... North... North Carolina... we were rehearsing on the Football field... we had no show that day... and it was hot...it was about 40 degrees... well...even more than that...44-45 degrees outside... and then all of a sudden... in the middle of the rehearsal... it was cold... and the sky was green and hail started coming down... so... we got yelled at to load everything into the school and as we were running... and being pinched by the hail... I looked up and I saw... clouds turning like a barrel wheel... but it hadn't... come down vertically yet... but I could see the tornado forming right on top of my head... and I felt like if I could reach it with my hand I could touch it and the clouds were so big and coming at me... and then I just got yelled to ... hurry back inside... the sirens rang off... and I saw the tornado come down

about 100 yards away... quite spectacular... I wish I could see it again...

E: Who else is there with you?

S: Everybody... the 36 dancers... I think the musicians were already inside... hum... I remember my staff... April was the one yelling at me to run inside and... I had all my equipment in my arms and I just... I couldn't move as I looked up... I was so astonished by the beauty of it... that I was standing there for about 30 seconds... not moving... looking up... yes...

E: Lets take a new word... the word is **LOST**...

S: Lost... ah... that was so long ago... I remember I was... we went to this camp... all my family... holy cow... My mama was playing volleyball... and there was this big forest where people would hike... and do...du tir-à-l'arc and they were routes in the woods... indicated with blue arrows... and yellow arrows... and red arrows... and I tried to follow one and I got lost.... I got lost... hours in that wood... it was horrible... it was horrible... but I got out eventually... but yes... I was lost...I was big scared... that was so long ago... I was about... 8 years old... hum...

E: Can you tell me anything else?

S: It was a beautiful day... it rained a bit when I was in the forest... but there were slides and a little park.. but where I got lost there was nothing... there were big hike trails... I had gone on to ... I followed the... I followed the yellow trail... that's what got me lost... the red one was the easy one... but they had said not to do any other trails... but I just left on my own and did the yellow one and got lost... the yellow trail...

E: When is this happening?

S: It was in the month of June... and time of day was 3 o'clock in the afternoon till just a little bit after supper... I was late for supper...

APPENDIX J

Scoring Protocol for Episodic Memories

SCORING PROTOCOL

General description:

Score only information directly related to a specific episodic memory. An episodic memory is defined based on the following criterion:

- The subject's response must involve an explicit event or occurrence that has happened to him/herself and that occupies a particular, brief time frame, with a specific description of the event.

- Generally, episodic memories have a time span of a day or less.

- Memories that include an episodic element as a central feature, although they may not be entirely episodic are acceptable.

Step 1: Scoring for cognitive effort. These categories aim at measuring the amount of cognitive effort the subject has invested to provide a memory of a specific personal event. The statements or pieces of information which are scored as cognitive effort will not be scored again in other categories or in the quality rating sections.

Repetition: Score one point for every statement which refers to information directly related to the event that was all ready stated before. The wording may or may not actually be exactly the same, however, the statement does not provide any additional or new information. Statements involving affect (see subject and other's affect section) are not scored for repetition.

Inference: Score one point for every statement which refers to details inferred on the basis of some other statement giving immediately before or after. For example: It must have been around 8 o'clock because the sun was coming down. It must have been in the winter because there was snow on the ground... It was in the spring because I was still in school...

Doubt: Score one point for every statement or piece of information preceded or followed by words assuming doubt or uncertainty, such as: I'm not sure but... I don't really know but...It was 5 or 6.... It was in 87, no 89... probably 87... I guess it was in the winter... I think it was a female...

<u>Step 2:</u> All the next steps refer to scoring for quality of information provided in the memories of personal events.

The next three categories are scored for self-reference:

Timing: Score one point for each statement or detail referring to "when the event took place in reference to the subject's life time. When I was a child... When I was 6 years old... When I came to Montreal... when school began that year... when I was in grade one... when I came home after school...It was at night, it was about 4 o'clock that day...

Subject's physical location:
Score one point for each statement referring to a specific place in which the subject was located at one point in time during the period recalled by the episodic memory. Note that there may be more than one location and that the described location may involve the subject and others. Examples: We walked into the room... I was at a summer camp.... I was in New Jersey... I was sitting or standing beside him... I was in the kitchen... I went to the doctor, hospital...Include statements which involve location of the subject even if the subject did not engage in the action of getting there such as: My mother brought me to the doctor, someone dragged me in the car...

