Awareness, Automaticity, and Control Issues in Implicit and Explicit Memory: Are Information Processing, Hypnotizability, Absorption, and Imagery Contributing Factors?

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ABSTRACT

Individual Differences, Information Processing, and Hypnotizability as Predictors of Implicit and Explicit Memory Outside of Hypnosis

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The major question of the existence of dissociations between awareness and unawareness or between automatic and controlled processings as sustaining the dissociation between implicit and explicit remembering remains mainly unanswered. For the purpose of exploring this question, a replication of Bowers and Schacter' (1990) study was first attempted. The effect of the level of encoding (structural versus semantic) for incidentally studied words on memory was assessed in indirect testing and in direct testing by the presentation of the same 3-letter stems of these words at both tests. The impact of awareness in indirect testing was also evaluated. A second phase of the experiment served to assess subjects' automaticity on two Stroop tasks, subjects' hypnotizability on three scales of measurement, and other subjects' individual differences on self-report questionnaires. Results replicated the findings of Bowers and Schacter (1990) in suggesting that level of encoding does not affect direct priming (implicit memory) while affecting recall (explicit memory). Implicit memory seemed possible even in self-reportedly unaware subjects, while awareness appeared more likely an outcome of higher implicit responding. Moreover, the finding of a positive relationship between hypnotizability and direct priming performance was interpreted to confirm the implication of automaticity in implicit remembering. Level of encoding effects at correct recall were related to absorption, that is probably to attention at study. Control on Stroop tasks (reduced interference on incongruent trials) was related with increases in correct recall. Together, results are interpreted as supporting the multiple systems view of remembering.

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Implicit Memory

Research antecedents. The last 15 years, and particularly the 1980s, have witnessed the blooming of systematic research in a new field of cognitive psychology called "implicit memory." Implicit memory as an unintentional, non-conscious form of memory has been contrasted with "explicit memory", which involves conscious recollection of previous events or previously learned material (Graf & Schacter, 1985).

The notion that behavior can be influenced by processes out of conscious control or out of the awareness of the individual can be traced back as far as Descartes, Leibnitz, Maine de Biran, and Herbart's theories of "insensible", "imprinted", "habit", "automaticity" and "suppressed" ideas, among others (see Schacter, 1987, 1990, 1992a, for historical reviews). In the late 19th century, implicit remembering has also been described by Korsakoff in patients with organic amnesia, as well as by Janet and Freud in patients with functional amnesias. During the same period, in the early days of psychology as a science, Ebbinghaus, studying savings in relearning, experimentally demonstrated that some effects of memory occurred out of the reach of awareness (Schacter, 1987). During the first third of the century, numerous demonstrations that subjects can learn to apply various rules without being able to explicitly describe them have been presented by Thorndike (Schacter, 1990). In turn, Hull demonstrated post-hypnotic implicit memory for skills, conditioned responses and facts, without explicit recall of the learning episode(s) experienced in hypnosis (Schacter, 1990). The beginning of the century also witnessed William McDougall's introduction of the terms implicit and explicit for distinguishing conscious from unconscious recognition (Schacter, 1990). More recently, a surge of interest in implicit memory was stimulated by studies by Warrington and Weiskrantz (1968) who showed that densely amnesic patients, who were severely impaired in their ability to remember recently presented stimuli, exhibited above-chance learning when they were tested by methods that tapped what is now referred to as direct, or repetition priming. (See Tulving and Schacter (1990), for some examples of ensuing studies.)

The descriptive terms "implicit" memory and "explicit" memory have been reintroduced by Graf and Schacter (1985) in order to distinguish between two forms of memory involving unintentional and intentional remembering. Explicit memory has traditionally been assessed by free recall, cued recall and recognition tasks that require intentional or conscious retrieval of information from a specific prior experience. Instructions at test make direct reference to a previous learning episode (e.g., "Was this word on the list you were shown?"). In contrast, implicit memory is assessed with indirect (Johnson & Hasher, 1987; Richardson-Klavehn &

Bjork, 1988) or incidental tasks (Jacoby, 1984), otherwise called implicit memory tasks, such as word stem or fragment completion, making no reference to a prior study episode.

Schacter (1992) states that the distinction between explicit and implicit memory is similar to previous distinctions made between memory with awareness versus memory without awareness (e.g., Jacoby & Witherspoon, 1982), declarative memory versus nondeclarative memory (Squire, 1992), and direct versus indirect memory (Johnson & Hasher, 1987). These distinctions are now used less frequently in the literature than is the explicit/implicit distinction.

The distinction between implicit and explicit memory is not perfectly equivalent to the distinction between direct and indirect tests of memory, however, even if they probably overlap considerably (Johnson & Hasher, 1987). It is not always certain whether an implicit task or an indirect test is performed solely on the basis of implicit memory. As discussed later, some subjects may become aware of the prior study episode when performing an allegedly implicit task. Similarly, an explicit memory task such as a recognition test may be solved or assisted by means of implicit memory processes. As such, the explicit/implicit distinction is a descriptive one that contrasts two different ways in which memory for prior experience can be expressed in terms of retrieval test. It does not necessarily reveal anything about underlying mechanisms, nor do the terms imply the existence of distinct memory systems.

Research on implicit memory now falls into four categories of measures: a) tests of factual, conceptual, lexical and perceptual knowledge; b) tests of procedural knowledge (i.e., skilled performance. problem solving); c) evaluative response (where presentation of stimuli affects affective preference and/or cognitive judgments); d) other measures of behavioral change, including neurophysiological response and conditioning measures (Richardson-Klavehn & Bjork, 1988). According to Schacter (1987), research on implicit memory itself could be considered to cover five distinct domains: a) savings during relearning, b) effects of subliminally encoded stimuli, c) learning and conditioning without awareness, d) preserved learning in amnesic patients, and finally, e) repetition priming. In repetition priming, implicit memory is manifested when a performance on a task is facilitated as a function of a recent encounter with the same stimulus in the absence of conscious recollection (it is expressed on tests in which subjects are not required, and are frequently unable, to deliberately refer to the previously studied information or the episode itself).

The facilitation effect of a prior study episode on performance on indirect memory tasks is also referred to as "direct priming." Its effects are measured in terms of the difference between proportion of completion of studied and nonstudied, or primed and unprimed words. As the term priming in a general, or theoretical sense could be considered to happen on indirect *and* direct tests of memory (from perceptual identification all the way to cued recall), we will reserve the terms "direct priming" or "repetition priming" when referring to the facilitation resulting from the presentation of targets in indirect testing. This is also to contrast it with what Cramer (1965) called "indirect priming", i.e, the facilitation resulting from the presentation of items that are semantically associated to targets.

A typical test of implicit memory using repetition priming is the stem completion task. Subjects are initially exposed to a set of target stimuli that are encoded under different conditions (e.g., elaboration study task such as rating the pleasantness of a word versus nonelaboration study task such as counting the number of vowels in a word). Following an interval, the subjects are then given a set of three-letter stems (e.g., REA___ for reason) to be completed with the first word that comes to mind, in which no reference to the prior learning episode is made. To disguise the indirect nature of the task, many test cues are new, distractor words that were not presented as part of the previous study list. The variable of interest is the extent to which stem completions from earlier presented words exceed the completion rate of the same words by subjects who have not been exposed to them. When the target rate exceeds the control rate, repetition priming is said to have facilitated performance.

Repetition priming has been assessed by a wide range of tasks, including word-stem completion, word-fragment completion (Tulving, Schacter, & Stark, 1982), word identification (Jacoby & Dallas, 1981; Jacoby & Witherspoon, 1982), lexical decision latencies (Moscovitch, 1985; Scarborough, Cortese, & Scarborough, 1977), homophone spelling, free association, solving of anagrams, reading of inverted script (Schacter, 1987; Roediger and Weldon, 1987 for reviews), object classification (Schacter, Cooper, & Delanay, 1990), and savings in picture completion (Parkin & Russo, 1990).

So far, research has provided ample evidence that performance on tests of implicit and explicit memory can be dissociated (see review by Berry & Dienes, 1991; Lewandowski, Dunn, & Kirsner, 1989; Richardson-Klavehn & Bjork, 1988; Roediger, 1990a,b; Roediger, Weldon, & Challis, 1989, Schacter, 1987; and Shimamura, 1986). For example, contrary to effects on *explicit* recall, the magnitude of effects of elaboration at encoding on *implicit* memory has been demonstrated to be comparable between elaborative and nonelaborative processing. The *absence* of an encoding effect on implicit memory was observed initially on a word identification task, which requires subjects to identify words from extremely brief presentation (Jacoby & Dallas, 1981), and has since been demonstrated with various other implicit memory tests (e.g., Carroll & Kirsner, 1982; Craik & Tulving, 1975; Jacoby & Craik, 1979; see Greene, 1992 for review). Graf and Mandler (1984) demonstrated that semantic versus nonsemantic encoding had little effect on the magnitude of direct (repetition) priming on a word completion task in which subjects wrote the first word that came to mind in response to three-letter stems of recently presented words. However, this level of processing manipulation had large effects on explicit tests of memory, such as free recall, cued recall, and recognition. Recall of studied words was significantly higher following semantic versus nonsemantic encoding (see also Graf, Mandler, & Haden, 1982; Graf, Squire, & Mandler, 1984). Graf and Mandler's Experiment 3 (1984) demonstrated this in a particularly clever way comparing implicit and explicit memory tasks that were designed to be as similar as possible. In the implicit task, subjects received the three-letter stems and were told to complete each with the first word to come to mind. In the explicit test, subjects were told that they were in a cued-recall task condition and were instructed to use the word stems as templates to remember words that had been shown earlier; each stem should be completed *only* with a word from the original list. The stems were the same for implicit and explicit versions, the only difference being in the instructions that preceded them. Thus, with all experimental manipulations being equal except for direct versus indirect instructions, level of processing failed to discriminate implicitly remembered words. The discriminant pattern of recalled words, however, was clearly dissociated from the pattern of implicitly remembered words.

Evidence of dissociations in performance between direct and indirect tests of memory in the area of repetition priming continues to accumulate. Several other studies have shown that experimental variables such as depth of processing (Jacoby, 1983b; Graf & Schacter, 1985; Java & Gardiner, 1991), spacing (Tulving, Schacter, & Stark, 1982), generation, attention (Parkin, Reid, & Russo, 1990), frequency of occurrence (Jacoby and Witherspoon, 1982; Roediger & Blaxton, 1987), the extent to which studied items form interitem associations (Graf & Schacter, 1989; Sloman, Hayman, Ohta, Law, & Tulving, 1988), or retroactive and proactive interference (Graf & Schacter, 1987), have large effects on explicit memory while having little or no effect on implicit memory. (e.g., Graf et al., 1982; Graf, Squire, & Mandler, 1984; Jacoby & Dallas, 1981; Roediger & Blaxton, 1985; Scarborough et al., 1979; Tulving et al., 1982). Other manipulations, such as changes in presentation formats, modality (e.g., auditory versus visual) (Gardiner, Dawson, & Sutton, 1989; Jacoby, 1983; Jacoby & Hyman, 1987;

Roediger & Blaxton, 1987; Schacter & Graf, 1989), and colors (Jacoby & Dallas, 1981; Morton, 1979; Moscovitch, Winocur, & McLachlan, 1986; Roediger & Blaxton, 1987), while affecting performance on indirect testing, exert a stronger influence on performance on directly tested material. Finally, under certain conditions, variations in level or type of study processing can actually have opposite effects on implicit and explicit memory performance (Richardson-Klavehn & Bjork, 1988).

The picture is complex, however, since these effects have not consistently been obtained. Within certain individual experiments, level of processing sometimes has an effect on implicit memory performance that reaches statistical significance, like in stem completion (Graf, Squire & Mandler, 1984; Squire, Shimamura, & Graf, 1987), or on lexical decision tasks (Duchek & Neely, 1989) despite the majority of non-significant results in the literature using similar experimental designs. Recall and recognition performance have been found to be higher when subjects generate to-be-remembered words than when they read them at encoding, whereas word identification performance has been found to be higher in "read" than in "generate" conditions (Jacoby, 1983b; Winnick & Daniel, 1970). Adequate perceptual processing has to be present, however, for these results to manifest, since lack of "whole word" perceptual processing lead to reduced direct priming levels (Bentin &

Katz, 1984; Burt, Walker, Humphreys, & Tehan, 1993; Henik, Friedrich, & Kellogg, 1983; Parkin, 1979; Smith, Theodor, & Franklin, 1983). It has also been found under certain conditions, and contrary to other findings, that some direct priming effects are sensitive to interference manipulations (Mayes, Pickering, & Fairbairn, 1987), although the nature of interference effects are poorly understood. In addition, Schacter and his colleagues (Graf & Schacter, 1985, 1989; Schacter and Graf, 1986a; Schacter and McGlynn, 1989) have demonstrated that direct priming in word-completion and free-association tests for "nonunitized" pairs of words (normally unrelated word pairs) is small and dependent on level of elaborative processing. However, when linguistic idioms (normally related word pairs) (e.g., sour grapes) are presented at study, there is an absence of distinctive direct priming effects as a function of elaborative encoding on a subsequent free association test (e.g., sour ___) (Schacter, 1985b).

Further evidence for dissociation between implicit and explicit memories comes from the demonstration that the magnitude of direct priming effects on implicit memory tests can be statistically (stochastically) independent of explicit recall and recognition when performance on direct versus indirect tasks is correlated at the level of individual items (e.g., Eich, 1984; Hayman & Tulving, 1989a; Jacoby & Witherspoon, 1982; Schacter, Harbuk, & McLahan, 1984; Tulving, Schacter, & Stark, 1982) even for nonverbal stimuli (Musen & Treisman, 1990). This means that correct recall of a particular item on a particular explicit memory test does not imply direct priming of the same item on the corresponding implicit memory test, and vice versa. For example, results from contingency analyses revealed that normals and even amnesic patients often give a correct response on a cued-recall test after having failed to produce the same response on a stem completion test. However, some investigators have reported strong *dependence* between implicit and explicit tests (e.g., Graf & Mandler, 1984; Greene, 1986), and Hintzman and Hartry (1990) have warned that there are severe statistical problems that complicate analyses such as these. Studies of this type cannot be considered as fully decisive regarding the independence between implicit and explicit memory.

Perhaps the most compelling evidence for dissociations between implicit and explicit memories is provided by studies of patients with organic amnesia. Amnesic patients, even though severely impaired on standard tests of explicit memory, show normal or near normal performance on various tests of implicit memory (for reviews, see Mayes, 1988; Moscovitch, 1982; Parkin, 1987; Roediger, 1990; Rozin, 1976; Schacter, Chiu, & Ochsner, 1993; Shacter & Tulving, 1982; Schacter, 1987; Shimamura, 1986; Squire, 1982) including for non verbal material (e.g., Benzing & Squire, 1989;

Gabrielli, Milberg, Keane, & Corkin, 1990; Gooding, van Eijk, Mayes, & Meudell, 1993; Nissen & Bullemer, 1987; Schacter, Delaney, & Merikle, 1990) and pronounceable non-words (Mayes, Poole, & Gooding, 1991). Different patterns of implicit remembering are observable between differentially diagnosed patients, providing more evidence for dissociations between explicit and implicit memory. Patients with Alzheimer's disease (Christensen & Birrell, 1991; Knopman & Nissen, 1987; Schwartz, Rosse, & Deutsch, 1993) or amnesic alcoholics (Canavan, 1992), for example, have unimpaired procedural memory, whereas patients with cerebellar or basal ganglia disorders may show deficits in implicit memory but not in explicit memory (see review in Hömberg, et al., 1993).

Furthermore, no significant effects of age on implicit task performance have been found, whereas explicit memory performance declined as a function of age (Java, 1992; Java & Gardiner, 1991; Light & Singh, 1987). Graf (1990), in reviewing implicit memory literature dealing with verbal material, concluded that there is a roughly 4% difference in performances on implicit memory tests between young and old, while this difference is about 50% or more on tests of explicit memory. In the same vein, studies in children have demonstrated that implicit and explicit memory follow different maturational trends (Hömberg, Bickmann, & Müller, 1993). For example, implicit memory, as measured by savings in picture completion, does not show an age-related change, while explicit memory does (Russo & Parkin, 1993).

In addition, direct priming seems to be surprisingly enduring when compared to explicit memory performance (Mitchell & Brown, 1988). The effects of a single presentation of a study item has been demonstrated to be sufficient to facilitate performance for at least 24 hours on perceptual identification tasks (Jacoby & Dallas, 1981), 48 hours on lexical decision tasks (Scarborough, Cortese, & Scarborough, 1977), a week on word-fragment completion tasks (Tulving, Schacter, & Stark, 1982), and a year on speeded reading of transformed script tasks (Kolers, 1976). Moreover, in fragment completion tasks, direct priming has been evident after intervals of 1 week and 5 weeks, as well as 16 months, while recognition memory declined sharply across the same delays (see brief review in Berry & Dienes, 1991; Sloman, Hayman, Ohta, Law & Tulving, 1988). However, other studies have not demonstrated such a striking advantage in persistence of implicit memory compared to explicit memory. Graf, Squire and Mandler (1984) demonstrated that performance on a stem completion test declined and reached chance after 120 minutes in amnesic as well as in normal subjects. In contrast, recognition performance in the nonsemantic condition (vowel task) was at chance after a delay of 15 minutes. Similar results were reported with alcoholics and patients with Korsakoff's syndrome in stem completion (Diamond & Rozin, 1984; Shimamura & Squire, 1984, Experiment 2B).

Theoretical accounts of implicit memory. Since the diversity of phenomena revealed by the study of implicit memory is great, many different theoretical views have been proposed to accommodate as much data as possible. In light of current research findings, three theoretical accounts are discussed and retained more often than others.

In the first approach, which seems to be bv far the most popular, findings on repetition priming in normal subjects and in amnesic patients have led some researchers to postulate that dissociations between implicit and explicit memory performance are possible manifestations of separate yet **interacting memory systems**, one of which, the implicit memory system, would be preserved in amnesics (e.g., Schacter et al., 1990a; Squire, 1987; Tulving, 1985; Tulving & Schacter, 1990). A number of different multiple memory system views have been defended (e.g., Johnson, 1983; O'Keefe & Nadel, 1978; Schacter & Moscovitch, 1984; Warrington & Weiskrantz, 1982). Aside from the implicit versus explicit memory distinction (Graf & Schacter, 1985; Schacter, 1987; Schacter & Graf, 1986; Sherry & Schacter, 1987), additional popular distinctions include "episodic" versus "semantic" memory systems (e.g., Cermak, Talbot, Chandler, & Wolbarst, 1985; Kinsbourne & Wood, 1975; Parkin, 1987; Schacter and Tulving, 1982; Tulving, 1972; 1985), and "declarative" versus "procedural" (more recently, "declarative" versus "nondeclarative") memory systems (Cohen and Squire, 1980; Squire, 1987; Squire & Cohen, 1984). In one of the latest accounts and following Gipson (1966), Tulving and Schacter (1990) have proposed that a single perceptual representation system (PRS) with subsystems for "word form" and "structural description" processing could be responsible for the perception of objects or words as structured wholes. The PRS would be manifested in implicit memory phenomena such as learning of skills and repetition priming effects. Schacter (1990) suggests that one or more separate systems would be needed to account for conceptually based priming. In an evolutionary perspective, the purpose of implicit memory is seen as preserving those aspects of learning situations that tend to recur across specific instances, and as such are context independent (Sherry & Schacter, 1987). The operation of implicit memory would explain why perceptual and motor skills transfer to different situations, that is, content transfers independent of form. In contrast, their view of explicit memory as involving the formation of new representations or data structures is similar to the declarative memory system view of Squire and Cohen (1984). Tulving and Schacter (1990) posit that the purpose of the explicit memory system would be to preserve specific contextual details of events so as to support conscious recollection of past experiences, and in consequence would comprise both episodic and semantic material. In this sense, content can be consciously reflected upon as a function of particular "forms", conditions, or contexts. The explicit memory system is therefore seen as context dependent.

An alternative interpretation of implicit/explicit dissociations is based on the idea that there is a single memory system in which level of performance is determined by the degree of overlap of cognitive processes required by the interaction between forms of encoding and forms of testing (e.g., Blaxton, 1989; Craik, 1983; Jacoby, 1983a,b; Moscovitch, Winocur, & McLachlan, 1986; Roediger & Blaxton, 1987; Witherspoon & Moscovitch, 1989). Roediger and his colleagues have labelled their view the "transfer-appropriate principle", which is based on the **processing view** of Kolers (1976). Two main types of processing are distinguished; data-driven and conceptually-driven processing (Jacoby, 1983b; Jacoby, Baker & Brooks, 1989; Roediger & Blaxton, 1987; Roediger, Weldon & Challis, 1989). Data-driven (bottom-up) processing is assumed to encompass the sensory processes responsible for analyzing surface features or cue information incoming from the test environment. Conceptually-driven (top-down) processing refers to the processes which are initiated by the subject such as elaborating, organizing and structuring, as well as analyzing the deeper meanings of stimuli. In this view, most indirect tests involve mainly data-driven processes because the subject is required to operate on perceptual information (like stems for example) provided by the experimenter. On the other hand, direct tests are seen as involving a significant amount of conceptually-driven processing because the subject must mentally reconstruct the study episode. However, a continuum is posited to exist from data-driven to conceptually-driven processes. Therefore, both processes would support explicit and implicit test performance in different proportions depending on tasks demands.

The third view, the **activation account,** holds that priming effects in implicit testing are dependent upon the temporary activation of preexisting representations such as familiar words, knowledge structures, or "logogens" (e.g., Graf & Mandler, 1984; Mandler, 1980; Morton, 1979; Rozin, 1976). This activation is assumed to happen automatically in implicit testing, to operate independently of level of processing at encoding, and to be free of contextual information about an item's occurrence as part of a prior episode. As such, automatic activation is assumed to not contribute to explicit rememoering of the same episode.

So far, each of these approaches has difficulty in accounting for all the available data and each is still contested by proponents of opposite views (see Bauer, Tobias, & Valenstein, 1993 for an overview of debate; and

Lewandowsky, Dunn, & Kirsner, 1989 for a more in depth discussion). Moreover, it can be postulated that "activation", "processing", and "multiple systems" theories are not necessarily mutually exclusive (Bauer et al., 1993). It is possible that some types of implicit memory rely more heavily on activation of preexisting knowledge, whereas others are the expression of new memory traces based on processing similarities between study and test. Schacter's (1990) multiple memory systems model with *interacting* implicit and explicit systems also could be considered to incorporate "processing" accounts. Both imply that the type of memory manifested depends on particular task demands and domain of knowledge being tapped. However, while a combination of theories would account for more of the existing data, it sacrifices the explanatory power of each approach, is nonparsimonious, and has not yet been considered in the literature.

Automaticity and awareness. One attempt at bringing some light over this theoretical stalemate could be to look at the unresolved issue regarding the influence of spontaneous awareness during implicit testing and at the relation between automaticity and implicit performance. In contrast to traditional explicit measures such as free recall, it is generally assumed that measures of implicit memory tap an unaware or unconscious form of retention (e.g., Jacoby & Whitherspoon, 1982; MacLeod, 1989). This contention is based on the fact that indirect memory tasks, by definition, do not refer to prior experience, and that amnesic patients show quite normal repetition priming despite great difficulty in recalling or recognizing the same words. Dissociation between explicit and implicit measures of retention in normal subjects and amnesic patients has provided empirically tested justification for this assumption. Of course, this assumption, and even experimentally controlled data, can be called into question because it is conceivable that normal subjects (in contrast to amnesic patients) may realize that the ostensibly implicit test can be solved by explicitly retrieving prior experiences in order to enhance their experimental task performance. In such a case, a theoretically implicit task may be transformed into one which is functionally explicit.

Schacter, Bowers, and Booker (1989), however, argue that this kind of "contamination" from explicit memory is ruled out when an experimental manipulation, such as depth of study processing, has no effect on priming and strong effects on explicit memory under conditions in which the same cues are provided on the two tests, and only test instructions are manipulated. Under such conditions (e.g., Carroll & Kirsner, 1982; Craik & Tulving, 1975; Graf & Mandler, 1984; Graf, Mandler, & Haden, 1982; Graf et al., 1984; Jacoby & Craik, 1979; Jacoby & Dallas, 1981), higher levels of recall performance are found following elaboration while level of implicit memory performance does not differ as a function of encoding. If subjects are engaging in explicit retrieval on an implicit test, an "explicit" pattern should be found (see Jacoby, 1991, for another approach to this issue).

The awareness question was addressed by Merikle and Reingold (1991) by first briefly presenting stimuli to subjects at the study phase of the experiment. Subjects tasks on the ensuing implicit and explicit measures remained the same and only instructions were varied. For the direct measure, subjects had to discriminate previously presented stimuli from new stimuli items that had not been presented during the "study" phase by reporting "old"/"new" distinctions for presented stimuli. For the indirect measure, instructions did not make any reference to the old/new distinction. Since performance on the conscious discrimination task was shown to be at chance level, it was concluded that perception of the briefly presented stimuli remained unconscious. The implicit measure indicated that priming had occurred in spite of unconscious memory.

This issue of awareness contamination with explicit retrieval strategies in implicit testing was addressed differently by Bowers and Schacter (1990). They attempted to assess awareness by eliciting self-reports from subjects. These authors verbally addressed nine questions to subjects immediately after they finished the stem completion task.

Four of these questions probed subjects' test awareness during the performance of the stem completion task (i.e., (1) "What did you think was the purpose of the stem completion task that you just finished?"; (2) "What was your general strategy in completing the word stems?"; (3) "Did you notice any relationship between the words I showed you earlier and the words you produced on the stem completion test?"; (4) "While doing the stem completion test, did you notice whether you completed some of the stems with words studied in the earlier list?"). Their criterion for unawareness included subjects who did not spontaneously mention the study episode in responding to the first two questions, and who responded negatively to both questions three and four. Subjects who either spontaneously referred to the study episode in response to the first two questions or who responded positively to either of the latter two questions were classified as "aware".

In Bowers and Schacter's (1990) experiment, a standard stem completion procedure was used. A within subjects variable was manipulated regarding the level of processing at encoding. Subjects were first exposed to a list of 24 familiar words, with half of them encoded semantically (rating the pleasantness of each word), and the other half encoded nonsemantically or structurally (counting the number of T-junctions in each word; based on Graf & Mandler, 1984). After a series of filler tasks lasting approximately 10 min (generating names of cities, countries, and famous names, respectively, to letter fragment cues), they were then given a sheet containing 75 three-letter stems (12 items represented target or study list items; 63 were distractor items) and were asked to complete them with the first word that came to mind. Baseline rates of completion of these 75 word stems were established by having a group of subjects who did not participate in the experiment complete them.