Subject's affect: Score one point for each statement involving the subject explicitly or indirectly mentioning some personal emotional experience at a given point in time (positive, neutral or negative) as part of the episodic memory. This include all forms of emotions, such as surprise, stress, desire, anger, joy, confusion, pain, expectation, as well as any present comments added to the past event such as "It was really nice, it was fun, it was really scary... it was the worst... Statements involving both the subject and others are scored only once for the subject category. Example: We were scared, we had fun...

<u>Step 3:</u>

Other's affect: Score one point for each statement involving the subject explicitly or indirectly attributing emotion to one or more other person or animal. This, like the previous category, includes all types of emotions. Example: Others were offended... everyone was looking at me out of astonishment... He was freaking out... Include statement which imply other's emotions based on the subject's view such as: She expected me to be scared...

Step 4:

Vividness: Score one point for each detail over and above the basic description of the event and giving the memory the character of a live experience. To assess whether or not a piece of information qualifies, question whether it is an essential part of the episodic memory or whether it is adding vividness to it. These include verbs and adjectives such as: "It was spinning, I was screaming loudly, I felt dizzy, I turned around and saw it, they were running around all over the place. Include all sensory details whether they involve vision or other sensory modalities. For example: I broke a plate the other day is not scored; however if the subject adds that the plate was white and blue (score two). Details may pertain to color, size, shape, texture, sound, temperature, smell, taste, orientation (left, right, top, bottom...), duration of time, quantity, distance etc. Statements which have already been scored as part of a previous category are not scored.

Score one point for each verbatim statements reported: This refers to all statements which are repeated as they were heard when the event actually occurred or that the subject remembered saying at a given point in time. This category is easy to score because the statements are usually already in quotations in the text.

APPENDIX K

Individual Differences Questionnaire

(Imagery)

Individual Differences Questionnaire (from Paivio, 1971)

The statements on the following pages represent ways of thinking, studying and problem solving. No two statements are exactly alike, so consider each statement carefully before answering. You are asked to rate each item on a 5-point scale which relates to how characteristic the statement is of you. Circling a rating of -2 indicates that the statement is extremely uncharacteristic of you, a rating of +2 indicates that the statement is extremely characteristic of you, a rating of 0 indicates that the statement is neither characteristic nor uncharacteristic of you.

It is important that you answer as frankly and as honestly as you can. Your answers will be kept in the strictest confidence.

-|-------|-------|-------|-------|--
-2 -1 0 +1 +2
Extremely Uncharacteristic ... Extremely Characteristic

1.	Listening to someone recount their experiences does not usually arouse mental pictures of the incidents being described.	-2	-1	0	+1	+2
2.	By using mental pictures of the elements of a problem, I am often able to arrive at a solution.	-2	-1	0	+1	+2
3.	I enjoy visual arts, such as paintings, more than reading.	-2	-1	0	+1	+2
4.	My daydreams are so vivid I feel as though I actually experience the scene.	-2	-1	0	+1	+2
5.	I do not have a vivid imagination	-2	-1	0	+1	+2
6.	I can easily picture moving objects in my mind.	-2	-1	0	+1	+2
7.	I can form mental pictures to almost any word.	-2	-1	0	+1	+2
8.	I have only vague visual impressions of scenes I have experienced.	-2	-1	0	+1	+2

Individual Differences Questionnaire (from Paivio, 1971)

9.	I think that most people think in terms of mental pictures whether they are completely aware of it or not.	-2	-1	0	+1	+2
10.	My powers of imagination are higher than average.	-2	-1	0	+1	+2
11.	I can close my eyes and easily picture a scene I have experienced.	-2	-1	0	+1	+2
12.	When someone describes something that happens to them, I find myself vividly imagining the events that happened.	-2	-1	0	+1	+2
13.	I seldom dream.	-2	-1	0	+1	+2
14.	I never use mental pictures or images when trying to solve problems.	-2	-1	0	+1	+2
15.	I find it difficult to form a mental picture of anything.	-2	-1	0	+1	+2
16.	My dreams are extremely vivid.	-2	-1	0	+1	+2
17.	My thinking often consists of mental pictures or images.	-2	-1	0	+1	+2
18.	My daydreams are rather indistinct and hazy.	-2	-1	0	+1	+2
19.	I enjoy the use of mental pictures to reminisce.	-2	-1	0	+1	+2
20.	I often use mental images or pictures to help me remember things.	-2	-1	0	+1	+2
21.	I do not form a mental picture of people or places while reading of them.	-2	-1	0	+1	+2