Two between-subjects manipulations were employed. The first involved an intentional versus incidental study manipulation. Half the subjects were told that their memory for studied words would be subsequently tested (intentional encoding). The other half were not informed of this possibility and were told that their responses on the task were needed for normative purposes (incidental encoding). Subjects were told that they would be participating in a face and word perception study. Accordingly, word stem completions were preceded by presentation of pictures of faces that all subjects were required to rate for pleasantness, and for whether the eye or mouth was the most distinctive feature. The second between subjects manipulation concerned test instructions. Half the subjects were told that some of the stems on the completion test could be filled with study-list items, but that they should nevertheless write down the first word that comes to mind (test informed). Test uninformed subjects were told nothing regarding the relation between study-list items and stem completions. The awareness questionnaire was then given only to subjects in test uninformed groups. Test informed subjects were considered to be aware that stems could be completed with study list items.

Results indicated that there was no effect of the intentional versus unintentional encoding manipulation on stem completion performance, so data were collapsed across these conditions. In addition, following nonsemantic (structural or shallow) encoding there was a negligible difference between test informed and test uninformed subjects. Following semantic (deep) encoding, however, there was a marginally significant priming advantage for test uninformed over test informed subjects. Regarding the relation between unawareness and priming, Bowers and Schacter (1990) found that half of their test uninformed subjects remained entirely unaware of the relation between the stem completion task and the previously studied words and showed robust priming effects (performance was significantly higher than baseline completion rate) of equivalent magnitude following semantic and nonsemantic encoding tasks. Unaware subjects completed just as many word stems as did test aware subjects. The authors concluded that these findings indicate that it is possible to obtain robust priming following both semantic and structural encoding tasks in unaware subjects, at least to the extent that such awareness is adequately captured by the post-test questionnaire. Finally, the authors concluded that dissociations between implicit and explicit memory are similar to those observed in amnesic patients, and can be found in normal subjects.

While the priming performance of test unaware subjects did not differ significantly following semantic and structural encoding, test aware subjects showed significantly more priming following semantic compared to structural encoding. These results are interesting in light of the performance on the cued-recall test (with the same nominal three-letter cues) administered just after the stem completion test. Cued recall was significantly higher for semantically encoded words than for nonsemantically (structurally) encoded words for all subjects. As well, recall performance in the semantic condition was considerably higher than on the completion test, whereas performance in the structural condition was actually slightly lower than on the completion test. Bowers and Schacter (1990) suggest a possible explanation for this latter set of results. When subjects became aware of the nature of the completion test, they might have explicitly attempted to complete stems with studied items. Such a strategy would be more efficient following semantic encoding, as structural encoding typically leads to extremely poor recall performance (e.g., Craik & Tulving, 1975; Graf & Mandler, 1984; Roediger & Blaxton, 1987). Thus aware subjects seem to respond in a pattern consistent with explicit recall.

Rybash and Osborne (1991) sought to replicate and extend these results. Their 60 college student subjects were divided equally between a free recall, a cued recall and a stem completion conditions. The dependent variable was the proportion of words remembered by subjects in each memory task condition. For the stem completion condition, an awareness questionnaire identical to the one used by Bowers and Schacter (1990) was presented immediately after the stem completion task. Of the 20 subjects in the stem completion condition, only 5 were found to remain test-unaware. Test-unaware subjects completed fewer stems than test-aware subjects, who completed fewer stems than subjects in the cued recall condition. Significant "priming" was exhibited by both the test-aware and the test-unaware subjects.

Bowers and Schacter (1990) had reported that one half of their sample remained test-unaware while performing the stem completion task and that their test-aware subjects completed just as many word stems as did test-unaware subjects. As Rybash and Osborne (1991) explain, these discrepancies could result from three main differences between the two studies. First, in Rybash and Osborne (1991), subjects processed all study words at a deeper level of semantic judgments [instead of only half of the words processed this way in Bowers and Schacter's study]. Second, Rybash and Osborne presented the stem completion task immediately after the subjects rated the pleasantness of study words, while Bowers and Schacter presented the stem completion task after three intervening filler activity tasks which introduced a delay of about 10 minutes, which perhaps made the link between study episode and implicit memory testing less obvious. Third, Rybash and Osborne included all of the 24 studied words among only 24 distractor words in the test list, while Bowers and Schacter chose only 12 of the 32 studied words to be included among 63 distractor words in the stem completion list.

The activation theory of memory dissociations, among others, can successfully interpret the above data. In this view, performance on indirect memory tests such as word-stem completion is attributable to temporary, automatic activation of preexisting representations (Graf & Mandler, 1984). By contrast, this view conceptualizes explicit memory as requiring additional (effortful, elaborative) processing. If implicit memory performance on word-stem completion, especially for subjects who really remain unaware, reflects some automatic cognitive processes, it might be productive to investigate if it somehow relates to performance on other measures of automaticity. Would the activation view be supported by these additional measures of automaticity? One area of cognitive research in which automaticity of processing is considered, in part, to explain performance is the field of hypnosis. Therefore, might individual differences in hypnotizability predict implicit memory performance? An empirically tested hypothesis of such a relation might contribute to our understanding of both phenomena and have implications on the theoretical views view of implicit memory.

Hypnotizability

Historical background. Two hundred years of inquiry in hypnosis has not yet fully solved the riddle of differences between individuals in hypnotic responding. As early as 1779, in his book entitled "Mémoire sur la découverte du magnétisme animal" (cited in Laurence & Perry, 1982), Franz Anton Mesmer wrote that individuals vary in their ability to be influenced by "universal fluid" or "animal magnetism." When Mesmer's magnetism was submitted to controlled scrutiny, a Royal Commission of Inquiry led by Benjamin Franklin concluded that the behaviors and experiences of patients in séances involving magnetism were attributable to three factors: imagination, the **automatic** tendency in humans to imitate, and sensitivity to physical touch in the form of passes of the hand (Franklin, de Byry, Lavoisier, Bailly, Majault, Sallin, D'Arcet, Guillotin, & Leroy, 1784, cited in Dixon & Laurence, 1992a). Only thirty years later, Faria

(1819, cited in Dixon & Laurence, 1992a) in attempting to explain individual differences in successful elicitation of "lucid sleep" (now called hypnosis), listed imagination, psychic impressionability, the ability to restrict attention to internal or external sensations, positive beliefs, expectations, profound confidence in one's ability to experience lucid sleep, and the rituals surrounding the induction process as important factors. Since Faria's writings, the notion that the subject rather than the magnetist is the controller of the process of magnetic sleep, has become a significant focus in our understanding of hypnotizability.

Theoretical views of hypnotizability. Since these early origins in the study of hypnotic phenomena, theoretical debate on the still unresolved aspect of individual differences in hypnotizability continues. Three main currents of conceptualizing about it have emerged (for reviews, see Bowers, 1976; Kihlstrom, 1985; Sheehan, 1979).

Following descriptions of animal magnetism by Mesmer and of de Puységur's somnambulism or magnetic sleep, the first model of hypnosis to exert a strong influence on research conceptualized it as a dissociative phenomenon. This view is supported by the finding that information elicited in the magnetized state or in hypnotized state sometimes becomes unavailable in the awake state and vice versa. Janet, for example, attached to the hypnotic state the concept of discontinuity in awareness and accompanying amnesia. He spoke of "disaggregation" which for him was similar to a passive falling apart of the psychological system (Frankel, 1990).

Attempting to explain individual differences in hypnotic capacity, E. R. Hilgard (1977) elaborated on this view and proposed the "neodissociation" model. He based his theoretical elaborations on the fact that some hypnotized subjects report perceptual, memory, affective, and other cognitive alterations as both **automatic** and involuntary. He maintains that multiple, semi-autonomous, cognitive control systems subsume mental functioning, and that some of these can be tapped by hypnosis. E. R. Hilgard has proposed that subjects in hypnosis temporarily modify the normal functioning of the "executive ego" so that the executive controls of certain "cognitive subsystems" are "dissociated" or divided between the hypnotist and the hypnotized individual. Moreover, for him, the "hypnotic set" would involve a decrease in the individual's initiative and critical thinking, as well as an inability to consciously monitor some aspects of his(her) actions like movement initiations. This would lead hypnotized individuals to subjectively experience their responses as involuntary instead of stemming from their own cognitive subsystems' activities. Therefore, for E. R. Hilgard, the wide range of hypnotic susceptibility is due essentially to specific individual differences in abilities to undergo cognitive processes such as dissociation (which he sees as a matter of degree), and perhaps even more so, to the individual's capacity to experience a relationship of trust between hypnotist and subject. This multiple control systems view stimulated an important number of interesting studies on the hidden observer (for example E. R. Hilgard, 1977; Bowers, 1981; Bowers & Davidson, 1991).

Proponents of another model, the "social-psychological" position, disagree with this view of hypnotizability as deriving importantly from "unusual" cognitive abilities (Sarbin, 1984; Sarbin & Coe, 1972; Spanos, 1986a; Spanos & Chaves, 1989). These researchers emphasize the continuity between hypnotic enactments and other forms of social behavior. In this view, individual differences in hypnotizability mainly result from differences in subjects' willingness to cooperate with the hypnotist and to comply with the inherent demand characteristics contained in suggestions and context. Hypnotic responses are thus subjectively "experienced" and reported as automatic and involuntary only by subjects who believe that such behaviors and experiences are expected from "good" hypnotic subjects. Therefore, the more subjects are willing to produce the responses they perceive as expected of them in hypnosis, the higher their hypnotizability scores are. Thus, in this model, the social-psychological factors (e.g., attitude, motivation, understanding, belief, expectation toward hypnosis, compliance-induced reporting biases, alteration in attentional focus, and misattribution of experience), demand characteristics of hypnotic suggestions and context in interaction with subjects imaginal abilities, underlie individual differences in hypnotizability. As seen above, for proponents of this view, the experimental evidence for a stable trait conceptualization of hypnotizability is tenuous.

As a further attempt at explaining individual differences in hypnotizability, a third theoretical approach, the synergistic model, has recently emerged. This model aims at reconciling accumulated evidences from both previous models. In this view, hypnotic capacity results from a complex synergistic interaction between context and social-psychological factors on the one hand, with certain cognitive abilities on the other (Laurence, 1990; Nadon, Laurence, & Perry, 1991). For example, Dixon, Labelle, and Laurence (1990), using a multivariate approach, found that a significant amount of unique variance in hypnotizability could be explained by each of a number of cognitive capacities as assessed by self-report measures. In other words, for this theoretical approach, the whole of hypnotic responding capacity is more than the sum of its parts.

Hypnotizability measures. While individual differences in the tendency to experience the magnetist's or the hypnotist's suggestions have been consistently observed since Mesmer, a number of hypnotic susceptibility scales have been developed to provide researchers with an objective common measure. The operational measure for hypnotizability became the total number of objectively scorable responses elicited during a standardized series of suggestions. Despite differences in theoretical views about hypnosis, the general consensus about performance on these measures, from Liebault's and Berheim's first scales in the late 1800's to more recent scales, is that they appear to measure the degree to which a person can set aside critical judgment (without abandoning it completely) and get involved in the fantasy inherent in the hypnotic suggestion (Gill & Brenman, 1959; Hilgard, 1977).

Normative data on hypnotizability reflect a distribution in the general population which follows an essentially normal curve (really trimodal, with one major mode in between two middle modes in Hilgard's 1977 data) as many other biological or psychological phenomena. Depending on where the cut off points are set, approximately 10 to 15 percent of the population exhibit a low degree of hypnotizability (e.g. scores of 0 to 3 on the HGSHS:A; Hilgard, 1965a), 10-15 percent have high hypnotizability scores (e.g., scores of 8 to 11 on the same scale), while the remaining 70-80 percent have moderate hypnotizability scores (from 4 to 7 on this scale) (Hilgard, 1965a; Laurence

& Perry, 1982).

Even though scores seem to decrease over population age range, most theorists contend that the evidence confirms a reliability of hypnotizability scores under stable testing conditions (e.g., Bowers, 1976; Hilgard, 1965a; Perry, 1977; Piccione et al., 1989). As examples of obtained reliability scores, Morgan, Johnson, and E. R. Hilgard (1974) found r = .64 over a 10-year period of performance on the SHSS:C of 85 subjects, while Piccione, et al. (1989) obtained an r = .82 across a 25-year period with the previous sample reduced to 50 subjects.

Correlates of hypnotizability. So far, the most widely used attempt in explaining differences in hypnotizability has been to uncover correlates of hypnotizability within the domain of personality and individual differences (Belicki, 1992; see reviews by Barber, 1964; Bowers, 1976; Deckert & West, 1963b; de Groh, 1989; Hilgard, 1965a,b, 1975; Kihlstrom, 1985; Kirsch & Council, 1992; Shor, Orne, & O'Connell, 1966; Weitzenhoffer, 1953). The original view on hypnotizability that prevailed was as a unidimensional construct naving to do with the suggestibility of the individual (Hull, 1933; Eysenck & Furneaux, 1945; Furneaux, 1952, all cited in Kirsch & Council, 1992). For example, Charcot described the hypnotic capacity as appearing in individuals predisposed to hysteria, whereas Berheim regarded it as a normal universal human trait involving increased susceptibility to suggestion (de Groh, 1989). Unfortunately, the concept of suggestibility has been the subject of many debates in research and still remains unclear (Schumaker, 1991). Moreover, it was later demonstrated, with the use of factor analytic methodology, that the concept of suggestibility was only one of several dimensions that appeared to be related statistically to hypnotizability (Schumaker, 1991).

Early researchers quickly turned to using various inventory measures of personality such as acquiescence, hysteria, neuroticism, extroversion, locus of control, cooperativeness, influenceability, Rorschach responses or scores on subscales of the Minnesota Multiphasic Personality Inventory, and found nonexistent, very small, or unreliable correlations with hypnotic responsiveness (de Groh, 1989). It became evident that the quest for hypnotizability correlates had to be oriented in another direction. Research turned to conceptualizations of hypnotizability as determined by cognitive capacities, and/or as situationally determined.

A number of investigators thus started to focus on imaginative involvement, later equated to absorption, as an important dimension underlying hypnotic capacity (for reviews see Hilgard, 1979; Roche, 1986, 1989). They found that hypnotizable individuals exhibit a tendency to have experiences resembling hypnosis in their daily life.

Building on earlier works, Hilgard (1974, 1979) conducted intensive structured interviews of highly hypnotizable subjects and concluded that these individuals tended to exhibit high levels of involvement ("almost total immersion") in at least one area of imaginative experience, like reading, drama, or mental adventures, accompanied by disattention to irrelevant stimuli. For her, imaginative involvement represented a central dimension underlying hypnotic responsiveness, even if it was a far from perfect predictor.

Other researchers, using measures directly relevant to Hilgard's interviews confirmed this finding of a relationship between hypnotizability and imaginative involvement in reading (Baum & Lynn, 1981; Fellows & Armstrong, 1977), in music (Snodgrass & Lynn, 1989), stories, games and pretend play in children (LeBaron, Zelter, & Fanurik, 1988), or in life in general (Davis, Dawson, & Seay, 1978). However, the positive relation between imaginative involvement and hypnotizability has been found at least once to be dependent on whether the interview was administered "in the context of hypnosis or not (i.e., with or without awareness of a possible relation between hypnotizability and performance on the TAS measure being investigated) (Drake, Nash, and Cawood, 1990-1991). In contrast, Baum and Lynn (1981) and Snodgrass and Lynn (1989) found that such correlations held even when imaginative involvement assessments were done "out of the context" of hypnosis. Notwithstanding, this concept of imaginative involvement has proved useful and was later developed into the concept of "absorption."

Absorption could be defined as a predisposition or "an openness to experience emotional and cognitive alterations across a variety of situations" (Roche & McConkey, 1990, p. 93). Studies using scales specifically designed to measure "absorption", such as those by Shor (1960), As (1963), and Tellegen and Atkinsor (1974), have documented an association (r = .19-.89) between hypnotic susceptibility and absorption (e.g., Dixon et al., 1990; Glisky & Kihlstrom, 1993; Glisky, Tataryn, Tobias, Kihlstrom, & McConkey, 1991; Nadon et al., 1987; Radke & Stam, 1991; for reviews see Council, Kirsch, & Hafner, 1986; de Groh, 1989; Roche & McConkey, 1990; Spanos, 1986a). It has also been noticed by some researchers (Evans, 1989) that these absorption scales correlated better with the Standford Hypnotic Susceptibility Scale, Form C (SHSS:C) of Weitzenhoffer and Hilgard (1962), than they do with the Harvard Group Scale of Hypnotic Susceptibility, form A (HGSHS:A) which has less difficult dissociative and cognitive suggestions.

The Tellegen Absorption Scale (TAS) by Tellegen and Atkinson (1974) has quickly become the instrument of choice for the purpose of measuring individual differences in hypnotic-like experiences outside of hypnosis. And, despite one reported negative finding on a psychometrically less known hypnotic scale, the BBS (Spanos, McPeake, & Churchill, 1976), and findings that the relationship may be moderated by attitudes (Spanos & McPeake, 1975a,b; Spanos, Brett, Menary, & Cross, 1987) or by expectancies (Council et al., 1986), it was found by two independent and more methodologically sound studies reported by Nadon, Hoyt, Register, and Kihlstrom (1991) that expectancies did not moderate the relation between absorption as measured on the TAS and hypnotizability. Kihlstrom (1985) has qualified the finding of a relation between the daily hypnotic-like experiences tapped the TAS and hypnotizability to be the strongest finding in the quest for explaining hypnotizability variance through cognitive correlates of hypnotizability.

Despite the status of absorption as a reliable correlate of hypnotizability, the correlations observed are too low to be used alone for explaining individual differences in hypnotic capacity, and researchers have explored imaginal mental activity as another line of inquiry.

As mentioned earlier, since the investigative commission on Mesmerism led by Benjamin Franklin in the 1700's, imagination has been considered an important factor in explaining individual differences in hypnotizability by researchers from all orientations. Certainly imagery plays an important role in hypnotic response since the suggestions themselves require subjects to engage in fantasy (e.g., imagining arm heavy) or to vividly imagine earlier life events (e.g., age regression). The construct of "fantasy proneness" was therefore developed in an attempt to tackle this implication of imaginative capacity in hypnotic capacity. A close relative of absorption ($r = .75$) (Lynn & Rhue, 1986) and imaginative involvement, the concept of fantasy proneness could be conceptualized as deriving from, and encompassing, the construct of imaginative involvement as elaborated by Hilgard (1970, 1974, 1979). Wilson and Barber (1983) were the first to apply the term "fantasy prone persons", "fantasy addicts", or "fantasizers" to individuals who live much of the time in a world of imagery, imagination, and fantasy. Wilson and Barber (1981; 1983) came upon such individuals in the context of an intensive interview study of excellent hypnotic subjects. Many of the fantasizers Wilson and Barber investigated reported spending at least half of their waking life fantasizing. These fantasizers also reported vivid hypnagogic imagery, physical and emotional manifestations as consequences of observed violence on television (e.g., nausea and anxiety), vivid memories of personal experiences, psychic and out of body experiences, occasional difficulty in differentiating fantasized events and persons from nonfantasized ones, and the ability to hallucinate objects and to get deeply involved in what they fantasize "as real, as real." Later, Spanos (1971) also hypothesized that imagery was an important contributor in successful responding to hypnotic suggestions and, in accord with his theoretical perspective, he preferred to develop the expression "goal-directed fantasy" for this phenomenon.

Meanwhile, as imagery questionnaires continued to be developed, evidence has accumulated that suggests a low to moderate relationship between hypnotizability and imagery abilities (e.g., Arnold, 1946; Bowers, 1978, 1979; Diamond & Taft, 1975; Hilgard, 1979, 1981; McBain, 1954; Nadon et al., 1987; Palmer & Field, 1968; Sheehan, 1979, 1982; Shor, Orne, & O'Connell, 1966; Spanos, Valois, Ham, & Ham, 1973; Sutcliffe, Perry & Sheehan, 1970; Wagman & Stewart, 1974; see review by Kirsch & Council, 1992). Although most studies found a positive relationship between hypnotizability and imagery abilities, others do not find so unambiguous or linear a relation (Coe, St-Jean, & Burger, 1980; Morgan & Lam, 1969; Palmer & Field, 1968; Perry, 1973; Spanos et al., 1973; Tart, 1966). These latter studies reported poor imaging ability to be associated with low hypnotizability, while good imagery did not seem to be limited to high hypnotizability (Perry, 1973; Sutcliffe et al., 1970). There seemed to exist gender differences in this relation as well. Sutcliffe et al., (1970) found the effect for men only, while Hilgard (1979) found that the relationship held only for females. General discussions and summaries on this issue can be found in Fromm and Shor (1979), de Groh (1989), Kihlstrom (1985), Sheehan (1979), as well as in Spanos and Flynn (1989).

Again, correlations obtained between imagery capacity alone and hypnotizability are low to moderate, and this is why some researchers have used imagery capacity measures in conjunction with absorption assessment as predictors of hypnotic susceptibility. A recent study by Nadon et al., (1987) found that considering subjects' preference for an imaginative cognitive style, as measured by the Preference for Imagic Cognitive Style questionnaire (PICS) (Isaacs, 1982), enhanced the prediction of hypnotizability above the contribution made by absorption as measured by the TAS (Tellegen & Atkinson, 1974). Therefore, measuring imagery capacity in conjunction with absorption seems to be important in the prediction of hypnotizability scores. However, as there probably exists conceptual overlap between absorption and imagination constructs (Lynn & Sivec, 1992; Nadon, 1983), constructs less conceptually related at face value have been explored in the hope that these may provide unique contribution toward explaining variance in hypnotizability.

Using the Belief in the Supernatural subscale of the Taft (1969) Experience Questionnaire, Nadon et al. (1987) found that belief in the supernatural contributed significantly to the prediction of hypnotizability and significantly increased the correct classification of subjects according to their hypnotizability after absorption scores on the TAS and imagery preference scores on the PICS had been considered. This is in accord with Wilson and Barber (1983) findings which indicate that, contrary to medium and low hypnotizable subjects, highly susceptibles believed or felt they had experienced phenomena such as spiritual apparitions, telepathy, and precognitions. How much these beliefs derive from unusual expression of imaginative capacities is not known at this point, but in Wilson and Barber (1983) 85% of highly hypnotizable subjects confused, at times, reality with fantasy or their memories of them, 85% reported out-of-body experiences, and 75% claimed encounters with spiritual entities. Indeed, individual differences in enjoyment of fantasy and belief in magic were detected in children at 4 years old, and differences in these dimensions related to hypnotizability levels in children 6 years old (Allen, 1985, in Nadon et al., 1987; Fanurik, LeBaron, & Zelter, 1985, in Nadon et al., 1987).

In order to further the investigation of this issue, Nadon and Kihlstrom (1987) developed the Paranormal Experiences Questionnaire (PEQ). This self-report measure assessing whether or not subjects have experienced reincarnation flashbacks, telepathy, and communication with spirits has been demonstrated by these authors to correlate with hypnotizability, a finding confirmed by Dixon, et al. (1990).

In turn, some researchers of the social-psychological approach have used measures of attitude towards hypnosis in their attempt to explain hypnotizability differences. The Carleton Attitude Scale has been developed in an attempt to explore the value that subjects place on hypnotic responding (Spanos et al., 1987). Motivation to respond to hypnosis and positive attitudes about it have been considered to be influential determinants of responsiveness to hypnotic suggestions by many investigators (e.g., Sheehan & Perry, 1976; Spanos & Barber, 1974). Numerous studies reported significant correlations between measures of attitudes toward hypnosis and hypnotic susceptibility (Barber & Caverly, 1966; Derman & London, 1965; Diamond, Gregory, Lenney, Steadman, & Talone, 1974; London, Cooper, & Johnson, 1962; Lynn, & Rhue, 1991; Spanos & McPeake, 1975a; Spanos, Radke, Hodgins, Bertrand, Stam, & Moretti, 1983; Spanos, Rivers, & Gottlieb, 1978; Yanchar & Johnson, 1981). Data usually reveal that subjects with very low attitude scores end up with low hypnotizability scores, while subjects with higher attitude scores are found spread over the whole range of the hypnotizability score distribution. Other studies have failed to find such consistency. For instance, Spanos, McPeake & Churchill (1976) failed to find a correlation between attitude and hypnotic responsiveness for one of the two attitude scales they employed, even though the correlation stood for the other attitude scale. Both teams of Melei and E. R. Hilgard (1964) and Rosenhan and Tomkins (1964) failed to find the same correlation in males, although they found it for females.

As a whole, the bulk of evidence seems to indicate that attitude towards hypnosis is a factor worth considering in trying to explain differences in hypnotizability scores or when relating hypnotizability with another variable. Furthermore, linear combinations of attitudes with absorption seem to increase the prediction of variance in hypnotic susceptibility over what can be predicted by absorption alone (Spanos & McPeake, 1975a; Spanos et al., 1983; Yanchar & Johnson, 1981). Moreover, attitudes of subjects toward hypnosis seem important to consider, especially when they are negative. One study found that the inculcation of negative attitudes disrupted the usual association between absorption and hypnotic susceptibility (Spanos & McPeake, 1975b).

Automaticity and Performance on Stroop Tasks

Instead of deriving measures from self-report questionnaires, another line of inquiry in the question of correlates of hypnotizability, has already focused on perceptual processing and on automatic information processing. For example, in a number of studies investigating imagery-related cognitive processing in high and low hypnotizable subjects, highs in hypnosis performed better than in a waking condition, and better than lows in and out of hypnosis, on speed of visual information processing (Friedman, Taub, Sturr, Church, & Monty, 1986), on perception of stereograms (Crawford, Wallace, Nomura, & Slater, 1986), on visual signal detection (Atkinson, 1991), and on visual memory discrimination (Crawford & Allen, 1983).

P. Bowers (1978, 1979, 1982, 1982-1983) and K. S. Bowers (P. G. Bowers & K. S. Bowers, 1979) introduced a new perspective on findings of hypnotizability correlates by showing that adding the measure of "effortless experiencing" of involvements, images, or creative ideas increases their correlations with hypnotizability in comparison to the assessment of absorption, vividness of imagery, or creativity alone. P. Bowers' composite effortless-experiencing measure was moderately related to high hypnotizability level ($r = .48-.62$).

In the same vein, in order to assess automaticity, or cognitive effort, for use of imagery in relation to hypnotizability, Hughes (1988, cited in Woody, Bowers & Oakman, 1992) examined the impact of neutral and fear imagery on heart rate fluctuations. It was found that, for high hypnotizables, the lower the ratings of cognitive effort required to produce fear imagery, the more heart rate increased. The reverse relation for low hypnotizables was found - the higher the cognitive effort ratings, the less heart rate increased. Further analyses suggested that for highs, heart rate increase was not related to cognitive effort, but to the imagery's emotional impact. This seems to indicate that low hypnotizables work cognitively to respond to an imagery suggestion, while highs become effortlessly absorbed in it.

This notion of effortlessness or automaticity in processing in relation to hypnotizability has been approached differently by Miller and Bowers (1986) who demonstrated that highs, while responding to an hypnotic analgesia suggestion, could at the same time use their cognitive resources in order to solve a complex semantic task. The same task could not be solved by lows or subjects using a strategic technique for pain control.