APPENDIX L

Differential Personality Questionnaire:

Absorption

DIFFERENTIAL PERSONALITY QUESTIONNAIRE: Scale AB
Auke Tellegen, Ph.D.
University of Minnesota, 1978

In this booklet you will find a series of statements a person might use to describe his or her characteristics. Each statement is followed by tow choices -- True and false. Read the statement and decide which choice better describes you. Then circle your answer beside each statement.

Please answer every statement, even if you are not completely sure of the answer. Read each statement carefully, but do not spend too much time deciding on the answer.

1. Sometimes I feel and experience things as I did when I was a child.	TRUE	FALSE
2. I can be greatly moved by eloquent or poetic language.	TRUE	FALSE
3. While watching a movie, a television show, or a play, I may become so involved that I forget about myself and my surroundings and experience the story as if it were real and as if I were taking part in it.	TRUE	FALSE
4. If I stare at a picture and then look away from it, I can sometimes "see" an image of the picture, almost as if I were still looking at it.	TRUE	FALSE
5. Sometimes I feel as if my mind could envelop the whole world.	TRUE	FALSE
6. I like to watch cloud shapes change in the sky.	TRUE	FALSE
7. If I wish, I can imagine (or daydream) some things so vividly that they hold my attention as a good movie or story does.	TRUE	FALSE
8. I think I really know what some people mean when they talk about mystical experiences.	TRUE	FALSE

9. I sometimes "step outside" my usual self and experience an entirely different state of being.	TRUE	FALSE
10. Textures -- such as wool, sand, wood -- sometimes remind me of colors or music.	TRUE	FALSE
11. Sometimes I experience things as if they were doubly real.	TRUE	FALSE
12. When I listen to music, I can get so caught up in it that I don't notice anything else.	TRUE	FALSE
13. If I wish, I can imagine that my body is so heavy that I could not move it if I wanted to.	TRUE	FALSE
14. I can often somehow sense the presence of another person before I actually see or hear him or her.	TRUE	FALSE
15. The crackle and flames of a wood fire stimulate my imagination.	TRUE	FALSE
16. It is sometimes possible for me to be completely immersed in nature or in art and to feel as if my whole state of consciousness has somehow been temporarily altered.	TRUE	FALSE
17. Different colors have distinctive and special meanings for me.	TRUE	FALSE
18. I am able to wander off into my own thoughts while doing a routine task and actually forget that I am doing the task, and then find a few minutes later that I have completed it.	TRUE	FALSE

19. I can sometimes recollect certain past experiences in my life with such clarity and vividness that it is like living them again or almost so.	TRUE	FALSE
20. Things that might seem meaningless to others often make sense to me.	TRUE	FALSE
21. While acting in a play, I think I could really feel the emotions of the character and "become" him or her for the time being, forgetting both myself and the audience.	TRUE	FALSE
22. My thoughts often don't occur as words but as visual images.	TRUE	FALSE
23. I often take delight in small things (like the five-pointed star shape that appears when you cut an apple across the core or the colors in soap bubbles).	TRUE	FALSE
24. When listening to organ music or other powerful music, I sometimes feel as if I'm being lifted into the air.	TRUE	FALSE
25. Sometimes I can change noise into music by the way I listen to it.	TRUE	FALSE
26. Some of my most vivid memories are called up by scents and smells.	TRUE	FALSE
27. Certain pieces of music remind me of pictures or moving patterns of colors.	TRUE	FALSE
28. I often know what someone is going to say before he or she says it.	TRUE	FALSE

29. I often have "physical memories"; for example, after I've been swimming I may still feel as if I'm still in the water.	TRUE	FALSE
30. The sound of a voice can be so fascinating to me that I can just go on listening to it.	TRUE	FALSE
31. At times I sometimes feel the presence of someone who is not physically there.	TRUE	FALSE
32. Sometimes thoughts and images come to me without the slightest effort on my part.	TRUE	FALSE
33. I find that different odors have different colors.	TRUE	FALSE
34. I can be deeply moved by a sunset.	TRUE	FALSE

APPENDIX M

Attitude Towards Hypnosis Scale

Attitudes Towards Hypnosis Questionnaire

Please answer each of the following statements by circling the number on the scale which best describes you.