Since taken together these studies seem to indicate that "automaticity" or effortlessness is somehow related to hypnotic capacity, some researchers have attempted to use Stroop color-naming tasks in order to investigate how differences in automaticity of information processing relate to hypnotizability. In the classic Stroop phenomenon, names of colors (BLUE or RED) or control stimuli (e.g., a series of X's) are presented in different colors (Stroop, 1935). Subjects' task is to ignore the written message and simply name the physical col‹ r of the word as fast as possible. When the word corresponds to the color presented (congruent presentation), reaction time is faster than when the color is presented with a neutral stimulus (control presentation); and when color and word do not correspond (incongruent presentation), reaction times are the longest. Stroop effects refer to these "facilitation" and "interference" effects respectively.

The Stroop phenomenon has been found to be resistant to change even after extensive practice, and has been demonstrated in a large variety of modifications of the task (for reviews, see Dyer, 1973; Jensen & Rohwer, 1966). Stroop effects have been considered to be impossible to fake (Blum & Graef, 1971), and this may explain the great popularity that the family of Stroop tasks has had in contemporary research. Indeed, MacLeod (1991) mentions that more than 700 studies have investigated variations of the Stroop task since the reviews by Dyer (1973) and by Jensen and Rohwer (1966). It is the very persistence of the phenomenon that has led some investigators to maintain that interference on incongruent presentations cannot be avoided because it is a consequence of automatic word reading (e.g., Posner & Snyder, 1975). Others simply argue that interference is generated because words are read faster than colors can be named (e.g., Morton & Chambers, 1973), since people possess more extensive experience in reading. Dunbar and MacLeod (1984) reviewed these positions, and suggested that neither were sufficient. MacLeod and Dunbar (1988) investigated the impact of learning new associations between shapes and colors on the Stroop performance. They suggested on the basis of their training data, that interference is dependent on the degree of automaticity of processing attained for each dimension.

Therefore, in regular conditions of administration, one can consider that reading a message is done faster and more automatically than the color naming decision which appears to be relatively more controlled. Physical color identification "facilitates" the word color naming in congruent presentations, and generate "interference" in incongruent presentations as it takes time to be cancelled before the word color can be named. When one says that word-reading is more automatic than color-naming, based on the view of automaticity as a continuum, it means that it requires less attention, and is happening with less intent or awareness. In contrast, color identification is considered to be relatively more controlled, more intentional. In support of the fact that performance on the Stroop can be taken as a measure of automaticity is the additional observation that despite instructions to the contrary, subjects find it very difficult to ignore the word when naming the ink, even if the word is upside-down and backward (Dunbar & MacLeod, 1984).

In using this paradigm of automaticity on Stroop tasks (Stroop, 1935) to investigate correlates of hypnotizability, it has been found that high hypnotizables exhibit more interference than low hypnotizables (Blatt, Dixon, & Laurence, 1990; Blum & Graef, 1971; Dixon, 1990; Dixon, Brunet, & Laurence, 1990; Dixon & Laurence, 1992b; Sheehan, Donovan, & MacLeod, 1988), and commit more errors (Blatt, 1991; Nadon, 1983). For example, Blum and Graeff (1971) compared six highs to two low simulators across five levels of post-hypnotically manipulated arousal on their Stroop performance. Highs demonstrated an increase in interference as a function of reduction in arousal from "very aroused to stuporous" while interference results of the lows varied according to a U-shaped curve. Moreover, highs showed a greater amount of interference than lows in all five arousal conditions. But, since only two lows were used in this study, these findings are not on firm statistical ground and should therefore be considered as only tentative.

Sheehan et al. (1988) using more subjects (26 Ss) investigated the Stroop effect in both high and low susceptible subjects. Subjects served as their own controls since they were tested under both waking and hypnotic conditions (hypnosis alone and hypnosis plus strategy). The strategy designed to help reduce Stroop interference instructed subjects to narrow the field of vision onto the last letter of the word. "Waking" and "hypnosis alone" conditions were administered in counterbalanced order in the first testing session, while the "hypnosis plus strategy" condition was implemented in the second session. Stimuli were presented one at a time on a computer screen and administered in blocks of two, three, or four color-naming interference trials. These experimental blocks were separated by buffer blocks of word-reading interference trials. Using the median reaction time for color naming in interference trials as their dependent variable, they found no effect of susceptibility. They also obtained a significant two-way interaction between hypnotizability and condition. Hypnosis alone compared to waking condition worsened Stroop performance, although the increase in reaction time was significant only for high susceptible subjects. Highs in hypnosis were the slowest performers of any condition. The authors concluded that their results are difficult to reconcile with the compliance account of hypnosis made by the social-psychological camp, especially in the view of the absence of post-experimentally reported strategies in high-susceptibles under hypnosis.

Dixon (1990, experiment 1) tried to extend this finding outside of hypnosis and in a context considered separate from hypnotizability assessment by comparing performance of seven high and seven low hypnotizable subjects in two different motivational conditions. In one condition subjects performed the task without any feedback regarding their performance. In a second condition, subjects periodically received such feedback and were instructed to try to beat their own reaction time in the next set of trials. Results showed that reaction times for all subjects on congruent, control and incongruent trials decreased in the feedback condition compared to the no feedback condition. This seems to indicate that motivational effects are the same for all subjects and for all types of trials. This again is hard to reconcile with a social-psychological view of hypnotizability which would predict that high hypnotizable subjects would be more motivated to respond to the demands of the testing situation. If such were the case, then highs should perform faster than lows on all types of trials, especially in the feedback condition. Moreover, the finding that high hypnotizables were significantly *slower* in the incongruent trials than subjects of lower hypnotic capacity further weakens a social-psychological interpretation. In line with the automaticity hypothesis, Dixon concluded that the increased interference in color naming for highs compared to lows was due to their greater automaticity of processing of the written word in incongruent presentations. This methodologically sound study therefore supports an automaticity of processing view of hypnotizability differences, while simultaneously invalidating the social-psychological view.

Further, Dixon et al. (1990; see also Dixon, 1990, Experiment 3) used a modification of the Stroop task based on Cheeseman and Merikle's (1986) paradigm, which varied cue visibility and probability, in order to test for strategy effects as well as automaticity effects. They first manipulated cue probability by implementing two conditions. In one condition the word and the physical color were congruent in one out of four trials, that is, the word predicted the color 25% of the time. In the other condition, the word and the color were congruent in three out of four trials, that is, the word predicted the color 75% of the time. In the first case, the best strategy to optimize performance was to ignore the word and concentrate on naming the color. Theoretically, it is assumed that in the first condition, the word is still processed in spite of the strategy to ignore it, and causes facilitation in congruent trials and interference on incongruent trials. In the second condition (75% congruent-trial probability), what works best for optimal performance is to pay attention to the word as a support for color naming. In this case, it is assumed that congruent trials are further facilitated by the strategy and incongruent trials are further slowed by the strategy in comparison to the same trials in the 25% congruent-trial probability.

In order to separate conscious from unconscious information processing, cue visibility was manipulated with a backward-masking procedure. By controlling duration of time between the offset of a prime word and the onset of a mask (inter-stimulus interval) (ISI), a cue word is rendered more or less visible. The shorter this interval, the less visible is the cue word as a result of the interference on perception produced by the mask. The authors implemented two conditions of cue visibility. In one condition the prime words were easily identifiable. In the other condition the cue words were presented below the subjective threshold of awareness for each subject (i.e., below the threshold at which the particular subject being tested could not confidently identify the cue word). For this last condition, it is assumed that, if subjects are unconscious of the prime word, they cannot use it for their strategy implementation toward the prediction of the upcoming color. Therefore, in this condition of degraded cue visibility, with strategic effects eliminated, facilitation and interference on congruent and incongruent presentations should solely depend on the automatic processing of the prime word.

Using this modified procedure, Dixon et al. (1990) compared nine high, nine medium, and nine low hypnotizable subjects. Their data indicated that high hypnotizable subjects exhibit more interference in incongruent presentations for both visible *and* degraded word trials, therefore supporting the hypothesis that, in a context removed from hypnosis, high hypnotizables process information with significantly greater automaticity, that is in an effortless, fast and involuntary manner (Posner & Snyder, 1975; Shiffrin & Schneider, 1977) than do low and medium hypnotizables. This again was interpreted to support the previous indication that highs have stronger verbal connection strengths than lows, and as the authors add, may explain the feeling of "involuntariness" they report in hypnosis. However, this greater automaticity in highs seemed independent of strategic processing since highs did not differ from mediums and lows in implementing the suggested strategy, indicating that they do not make better use of performance optimization strategies than their counterparts.

Dixon and Laurence (1992b) sought to replicate the finding that highly hypnotizable subjects process the color words more automatically than lows do. They further attempted to separate more effectively automatic and strategic processes in a follow-up study. They used only two words (red and blue) and their corresponding colors for trial presentations. This permitted the assessment of strategic processing by allowing the introduction of a condition in which the cue word predicted the opposite color three times out of four (a 75% incongruent-trial probability condition). On the other hand, automatic processing was investigated by using backward masking and varying the inter-stimuli interval (ISI) according to seven different levels. In such a design, when the ISI is long enough for subjects to implement the strategy of predicting the color from the opposite word, reaction time on incongruent trials should be shortened. The strategy implementation permitted by a long ISI interferes, however, on one out of four congruent trials, and should slow down color naming. Thus, long ISIs and 75% incongruent-trial probability conditions should generate reverse Stroop effects, with shorter reaction times on incongruent trials and longer ones on congruent trials. In short ISI conditions, the standard Stroop effects should be observed since subjects do not have time to implement a strategy and thus regular automatic processing of the word should occur. This design therefore puts the effects of strategic against the effects of automatic processing and permits a more adequate distinction between them. This design represented an improvement over the Dixon et al.'s (1990) study in which strategic and automatic effects were additive.

This new design first demonstrated that highs performed significantly differently between congruent and incongruent trials at short ISIs (16.7 ms and 200 ms) while lows did not. For trials with long ISIs (400 ms or longer), both highs and lows showed the reverse Stroop effects by being significantly faster on incongruent than on congruent trials. These findings were interpreted to confirm the automaticity hypothesis and to fail to support the social-psychological view.

In contrast with the previous study, Dixon and Laurence's (1992b) data revealed that highly susceptible subjects *can* implement a strategy more rapidly than low hypnotizable subjects in order to improve their reaction time performance in the Stroop task. In effect, they found that highs showed the reverse Stroop effect and were therefore able to implement strategic processing at a 200 ms ISI, while lows achieved significant reversal only at longer delays. However, since these last findings could be accounted for by both the social-psychological position and the automaticity hypothesis, they do not in themselves resolve the theoretical debate.

In turn, Blatt (1991) investigated the possibility that highs and lows acquire automaticity of processing differently. Using MacLeod and Dunbar's (1988) paradigm of training subjects to associate a specific color to a specific picture shape, she presented subjects with four polygons of different shapes and taught them to attach a specific color to each shape. Subjects had 2304 practice trials for naming the color associated with each shape. White shapes were presented in random order. Testing involved the presentation of shapes in the associated color (congruent trials), or in a different color from the learned name (incongruent trials), or in white (control trials). Subjects' tasks varied from ignoring the physical color and naming the shape to ignoring the shape and naming the physical color. In all, training and testing covered five sessions spread over five days.

Blatt (1991) found that highs seem to automatize shape naming faster than lows. In fact, on day 1 of testing highs already showed interference and facilitation in naming colors on shapes. Lows showed these effects only on the last block of trials on the fifth day of testing. Similarly, when the task was reversed, by day 4 of testing, compared to lows, highs displayed more interference in naming shapes presented in a color incongruent from the one that had been associated to it in the learning phase, but demonstrated a greater reduction in interference than lows by day 5.

In terms of errors made, the previously mentioned studies report low error rates for all conditions (Blatt, 1991; Sheehan et al., 1988), which are sometimes less than 1% (Dixon et al, 1990; Dixon & Laurence, 1992b). This could be taken to indicate that the patterns of results obtained are not attributable to a speed accuracy trade off.

These indications of a greater automaticity of processing for highs were not maintained in a different context of testing, however. Recently, Labelle (1994) suggested that when subjects (N = 36 Ss) were tested "in-context" (of where they were tested for hypnotizability), performance results may have differed from what had been found "out-of-context" in a separate study the same laboratory on the same task by Dixon (1990, Experiment 1) *because* of a psychological context effect. Dixon had observed a significant two-way interaction between hypnotizability and performance in color naming on the Stroop task. This was attributable to the fact that highs performed significantly slower than lows on incongruent trials. Reaction times for highs and lows did not differ on congruent and control trials. In contrast, Labelle found that highs exhibited more facilitation than lows; highs also had a tendency to show less interference than lows. Moreover, lows in Labelle's study were consistently slower than in Dixon's study and were also slower than her highs on all types of trials. Labelle, suggests that discrepancies between her and Dixon's results may have been due to the fact that their respective subjects were tested on the Stroop in different contexts for hypnotizability. Labelle's subjects were tested on the Stroop in a context related to hypnotizability; the consent form they signed clearly mentioned that they were to participate in two testing sessions, the first involving hypnosis and memory and the second pertaining to information processing. In comparison, Dixon's subjects can be considered to have been tested on the Stroop out of the hypnosis context; his study was presented as a perceptual study on reading processes and subjects had been assessed for their hypnotizability by other experimenters.