13. I find the whole idea of becoming hypnotized an attractive prospect.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

14. I would like to become deeply hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

15. I would not mind being known as someone who can be deeply hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

16. I am totally open to being hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

17. One's ability to be hypnotized is a sign of their creativity and inner strength.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

18. I wonder about the mental stability of those who become deeply hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

19. Those who are easily hypnotized are weak people.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

20. Those who can become deeply hypnotized are as normal and well adjusted as anyone.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

21. Intelligent people are the least likely to get hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

22. I have some apprehensions about hypnosis and being hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

23. If someone attempted to hypnotize me, I would tend to hold back rather than let myself get carried away by the process.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

24. I'm not afraid of becoming hypnotized.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

25. I am wary about becoming hypnotized because it means giving up my free will to the hypnotist.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

26. A deeply hypnotized person is robot-like and goes along automatically with whatever the hypnotist suggests.

1	2	3	4	5	6	7
(Not at all true)						(Very true)

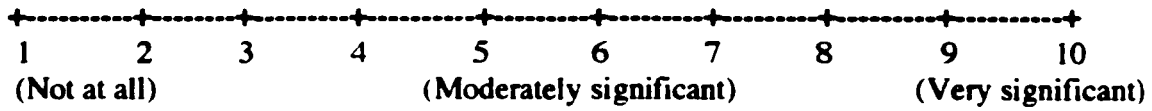
APPENDIX N

Emotional Significance Rating Scale For Episodic Memories

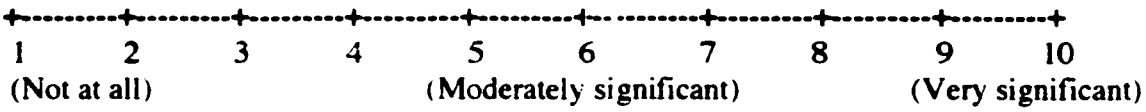
Subject Number:_____ **Condition:**_____

EMOTIONAL SIGNIFICANCE RATINGS

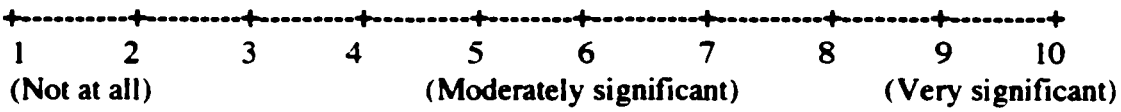
2. In terms of emotional significance or impact in your life how would you rate the _____ event on a scale from 1 to 10.



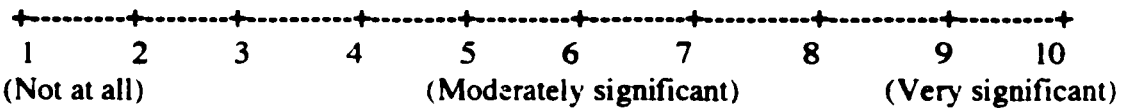
3. In terms of emotional significance or impact in your life how would you rate the _____ event on a scale from 1 to 10.



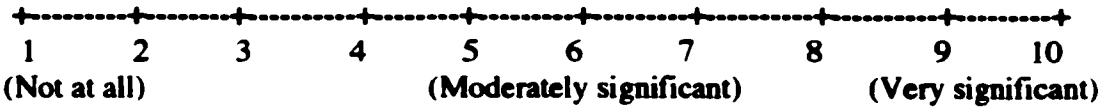
4. In terms of emotional significance or impact in your life how would you rate the _____ event on a scale from 1 to 10.



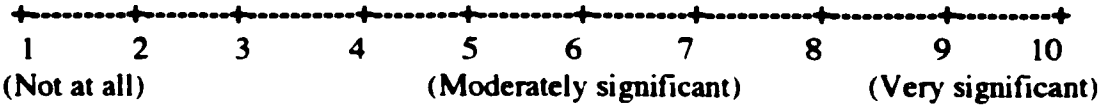
5. In terms of emotional significance or impact in your life how would you rate the _____ event on a scale from 1 to 10.