In support of Labelle's (1994) contention that the testing of her subjects in-context for hypnotizability may have lead her lows to respond more slowly and thus to produce a pattern of results different from Dixon's (1990) are three sets of findings. First, her lows had significantly more negative attitudes towards hypnosis than her highs. Second, when attitude was covaried out of analyses relating the number of errors made on incongruent trials to hypnotizability, the residual mean number of errors for her lows was reduced by half, while it remained basically unchanged for her highs. Third, when temporal effects were considered, her lows responded significantly less rapidly on congruent than on control trials in the first block of trials. This last finding is inconsistent with what has been regularly found in the Stroop literature and was reversed in the last block of trials. It may also explain the finding that her highs exhibited more facilitation than her lows. Therefore, Labelle's failure to demonstrate a greater automaticity of processing for her highs compared to her lows would depend on her lows' distorted performance induced by "in context" testing (i.e., with an awareness of a possible relation between hypnotizability and performance on the Stroop task being investigated).

Similar to Labelle (1994), indications of a greater automaticity of processing for high hypnotizables was not maintained in a study testing a different perceptual modality. In a Stroop analog study using auditorily presented stimuli, Oakman and Woody (1992) presented subjects with the words "loud" or "soft" over a speaker in volume either congruent or incongruent with their meaning at a 50% congruent-trial probability. Subjects' task was to ignore the spoken words and to indicate by key pressing if words were presented in either soft or loud volume. They found a tendency, only approaching statistical significance, for lows to respond faster than highs in both congruent and incongruent trials. This finding is counterintuitive to the social-psychological position since demand characteristics called for speeded reactions which should have been demonstrated by highs. Moreover, highs in this study did not show significantly greater interference than lows on incongruent presentations.

Thus, the debate is ongoing. It would be interesting to test performance on the same Stroop task under more rigorous conditions of independence from the hypnotic context in order to look at how this measure of verbal automaticity, in conjunction with hypnotic capacity, might help us explain some of the alleged automaticity in unaware implicit remembering.

Hypnotizability and Implicit Memory

Memory in relation to hypnotizability has already been explored in a few studies on recall and on memory creation (see Labelle, 1994 for a review on memory creation). For example, a study by Sheehan and Statham (1989), using a modified version of the SHSS:C, indicated that more of the high-susceptible than low-susceptible subjects responded incorrectly and with more confidence when exposed to misleading information in hypnosis. As well, more of the high-susceptible subjects responded correctly when given nonmisleading information. One possible hypothesis for explaining effects among high-susceptible subjects maintained by Sheehan and Statham relates to differences in styles of information processing. They suggested that perhaps susceptible subjects attend globally to events while paying relatively less attention to exact details such as individual words.

Similar findings were obtained by Labelle, Laurence, Nadon, and Perry (1990) when after suggesting a false memory to subjects in hypnosis they found that high and moderately high but not low hypnotizable subjects incorporated the suggested pseudomemory. Moreover, memory creation could be better predicted when imagery and the interaction between imagery and hypnotic susceptibility were taken in consideration aside from susceptibility alone. Spanos, Gwynn, Comer, Baltruweit, and de Groh (1989) found that across hypnosis and nonhypnosis conditions, high hypnotizable subjects misattributed characteristics of a suspect to the offender more often than did low hypnotizable subjects during interrogation. Other studies confirmed this observation that more high than low hypnotizable subjects in both hypnosis and waking conditions accept the suggestion for a false memory (Kenney, 1989; McConkey, Labelle, Bibb, & Bryant, 1990; Labelle, 1994; Sheehan, Garnett, & Robertson, 1993; Sheehan, Statham, & Jamieson, 1991a,b; Sheehan, Statham, Jamieson, & Ferguson, 1991; Barnier & McConkey, 1992). The same finding emerged in a study by Kenney (1989) using only the group administered hypnotizability scale of HGSH:A and memory suggestion outside of hypnosis. However, in Barnier and McConkey's (1992) study, when the context of testing was shifted from a formal one to an informal one and the link between the suggestion and the pseudomemory test was therefore dissociated, subjects' pseudomemory reports decreased. In summary, although the above data suggest that some social-psychological factors have been at work in pseudomemory suggestion and reporting, hypnotizability of subjects remains an important consideration in whether a suggested memory item is reported or not.

There are further indications that hypnotizability and memory are related. Kearns and Zamansky (1984) observed a trend for hypnotizability and recall to be positively related in a hypnotic condition but not in a nonhypnotic condition, when an imagery-mediated paired-associate learning task was used. However, using the same learning task, 'T Hoen (1978) found that high hypnotizable subjects recall more high imagery paired associates than low hypnotizables in an alert-awake condition. For their part, Sweeney, Lynn, and Belleza (1986) failed to replicate this finding of an association between hypnotizability and imagery-mediated recall. However, Sweeney et al. required subjects to respond in a longer time interval (20 seconds) than required of subjects in 'T Hoen's study (5 seconds), and used the HGSHS:A instead of the SHSS:C used by 'T Hoen, which may tap different levels of hypnotic abilities. Moreover, Sweeney et al. advertised their study as an experiment on imagery and did not assess subjects' hypnotizability until after the imagery-mediated task. Prior studies tested subjects in a context in which subjects were aware of their hypnotizability scores. Interestingly, Sweeney et al. (1986) found a significant correlation between recall performance (explicit memory) and Tellegen Absorption Scale scores.

Direct priming effects (implicit memory) in relation with hypnotic responding has not been extensively investigated yet. This relation has been documented for highly hypnotizable subjects only. In fact, Kihlstrom (1980) found that highly susceptible subjects with a profound posthypnotic amnesia for a word list memorized during hypnosis nevertheless showed priming effects in generating free associations and category instances. This leaves us with an open question regarding the full spectrum of the relation between implicit memory performance and hypnotic responding capacity.

The present study

To the best of our knowledge, the domain of implicit memory has not been investigated outside of hypnosis in relationship with hypnotizability or to automaticity on a verbal perception task like the Stroop test. Such a study could advance our theoretical understanding of both hypnotizability and implicit memory phenomena.

Regarding the implicit memory assessment itself, a replication of Bowers and Schacter's (1990) experiment will be attempted in the initial step, with four slight modifications. First, the study informed condition (intentional learning) will be omitted since, in Bowers and Schacter's as well as in Greene's (1986) studies (also using three letters as cues or stems), no differential influence between study informed versus from study uninformed conditions (incidental learning) was found on subjects' performance on the implicit tests. Second, subjects will be tested in groups instead of individually. The third modification which follows from the second, will involve the presentation of study words and the "test awareness" questionnaire on slides, with subjects writing down their answers. The fourth modification will be the addition of a second post-experimental inquiry questionnaire which will aim at evaluating in more detail subjects' awareness during their completion of the stems in the implicit testing. In addition, this inquiry will probe subjects' inner experience and beliefs regarding the aims of the experiment as it evolved at different moments in the study.

As in Bowers and Schacter's (1990) experiment, the two tasks of pleasantness ratings and T-junction counting will be used as structural and semantic processing respectively, because they showed the most comparable performance on the indirect measure of stem completion task in the first experiment of Graf and Mandler (1984). The two tasks, stem completion and cued recall, will serve as tests of implicit and explicit memory respectively. Because these tests use the same three letter stems, effects of instructions (implicit/explicit) on completion rates will thus be investigated almost in isolation.

Consistent with earlier findings (Graf & Mandler, 1984; Bowers & Schacter, 1990; Graf & al., 1982; Warrington & Weiskrantz, 1970, 1974), we expect that elaboration in semantic processing tasks would increase cued-recall performance above recall performance after structural processing. However, for unaware subjects, we expect to obtain priming effects on the stem completion test to be similar for semantic and nonsemantic processing tasks. In contrast to Bowers and Schacter's results, we expect that more subjects will be classified as unaware because the test awareness questionnaire and the post-experimental inquiry questionnaire will be administered in all conditions. That is we intend to include test informed subjects, because they might remain unaware during the stem-completion test in spite of the pre-test information received.

The relation between implicit memory performance and hypnotizability will be explored in a second step. If performance on a word completion test reflects primarily the increased accessibility of a word as a consequence of an automatic activation process, it seems reasonable to expect that high hypnotizable subjects, who have been shown more automaticity on the Stroop task and more effortlessness in responding to hypnotic suggestions, will perform better than low hypnotizable subjects on an implicit task. This relation is expected especially for test-unaware subjects because logically only they are assumed to perform the stem-completion task implicitly, or automatically, without adopting conscious or intentional retrieval strategies (Bowers & Schacter, 1990; Schacter et al., 1989). However, cued recall performance, being based on retrievability of past event experiences through intermediate conscious efforts, and being somewhat independent of automatic activation, should therefore not be related to subjects' hypnotizability.

Friedman, Taub, Sturr, & Monty (1987) proposed that a relationship between hypnotizability and cognitive tasks may not be found in complex processes, but may be observed in more basic ones. High hypnotic susceptibility may be linked to superior performance in the earliest stage of visual information processing (Friedman et al., 1987), especially when the information is literal or untransformed (Crawford, et al., 1986). If this is the case, we would expect hypnotizability to be positively related to performance on structural processing of words in implicit responding, but not with semantic processing.

If we model a synergistic view, we can investigate to what extent hypnotizability, certain cognitive capacities, and personal/social attitudes towards hypnosis, (as well as their interactions) can explain individual differences in implicit memory performance.

Correlations (univariate or multivariate) between any cognitive capacity assessed solely by self-report questionnaires and hypnotizability have been dismissed by proponents of the social-psychological camp as resulting from what Council et al., (1986) have termed the context effect. In order to offset the same critique with regard to implicit memory performance, subjects could be tested on the less subjective (more objective) measure of Stroop performance. Such a measure taken outside of the hypnotic context and examined in a multivariate approach would further support the view of automatic responding in unaware implicit memory performance, and might secondarily increase our understanding of the hypnotic phenomenon itself. It therefore seems appropriate to include a Stroop task in the present study.

Moreover, changing Stroop task instructions from demands for accuracy to an emphasis on speed, has been demonstrated to decrease mean reaction time in congruent presentations, as well as to increase number of errors made, while leaving interference effects basically unchanged (Chen & Johnson, 1991; Peretti, 1971). These strategy instructions will be used and compared in the present study. In addition, if, as social-psychological theorists posit, highs are only compliant or self-deluding and would try to respond faster on this task, a self-competition speeded condition would help in bringing lows' speed of responding on control presentations to the same baseline speed as highs.

As in most modern Stroop studies (MacLeod, 1991) the present study will measure individual reaction times using computer devices and average them over type of presentation (congruent, incongruent, and neutral). Neutral, congruent, and incongruent stimuli will be mixed and presented in similar probabilities instead of being presented in blocks. Such a design prevents subjects from reducing the task to different strategies such as transforming the congruency condition into a condition where they develop the strategy of simply reading the word (see MacLeod, 1991, for a review of the influence of probability of various trials). For the same reason of preventing subjects strategy effects, five different stimuli will be used instead of a smaller number such as only two.

If implicit memory performance is the reflection of some automatic activation process, the same pattern of results is expected between implicit memory and performance on the Stroop tasks as what has been found between hypnotizability and performance on the Stroop tasks. That is, as Stroop effects increase, so will (unaware) implicit memory performance. Greater interference from word reading on color naming on incongruent trials in the Stroop task should therefore be obtained with higher implicit memory performance. With reference to a possible facilitation effect on color naming in congruent trials, this effect might not be so evident since facilitation has been observed with less frequency than interference in the Stroop research literature (MacLeod, 1991) and has not been obtained by Dixon (1990).

Finally, as most studies have used only one measure of hypnotizability, three measures [two group administration scales (HGSHS:A and CURSS) and one individually administered (SHSS:C)] will be used in conjunction to provide a more accurate evaluation of this capacity. Although hypnotic responsiveness appears to be relatively stable, there are a few subjects whose level of responsiveness changes from an initial assessment to a subsequent one (Gwynn, Spanos, Gabora, & Jarrett, 1988; Register & Kihlstrom, 1986; Shor et al., 1966). To cite Perry, et al. (1992):

> Given the data on plateau susceptibility, which suggest that many individuals do not reach their optimal degree of hypnotizability in one session, it would appear that an investigator who takes at least two measures of hypnotic ability is likely to be on firmer ground in terms of the reproducibility of findings by other, independent investigators. (p. 486).

It has therefore been argued that initial testing on HGSH:A for example should be supplemented by subsequent individual testing. The HGSHS:A and SHSS:C correlate at only .59 (Bentler & Roberts, 1963; Coe, 1964; Evans & Schmeidler, 1966; Green, Lynn, & Carlson, 1992; Register & Kihlstrom, 1986), while Spanos, Radke, Hodgins, Bertrand, Stam, and Moretti (1983) have reported correlations of .62 and .60 respectively for CURSS:O with HGSHS:A and CURSS:O with SHSS:C (see Perry et al., 1992 for criticisms of these results). The taped suggestions and self-rating format of HGSHS:A represents a reassuringly reliable (r = .82) instrument for an initial exposure to hypnosis for naive subjects, but HGSHS:A scores may be affected by the group administration which could foster response bias, social comparison, conformity, etce tera (Sheehan & McConkey, 1982). Moreover, as it comprises empirically more difficult items than the HGSHS:A, the SHSS:C is thought to assess higher ranges in the hypnotizability "continuum". Finally, the CURSS scale is the main instrument used by proponents of the social-psychological view. Thus, the use of all three of these scales will better assess subjects' hypnotizability.

Method.

Subjects

Eighty-eight subjects participated in the memory study (63 females and 25 males). They ranged in age between 18 and 47 years, with a mean age of 23.4 years (SD = 5.9). An additional 68 subjects completed stem completion lists without having received any previous priming or presentation of the tested words. Their responses served to establish baseline completion values for target words on the implicit memory task. Experimental and baseline subjects were recruited through oral recruitment in undergraduate psychology classes. Requests were made for volunteers who had completed at least their high school education in English. Baseline subjects filled out the stem completion sheet while in class. In other classes, experimental subjects signed up for participation in a study involving face and word perception (see **Appendix A** for recruitment text and **Appendix B** for phonescript of scheduling procedure). All volunteer subjects were undergraduate students at Concordia University. Experimental subjects were tested in small groups ranging in size from 2 to 14 participants according to subjects' availability.