6. In terms of emotional significance or impact in your life how would you rate the _____ event on a scale from 1 to 10.



7. In terms of emotional significance or impact in your life how would you rate the _____ event on a scale from 1 to 10.



APPENDIX O

Correlation Matrices

Between Hypnotizability, Neuropsychological Data, Absorption,

Attitude and Imagery

Table 01

Intercorrelations Between Hypnotizability and Frontal Neuropsychological Test Scores (WCST, SOPT, Verbal Fluency)

Variables	SHSS	WCSTC	WCSTPE	WCSTE	VFSCORE	SOPTE	SOPTPE	STROOP
Stanford Hypnotic Susceptibility Scale	------	.29**	.25*	.28**	.13	-.14	.22*	-.24*
Wisconsin Card Sorting Conceptual		------	.90***	.84***	.09	-.22*	-.11	-
.28**								
Wisconsin Card Sorting Pers. Errors			------	.69***	.03	-.18	-.07	-.24*
Wisconsin Card Sorting Errors				------	.10	-.32**	-.13	-.22*
Verbal Fluency Score					------	-.04	-.11	-.11
Self-Ordered Pointing Task Errors						------	.14	.17
Self-Ordered Pointing Task Pers. Errors							------	.14
Stroop								____

r = *p< .05, **p < .01, ***p< .001 (N = 90)

Table O2

Interrelations Between Hypnotizability and Frontal (Automaticity) Neuropsychological Tests Scores

Variables	SHSS	STROOPC	STROOPN	STROOPINC	STROOPE
Stanford Hypnotic Susceptibility Scale	------	-.23*	-.21*	-.25*	.13
Mean Reaction Time for Stroop Congruent		-----	.92***	.85***	-.15
Mean Reaction Time for Stroop Neutral			------	.84***	-.13
Mean Reaction Time for Stroop Incongruent				------	.02
Number of Errors (Stroop)					--------

r = *p< .05, **p < .01, ***p< .001 (N = 90)

Table O3

Intercorrelations Between Hypnotizability and Frontal (Attentional) Neuropsychological Tests Scores

Variables	SHSS	D2RT	D2E	TMA	TMB	CPTRT	CPTO	CPTC	STROOP
Stanford Hypnotic Susceptibility Score	------	-.28**	.26*	-.06	-.14	.09	-.16	-.11	-.24*
Target Detection (D2) Reaction Time		------	-.22*	.40***	.38***	-.13	.15	.11	.38***
Target Detection (D2) Errors			------	-.11	.19	-.07	.16	.08	-.05
Trail Making A				------	.47***	-.17	-.02	-.08	.34***
Trail Making B					------	-.19	.01	.02	.37***
Continuous Performance Test Mean Reaction Time						------	-.31**	.52***	-.37***
Continuous Performance Omission Errors							------	.20	.13
Continuous Performance Commission Errors								------	.00
Stroop									------

r = *p< .05, **p < .01, ***p< .001 (N = 90)

Table O4

Intercorrelations Between Hypnotizability and Non-Frontal Neuropsychological Test Scores

Variables	SHSS	REYCOPY	REYRECALL	VOC	RAVEN	DS
Stanford Hypnotic Susceptibility Scale	------	.05	-.06	.10	-.20	.20
Rey Complex Figure Copy		------	.40***	.10	.10	.01
Rey Complex Figure Recall			------	.12	.35***	.05
Vocabulary Subtest (Short-Version)				------	.26**	.01
Raven Standard Progressive Matrices					------	-.02
Digit Symbol Subtest						------

r = *$p < .05$, **$p < .01$, ***$p < .001$ ($N = 90$)

Table O5

Intercorrelations Between Hypnotizability, Attitude, Absorption and Imagery Scales

Variables	SHSS	ATTITUDE	IMAGERY	ABSOPTION
Stanford Hypnotic Susceptibility Scale	------	.29**	.29**	.34***
Attitude Towards Hypnosis Scale		------	.11	.27**
Individual Differences Questionnaire (Imagery)			------	.54***
Differential Personality Questionnaire (Absorption)				------

r_{-} = *p< .05, **p < .01, ***p< .001 (N = 90)

APPENDIX P

Source Tables for Analysis of Variance

Recognition Data (Short Delay)

Table P1

Source Table for Univariate Test on Number of REMEMBER Responses by Study Conditions (15 minute delay)

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	3300.28	1	3300.28	31.70	.0001
Within Groups	9161.82	88	104.11		

Source Table for Univariate Test on Number of KNOW Responses by Study Conditions (15 minute delay)

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	46.94	1	46.94	1.23	.270
Within Groups	3356.18	88	38.14		

Source Table for Univariate Test on Number of GUESS Responses by Study Conditions (15 minute delay)

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	780.28	1	780.28	11.86	.001
Within Groups	5788.71	88	65.78		

Table P2

Source Table for Univariate Test on Number of Target Words Recognized by Study Conditions Following 15 Minute Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	1416.10	1	1416.10	20.51	.0001
Within Groups	6076.22	88	69.05		

Source Table for Univariate Test on Number of Lure Words Recognized by Study Conditions Following 15 Minute Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	220.90	1	220.90	4.91	.03
Within Groups	3961.60	88	45.02		

Source Table for One-way Anova on Overall Accuracy (Targets-Lures) by Study Conditions Following 15 Minute Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	2755.60	1	2755.60	33.24	.0001
Within Groups	7295.56	88	82.90		

APPENDIX Q

Source Tables for Analysis of Variance

Recognition Data (One-Week Delay)

Table Q1

Source Table for Univariate Test on Number of REMEMBER Responses by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	207.57	1	207.57	3.10	.084
Within Groups	3410.51	51	66.87		

Source Table for Univariate Test on Number of KNOW Responses by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	77.31	1	77.31	1.84	.181
Within Groups	2138.69	51	41.94		

Source Table for Univariate Test on Number of GUESS Responses by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	126.56	1	126.56	1.52	..224
Within Groups	4254.76	51	83.43		

Table Q2

Source Table for Univariate Test on Number of Target Words Recognized by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	65.49	1	65.49	4.06	.049
Within Groups	823.04	51	16.14		

Source Table for Univariate Test on Number of Lure Words Recognized by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	34.69	1	34.69	1.33	.253
Within Groups	1325.39	51	25.99		

Source Table for Univariate Test on Number of New Words by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	41.73	1	41.73	2.88	.096
Within Groups	739.25	51	14.50		

Table Q3
Source Table for One-Way Anova on Overall Accuracy (Targets-Lures- New) by Study Conditions Following a One-Week Delay

Source	*SS*	*DF*	*MS*	*F*	*p*
Between Groups	417.87	1	417.87	10.03	.002
Within Groups	2124.85	51	41.66		

APPENDIX R

Correlation Matrices Between Hypnotizability And Recognition Variables

Table R1

Intercorrelations Between Hypnotizability and Types of Recognition by Study Conditions Following a 15-minute Delay

FULL ATTENTION CONDITION (*N*=45)

VARIABLES	SHSS	REMEMBER	KNOW	GUESSING
Stanford Hypnotic Susceptibility Scale	------	.42***	.01	-.18
Number of Remember Responses		------	-.38**	-.31*
Number of Know Responses			------	.27
Number of Guessing Responses				------

DIVIDED ATTENTION CONDITION (*N*=45)

VARIABLES	SHSS	REMEMBER	KNOW	GUESSING
Stanford Hypnotic Susceptibility Scale	------	.03	.15	.49***
Number of Remember Responses		------	.03	-.32*
Number of Know Responses			------	.05
Number of Guessing Responses				------

*p <.05, **p < .01, ***p < .001

Table R2
Intercorrelations Between Hypnotizability and Types of Recognition by Study Conditions Following a One-Week Delay

FULL ATTENTION CONDITION (*N*=26)

VARIABLES	SHSS	REMEMBER	KNOW	GUESSING
Stanford Hypnotic Susceptibility Scale	------	.10	.20	.09
Number of Remember Responses		------	.08	-.26
Number of Know Responses			------	-.16
Number of Guessing Responses				------

DIVIDED ATTENTION CONDITION (*N*=27)

VARIABLES	SHSS	REMEMBER	KNOW	GUESSING
Stanford Hypnotic Susceptibility Scale	------	.20	-.02	.26
Number of Remember Responses		------	.08	-.33
Number of Know Responses			------	-.32
Number of Guessing Responses				------

*p <.05, **p < .01, ***p < .001

Table R3
Intercorrelations Between Hypnotizability and Accuracy Variables by Study Conditions Following a 15 Minute Delay

FULL ATTENTION CONDITION (*N*=45)