From the original pool of 88 subjects who participated in the memory experiment, 82 (57 females and 25 males, mean age = 23.6 years, SD = 6.0), accepted to come back for a second session involving a Stroop experiment. Sixty-eight subjects (46 females and 22 males, mean age = 24.2 years, SD = 6.4) who had completed the memory and Stroop tasks accepted to come back for an assessment of their hypnotizability on the group administration of the Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A; Shor and Orne, 1962). Of these, 61 subjects (42 females and 19 males, mean age = 23.6 years, SD = 5.9) came back for a second group testing of hypnotizability using the Concordia University Version of the Carleton University Responsiveness to Suggestion Scale (ConCURSS; Perry and Pichette, unpublished scale). Finally, 58 subjects (40 females and 18 males, mean age = 23.8 years, SD = 5.9) agreed to be individually tested on the Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C; Weitzenhoffer and Hilgard, 1962).

A total of 30 subjects did not complete the experiment. Of these, two subjects who were color blind were not invited to come back, since the second testing involved color naming on the Stroop tasks. Two subjects could not be reached by phone or mail. Two subjects refused to come back a second time since they had originally been recruited for an experiment involving one testing session only. The remaining 24 subjects refused to come back for the hypnotizability assessment sessions. Some stated clearly that they were uncomfortable with hypnosis (7 Ss) and some said they were too busy (14 Ss).

Therefore, of the 88 subjects who participated in the memory assessment session, a total of 58 subjects completed the five testing sessions in the study. **Table 1** presents a breakdown of number of subjects who participated in each testing session with mean age of subjects and standard deviation for each session. Subjects signed a consent form at the beginning of each session (see Appendices C to G) and, depending on the session, were paid $6.00 or $7.00 for their participation in each session.

Materials: Questionnaires, Apparatus, and Stimuli

In the first session, subjects were assessed on two memory tests (one implicit and one explicit), on two questionnaires assessing their awareness regarding the implicit testing, and on filler activity questionnaires. Over the four following sessions subjects were tested on two Stroop tasks, on three hypnotizability scales and on four self-report measures.

Materials for the memory session (See **Appendix C** for study material, instructions to subjects, and debriefing; see **Appendix D** for consent form; see **Appendix E** for answering forms). Experimenter's instructions, word lists, stem completion forms, filler tasks and one of the "test awareness" questionnaires were provided by J. S. Bowers from the University of Arizona. Eighteen black and white

Table 1

Experimental sessions in the present study and number of subjects in each session with mean ages and standard deviations.

IMPLICIT MEMORY Session #1	**STROOP** Session #2	**HARVARD** Session #3	**ConCURSS** Session #4	**STANFORD** Session #5
N= 88 Ss	N= 82 Ss	N= 68 Ss	N= 61 Ss	N= 58 Ss
Mean age=23.4	Mean age=23.6	Mean age=24.2	Mean age=23.6	Mean age=23.8
SD=5.9	SD=6.0	SD=6.4	SD=5.9	SD=5.9

portraits presented on slides comprising the "face rating" task were from Ekman and Friesen (1975) (affective and neutral expressions). The projector used was a Kodak Ektagraphic III AMT with timer set at 5 s intervals. Filler tasks included two fragment completion tests, one of famous people, and one of famous cities, as well as a blank sheet on which subjects listed names of countries. A Timex stop watch was used for timing each of the three minute testing periods for these filler tasks.

Incidental study material used for later memory testing consisted of a list of 32 words. Of these 32 words, only the middle 24 were reused for testing memory at a later point. The first 4 and the last 4 words served as primacy and recency buffer words respectively. The 24 study words were the same as those used by Bowers and Schacter (1990) and selected originally from the Kucera and Francis' (1967) norms of frequency. Three constraints were placed on the selection of these study words. First, words had to be between 5 to 10 letters long, and of medium frequency (mean frequency = 93, range from 2 to 650 occurrences per million). Second, their initial three letters had to be unique in the set of 32 words presented to subjects. Third, each of these three letter stems had to have at least 10 completion possibilities. The style of print for words on the slide and on the answering sheet was kept identical.

Implicit memory was later assessed by a stem completion task. It consisted of 75 three-letter stems to be completed by subjects. Embedded among 63 distractor stems, were only 12 stems from the 24 experimental study words.

Contrary to the implicit test, explicit memory was assessed by a cued recall test consisting of all three-letter stems from the 24 previously studied words.

Subjects' awareness or unawareness of using study words to complete stems in implicit memory testing was assessed on a post-test questionnaire replicated from Bowers and Schacter (1990). This questionnaire, comprised of nine questions, included four questions pertaining to the test-awareness assessment itself. Example questions included "Did you notice any relation between the stem completion and the previously studied list?", and "Did you notice if you completed any of the stems with words from the earlier list?" This set of questions provided a basis on which to derive a first "awareness" score. As per Bowers and Schacter, when subjects retrospectively reported that they noticed during the *implicit* test performance that any test item had been previously studied, they were classified "aware" according to the Bowers and Schacter's criterion (BSC-aware). The BSC-unaware classification comprised only subjects who did not notice that any word stems could be completed with study-list items or that there was a relation between study words and possible stem completions. The scoring for this awareness criterion was performed by two independent judges, with an interrater reliability of .95. In cases where there was disagreement, a third rater made the final decision.

Finally, an extensive post-experimental inquiry questionnaire aimed at investigating in more detail the thoughts which subjects might have had at different stages of the experiment, was designed for the purpose of this study. The phase referring to stem completion comprised a series of eight descriptive options of awareness/unawareness experiences (see Appendix I). Subjects selected only one of the eight possible options. A subject's response represented a second criterion for scoring subjects as aware or unaware on the implicit memory task. Subjects choosing the first or the second of the eight options available were classified as unaware according to the post-experimental inquiry criterion (PEIC-unaware). All other subjects were classified as PEIC-aware.

Stroop apparatus (As designed by Dixon, 1990; see **Appendix F** for text of invitation, **Appendix G** for consent form, and **Appendix H** for texts of instructions to subjects and debriefing). Stimuli were displayed on an Electrohome Colour Monitor that was interfaced to an Apple II+ computer through an Electrohome Supercolour board. These stimuli were observed by subjects at the end of a 1 meter viewing tube. Subjects had to press a start button in order to initiate the presentation of stimuli on each trial, and their verbal responses in naming colors were recorded by a voice activated relay interfaced to the computer by a John Bell Board which afforded ± 2 msec accuracy.

A 2 pixel white fixation dot against a black background was presented before the appearance on the screen of all stimuli. The stimuli consisted of the words RED, GREEN, BLUE, YELLOW and XXXXX, written in letters of 0.4 cm (5 pixels) by 0.6 cm (7 pixels) in size. These letters were spatially centered in terms of width and height around the location of the fixation dot. All words were presented an equal number of times in one of four colors: red, blue, yellow or green. The particular hue of each color was selected by two independent judges with the instruction that they were to select the hue that was prototypical of this color. The background luminance during stimuli presentation was within the range of luminance in which there is minimal rod activity in order to prevent differential adaptation confounds between and within blocks.

For each trial, the subject had to press the start button in order to make the fixation dot disappear and to initiate the presentation of a 250 ms blank field followed by the stimulus presentation. Stimulus presentation was resumed when a subject's voice triggered an impulse from the voice activated relay, or when more than 2500 ms had elapsed. Both the fixation dot and stimuli were synchronized by the vertical synchpulse of the monitor in order to insure that all stimuli were painted within a single video frame. Reaction times were measured from the onset of stimulus appearance until the color was named aloud by the subject.

Attitude Towards Hypnosis Questionnaire (Spanos et al., 1987). This 14-item questionnaire was constructed in Spanos and colleagues' laboratory. Each item is rated on a scale from 1 (not at all true) to 7 (very true). Although some items are phrased in the negative regarding views about hypnosis, all items are scored so that high scores reflect positive attitude toward hypnosis. Aside from the total score, three scores are derived from three different subscales which are labelled "positive beliefs about hypnosis" (the first five items), "mental stability" (the next four items), and "fearlessness" of hypnosis (the last five items). The items on the positive beliefs subscale reflect an openness to hypnosis and the prospect of being hypnotized. The mental stability subscale is more related to the view that those who can be hypnotized neither possess a weak mind, nor are they unstable. Finally, the fearlessness subscale assesses the fear that a hypnotic procedure evokes. Internal consistency reliabilities for the total scale and subscales were found to be adequate (Cronbach's alpha values of .81 for the total scale, .72 for positive beliefs, .68 for mental abilities, and .70 for fearlessness) (Spanos et al., 1987).

Tellegen Absorption Scale (TAS; Tellegen, 1981, 1982; Tellegen & Atkinson, 1974). This measure of "Openness to Absorbing and Self Altering Experiences" was designed to assess spontaneous involvement in imaginal and aesthetic stimuli, as well as openness or tendency to alter perception of oneself in daily life experiences. It contains 34 true-false items that are related to appreciation and involvement in everyday events (i.e. nature, music and art), in fantasy or in unusual experiences. For example, some items state: "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"; "Some of my most vivid memories are called up by scents and smells"; "Sometimes I feel a second self floating above my body and looking down on the other as an empty shell". Subjects respond to each item by a true or false statement. Total scores, which are obtained by adding the number of "True" answers, can range from 0 to 34. The TAS inventory was reported by Isaacs (1982) to have an internal consistency alpha coefficient of 0.89.

Individual Differences Questionnaire (IDQ; Paivio, 1971; Paivio & Harshman, 1983). The version of this scale used in the present study contained 21 items which were chosen among the 86 items that were originally developed by Paivio in 1971. The selected items were the ones loading heavily on three of the six factors that were extracted from the 86 item version of this questionnaire by Paivio and Harshman (1983). The three factors, considered of interest for the purpose of evaluating subjects' imaginal involvement abilities and habits, were "Habitual Use of Imagery" (13 items) (e.g., "I often use mental images or pictures to help me remember things"), "Vividness of Dreams, Daydreams and Imagination" (six items) (e.g., "My daydreams are rather indistinct and hazy"), and "Use of Images to Solve Problems" (two items) (e.g., "I often use mental pictures to solve problems"). Moreover, in distinction from the original true-false version of the questionnaire, the present shortened version of the questionnaire incorporates a Likert-scale response format (from 0 to 4). Finally, the present shortened version also possesses the distinctive feature from the original IDQ of including both positively and negatively worded items, in order to control for individual differences in response set of acquiescence.

<u>Paranormal Experiences Questionnaire</u> (PEQ; Nadon & Kihlstrom, 1987; Nadon, Hoyt, Register, & Kihlstrom, 1991). This questionnaire composed of 23 items is designed to assess subjects acquaintance with paranormal experiences as adults and as children. The underlying assumption being that there exists a stable cognitive basis for "anomalous" experiences like telepathy, reincarnation, and communication with spirits (see Nadon & Kihlstrom, 1987). Examples of

questions include: "Have you ever felt that you were in communication with someone who had died?"; "Have you ever felt that you were able to transmit thoughts through telepathy?"; "Have you ever felt that your body was emitting light or energy?". Subjects indicate a "Yes" or a "No" answer to each item, first "as a child" and second "as an adult". The two sets of answers are scored separately by summing "Yes" responses, resulting in two scores, one per subscale.

A Cronbach's alpha of .82 as a reliability index has been reported for the questionnaire by Nadon and Kihlstrom (1987) based on a sample of 1157 adult subjects. It was found to have an internal reliability alpha coefficient of .84 for children (Nadon, personal communication, April, 1989).

Harvard Group Scale of Hypnotic Susceptibility: Form A (HGSHS:A; Shor & Orne, 1962; see **Appendix I** for consent form). This hypnosis scale is designed for testing in a group context. We used a slightly abbreviated form of the scale removing the first suggestion. The procedure of this shortened version involves subjects listening to a tape recorded relaxation induction followed by a series of 11 suggestions presented in order of increasing response difficulty from ideomotoric, to challenging, to cognitive. An example of a suggestion requiring a motor response is when a subject is instructed to hold his/her left arm straight out and respond to the suggestion that his/her hand and arm are becoming heavy, as though a weight were pushing the arm down. An instance of a challenge item is when a subject is instructed to try to oppose a motor response like trying to lift the right hand and arm after being suggested that the arm is perhaps too heavy to lift. Suggestions requiring cognitive responses include imagining a fly in the room, or forgetting posthypnotically everything that has happened in hypnosis until given a cue to cancel the suggested amnesia. After dehypnotization, subjects report on their experience in hypnosis by first writing everything that they can remember happening since they began the hypnotic induction before and after the cancellation of the posthypnotic amnesia suggestion. Subsequently, subjects indicate if "an onlooker" would have observed them responding or not to the suggestion according to suggestion-specific objective criteria. For example, choices for the ideomotor suggestion of the arm getting heavy are: "A. My hand had lowered at least six inches by then; or B. My hand had lowered less than six inches by then" (before the time subjects are told to let their hand down deliberately). Subjects can respond or not to the posthypnotic amnesia suggestion, and pass or not any of the ten other suggestions. Scores range between 0 and 11. Contrary to the original HGSHS:A, the version used in this study does not score out of 12 items because it does not include the first "head falling" suggestion which is presented before the hypnosis per se.