VARIABLES	SHSS	TARGETS	LURES	OVERALL
Stanford Hypnotic Susceptibility Scale	------	.37**	.11	.25
Number of Target Words		------	.22	.75***
Number of Lure Words			------	-.48***
Overall Accuracy (Targets-Lures)				------

DIVIDED ATTENTION CONDITION (*N*=27)

VARIABLES	SHSS	TARGETS	LURES	OVERALL
Stanford Hypnotic Susceptibility Scale	------	.29*	.51***	-.15
Number of Target Words		------	.35*	.65***
Number of Lure Words			------	-.49***
Overall Accuracy (Targets-Lures)				------

*p <.05, **p < .01, ***p < .001

Table R4

Intercorrelations Between Hypnotizability and Accuracy Variables by Study Conditions Following a One-Week Delay

FULL ATTENTION CONDITION (*N*=26)

VARIABLES	SHSS	TARGETS	LURES	NEW WORDS	OVERALL
Stanford Hypnotic Susceptibility Scale	------	.12	.30	.18	-.26
Number of Target Words		------	.69***	.57**	-.19
Number of Lure Words			------	.83***	-.80***
Number of New Words				-------	-.85***
Overall Accuracy (Targets-Lures)					-------

*p <.05, **p < .01, ***p < .001

Table R5

Intercorrelations Between Hypnotizability and Accuracy Variables by Study Conditions Following a One-Week Delay

DIVIDED ATTENTION (*N*=27)

VARIABLES	SHSS	TARGETS	LURES	NEW WORDS	OVERALL
Stanford Hypnotic Susceptibility Scale	------	.32	.49**	.17	-..31
Number of Target Words		------	.54***	.57**	-.22
Number of Lure Words			------	.61***	-.85***
Number of New Words				-------	-.76***
Overall Accuracy (Targets-Lures)					-------

*p <.05, **p < .01, ***p < .001

APPENDIX S

Source Table for Analysis of Variance

Emotional Significance Scale

Source Table for Repeated Measure Analysis of Variance on Emotional Significance Ratings (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	4.94	1	4.94	1.87	.19
Error	47.43	18	2.63		
Conditions	6.19	1	6.19	1.83	.19
Hyp. X Cond.	2.16	1	2.16	.64	.43
Error	60.73	18	3.37		

APPENDIX T

Source Tables for Analysis of Variance

Cognitive Effort Variables

Source Table for Repeated Measure Analysis of Variance on Reaction Time (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	.19	1	.19	.00	.96
Error	1107.10	18	61.51		
Conditions	102.85	1	102.85	20.09	.000
Hyp. X Cond.	.21	1	.21	.04	.84
Error	92.14	18	5.12		

Source Table for Repeated Measure Analysis of Variance on Number of Prompts (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	52.90	1	52.90	3.11	.095
Error	306.20	18	17.01		
Conditions	12.10	1	12.10	1.41	.25
Hyp. X Cond.	4.90	1	4.90	.57	.46
Error	155.00	18	8.61		

Source Table for Repeated Measure Analysis of Variance on Content Effort (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	55.23	1	55.23	.84	.37
Error	1189.25	18	66.07		
Conditions	42.02	1	42.02	1.99	.18
Hyp. X Cond.	5.62	1	5.62	.27	.61
Error	380.85	18	21.16		

APPENDIX U

Source Tables for Repeated Measure Analysis of Variance

Quality Variables

Source Table for Repeated Measure Analysis of Variance on Self-Reference Variable (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	608.40	1	608.40	.8.72	.009
Error	1256.00	18	69.78		
Conditions	28.90	1	28.90	.89	.36
Hyp. X Cond.	2.50	1	2.50	.08	.79
Error	584.60	18	32.48		

Source Table for Repeated Measure Analysis of Variance on Other's Affect (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	1.22	1	1.22	.10	.76
Error	232.50	18	12.89		
Conditions	9.03	1	9.03	.99	.33
Hyp. X Cond.	18.23	1	18.23	2.00	.18
Error	164.50	18	9.12		

Source Table for Repeated Measure Analysis of Variance on Vividness (Hypnotizability by Recall Conditions)

Source	*SS*	*DF*	*MS*	*F*	*p*
Hypnotizability	72.90	1	72.90	1.20	.29
Error	1093.20	18	60.73		
Conditions	.40	1	.40	.01	.91
Hyp. X Cond.	19.60	1	19.60	.67	.42
Error	523.00	18	29.06		