This test has been standardized in Montreal as well as elsewhere (see Laurence & Perry, 1982). The HGSHS:A has adequate test-retest reliability (r > 0.80), and has been validated against other measures of hypnotizability, with coefficients averaging around 0.70 (Bowers, 1981). Comparing data from six normative studies from five different countries, Perry, Nadon, and Button (1992) conclude that the HGSHS:A can be said to consist empirically of items of progressively increasing difficulty, "and that overall the HGSHS:A is relatively unaffected by sociocultural factors."

Concordia University Version of the Carleton University Responsiveness to Suggestion Scale (ConCURSS; Perry & Pichette, unpublished scale; see **Appendix J** for consent form; see **Appendix K** for the Concordia version). The ConCURSS is a modified version of the CURSS (Spanos, Radke, Hodgins, Stam, & Bertrand, 1983; Spanos, Radke, Hodgins, Bertrand, Stam, & Dubreuil, 1983; Spanos, Radke, Hodgins, Bertrand, Stam, & Moretti, 1983). The modification is in the pre-hypnotic and hypnotic induction phases of the session. Spanos and his colleagues (1983) are theoretically invested in the social psychological role demands which drive hypnotic "performance." The experience of hypnosis is therefore presented as a hypnotic "performance" which depends upon a subject's motivation to comply and to respond to demand cues inherent in each suggestion. Subjects are encouraged to do their best to "perform." Perry and Pichette (unpublished) neutralize this pre-hypnotic information by encouraging more open-ended responding, to "let happen whatever happens", similar to instructions used on the HGSHS:A and on the SHSS:C. The ConCURSS is appropriate for group or individual administration, and requires approximately 45 minutes to administer. It is comprised of seven suggestions, and subjects write down their own responses after administration is complete.

Scores on the CURSS are stable over retest periods ranging from 2 weeks to 3 months (Spanos, Radke, Hodgins, Bertrand, Stam, & Dubreuil, 1983), and scores correlate significantly (r = .58 to .65) with scores on the SHSS:C (Weitzenhoffer & Hilgard, 1962) and the HGSHS:A (Shor & Orne, 1962) (see Spanos, Radke, Hodgins, Bertrand, Stam, & Moretti, 1983).

Three CURSS (and ConCURSS) scores are obtained for each subject. The CURSS:O (objective) reflects the number of suggestions to which subjects make the appropriate overt responses. Scores range from 0 (no suggestion passed) to 7 (all suggestions passed). The CURSS:S (subjective) indicates the extent to which subjects subjectively experienced suggestions. Each suggestion is associated with a 4-level subscale: "(a) not at all, (b) to a slight degree,

(c) to a moderate degree, (d) to a high degree". Alternatives from (a) to (d) are given ascending scores from 0 to 3 respectively, and scores on the seven suggestion items are summed, yielding a range of 0-21 for CURSS:S scores. The CURSS:O-I (objective-involuntary) reflects the number of objectively passed suggestions that are also experienced as occurring involuntarily. This dimension is also scored along the preceding 4-level scoring system. To receive a point on the CURSS:O-I scale, subjects must pass a suggestion objectively and answer at least (c) or (d) on the objective-involuntary subscale. CURSS:O-I scores range from 0-7.

Stanford Hypnotic Susceptibility Scale: Form C (SHSS:C; Weitzenhoffer & Hilgard, 1962; see **Appendix L** for consent form). Like the HGSHS:A this 12-item scale with an internal consistency r = .85, samples three categories of hypnotic suggestions with more emphasis, however, on cognitive types of suggestions. Given that these types of items are more difficult to pass, the SHSS:C possesses a higher "ceiling" than the HGSHS:A, giving scores that are less clustered at the upper end of the scale. Similar to HGSHS:A, items on the SHSS:C are presented in ascending order of difficulty as based on empirical observations. Scoring of each item is done by the experimenter according to objective criteria. For instance, a subject is considered to pass the item of "hand lowering" if his/her hand goes down more than six inches when given the suggestion to imagine that a weight, in the form of a heavy baseball or billiard ball, is pressing down his/her elevated arm and hand. This instrument is the most frequently used in research involving hypnosis (Bowers, 1981; Kihlstrom, 1985) due in part to its statistical robustness (Sheehan & McConkey, 1982). In the present study the anosmia item was replaced by a post hypnotic suggestion of standing up to stretch when the experimenter does so after dehypnotization. Furthermore, all references to hypnosis being comparable to sleep have been removed from the initial relaxation induction period.

Procedure

Experimental subjects who completed the entire study attended five sessions.

Implicit and explicit memory tasks. During the first session involving memory testing, subjects who volunteered were tested in the afternoon in small groups varying in size from 2 to 14 individuals. Subjects were seated at every second seat in a classroom and given a pencil and a consent form.

The session started with a face perception task in order to validate subjects expectation that the study was about perception. Subjects received an initial pack of answering sheets and were shown 18 portraits of faces on slides which they were asked to judge individually on one of two dimensions. For each face subjects had to either, a) rate the pleasantness of the face on a scale from 1 to 7 (1 being the least pleasant and 7 being the most pleasant), or b) choose the most distinctive feature of the face, either the mouth or the eyes. Before presenting each portrait, the required rating was called out by the experimenter, who either said the word "feature" or "pleasantness." Subjects were allowed to look at a portrait for 5 seconds which was followed by a blank presentation of 5 seconds allowing them to write down their answer, either a number from 1 to 7 for pleasantness ratings or the letter "E" or "M" for eyes or mouth in feature ratings.

The second task consisted of a word rating procedure. It represented a within-subjects manipulation which varied the "level of encoding" of incidentally "studied" words by asking for either semantic or structural processing of each word. Each subject processed half of the study words semantically, and the remaining half structurally. For semantic encoding, subjects rated the pleasantness of a word on a scale from 1 to 7 (1 being the least pleasant and 7 being the most pleasant). For structural encoding, subjects counted the number of T-junctions in a word. The experimenter explained the notion of T-junctions by showing examples of two different letters on slides prior to the task and made sure the concept of counting the number of different places where two straight lines join in a letter, like in the letter "T" (Graf & Mandler, 1984), was well understood by subjects. Subjects were then shown on slides 32 words in sequence for 5 seconds at a time, and were asked to make one of two judgments for each word. These judgments were called out by the experimenter before presenting each word. The experimenter asked for a "pleasantness" or "T-junction" rating. As a word appeared on the screen, subjects were instructed to pronounce it out loud in order to enhance encoding. Then during the 5 second blank following each word, subjects wrote down their rating for that word. If they ran out of time in the T-junction judgment, they were asked to simply estimate their number. Upon completion, subjects were instructed to leave their answering sheets on the seat beside them.

Incidentally studied words were presented differently to two groups of subjects in order to counterbalance level of processing. The first half of subjects rated half of the words for pleasantness, and the other half of the words for their number of T-junctions. The second half of subjects counted the number of T-junctions in the 12 words that were rated for pleasantness by the first half of subjects, and rated for pleasantness the 12 words that were rated for their number of T-junctions in the first instance.

Following this, the experimenter handed-out a second set of answering sheets on which subjects completed three filler tasks lasting 3 minutes each. Prior to the first task, the experimenter completed on the blackboard an example of the task at hand. Subjects were then presented with 18 letter-fragments representing the names of famous individuals and were instructed to complete as many fragments as possible. In the second task, subjects still had to complete word fragments, but this time of famous cities. The third task required subjects to list for 3 minutes as many countries as possible starting with the first letter of the alphabet and, when feeling they had exhausted the possibilities of that letter, to generate countries beginning with the letter "B" and so on. The purpose of the filler tasks was to induce an appropriate set for stem completion testing. Upon completion of this task subjects were instructed to leave their answering sheets on top of the previous ones.

The next task involved a stem completion test (implicit testing), with the experimenter first giving an example of a stem completion on the blackboard. Subjects were instructed to complete 75 three letter stems with the first word that came to their mind, proper names being excluded. Among these stems, were embedded six of the semantically and six of the structurally encoded words from the earlier word rating task. An implicit memory manipulation involved between-subjects "informed" and "not informed" instructions, as the instructions on this task varied across two groups of subjects. Half of the subjects, who consisted of the informed condition were told that they "might notice that some of the stems could be completed with words from the previously studied list." In spite of this possibility, they were asked to "complete the stems with the first word that comes to mind, whatever that might be" (see **Appendix D** for the specific wording of this manipulation). The remaining half of subjects, comprising the not informed condition, were told nothing of the relation between the list of words studied beforehand and the stem completion task at hand.

Only 12 of the 24 "studied" words were presented as stems, and these were embedded among 63 unrelated stems in the testing list. Two implicit memory testing lists were established, with each containing a set of 12 target word stems that could be completed as study words. Subjects randomly received and completed only one of the two stem-completion lists, and were therefore tested on only half the 24 studied items. The completed stem completion sheet was put aside with the previous response forms.

It follows that for the implicit memory testing, words were completely counterbalanced between and within variables; type of encoding (semantic versus structural) was counterbalanced with testing instructions (informed versus uninformed) and with respect to the two stem completion lists. **Table 2** diagrammatically presents the implicit memory testing manipulations with the distribution of

Table 2

Distribution of number of subjects for each condition in the implicit memory testing.

Instructions at Testing	Stem Completion List	Earlier Encoding	
		Semantic (6 words)	Structural (6 words)
INFORMED N = 47 Ss	List 1 (12 words) N = 23 Ss	N = 11 Ss	
		Structural (6 words)	Semantic (6 words)
		N = 12 Ss	
	List 2 (12 words) N = 24 Ss	Semantic (6 words)	Structural (6 words)
		N = 11 Ss	
		Structural (6 words)	Semantic (6 words)
		N = 13 Ss	
NOT INFORMED N = 41 Ss	List 1 (12 words) N = 21 Ss	Semantic (6 words)	Structural (6 words)
		N = 10 Ss	
		Structural (6 words)	Semantic (6 words)
		N = 11 Ss	
	List 2 (12 words) N = 20 Ss	Semantic (6 words)	Structural (6 words)
		N = 10 Ss	
		Structural (6 words)	Semantic (6 words)
		N = 10 Ss	

subjects according to the different groups generated.

In the fifth step, the experimenter handed-out the third pack of answering sheets for the awareness questionnaire from Bowers and Schacter (1990) (BSC). Each question was displayed on a slide and there was no time limit imposed on subjects for writing down their answers.

After BSC awareness/unawareness testing, subjects were administered a cued recall test (explicit testing). Subjects were told to complete all of the stems they could remember from the previously s udied list of 24 experimental words. Of these 24 target words, 12 had been implicitly tested and the 12 others had not been previously tested since stem completion was presented before the cued recall test. This order was implemented to ensure that implicit testing was never contaminated by the reference made by cued recall to the prior study episode. However, this order raised the possibility that cued recall performance could be facilitated by the preceding stem completion test. To examine this possibility, differences in performance on the cued recall test between the 12 words previously tested on the stem completion test and the 12 untested words will be analyzed. There was no time limit to complete the cued recall task, and when done with it subjects were instructed to leave their answer sheets on the seat next to them.

At this point, a second experimenter replaced the first and asked subjects to complete a post-experimental inquiry questionnaire. The session ended with the second experimenter debriefing subjects and answering their questions regarding the memory session. Subjects were paid $6.00 for their participation in this session which lasted approximately 1 1/2 hours.

Stroop tasks (Stroop, 1935). Subjects participated in a Stroop session which involved randomly presenting either written names of colors (BLUE, RED, YELLOW or GREEN) or control stimuli (a series of Xs). The words and control stimuli were randomly presented in one of four ink colors, blue, red, yellow, or green. Subjects' task was to name the ink *color* as fast as they could. Reaction times for naming color while ignoring the word were measured for later comparisons between three different conditions; "congruent", where the color name and the physical color corresponded (e.g., a RED stimulus printed in red); "incongruent", where the color name and the physical color were not the same (e.g., the RED stimulus printed in blue); or "control", where the series of Xs appeared in a particular color (e.g., the XXXXX's stimulus printed in red).

Subjects were contacted for the Stroop task two months after the initial memory session. Subjects were reached over the phone by a different experimenter in order to invite them to participate in a color and word processing experiment as well as to informally screen them for color blindness. This second testing was presented as a second study unrelated to the previous memory testing performed by a colleague of the first two experimenters. Since no mention of hypnosis was made at this stage, these subjects were considered as tested "out of the hypnotic context" on the Stroop tasks. Each subject was tested individually by an experimenter who was blind to his/her memory scores.

Subjects were directed to a seat in front of the viewing tube and asked to read and sign a consent form summarizing the Stroop task procedure. During testing, subjects were asked to keep their forehead in contact with the headrest at the proximal end of the viewing tube and to keep their vision focused on a dot in the middle of the screen. They were also told this dot meant that a trial was ready to be initiated by pressing the start button. Pressing the start button would make any one of four words appear on the screen, i.e., BLUE, RED, GREEN, YELLOW, or a series of five XXXXX's. Subjects were instructed that their task was to ignore the word or the XXXXX's, and to instead concentrate on naming out loud its physical color (blue, red, green or yellow), doing this as fast as possible while making as few errors as they could. It was also mentioned that a microphone would pick up their voice and that their reaction time to naming the color would be recorded by the attached computer.

Subjects were then shown over four trials the control stimulus, printed successively in one of four different experimental colors in order to verify that they could discriminate and name the colors successfully. After presentation of the four different experimental colors and prior to the presentation of experimental stimuli subjects were reminded to avoid using certain strategies in order to make the task easier, like the blurring of the eyes which would prevent reading the stimulus word, or focusing only on the last letter of the word. Subjects were therefore instructed to focus their vision on the dot prior each trial and to simply concentrate on naming the color of the stimulus out loud, as quickly as possible and with as few errors as possible. Subjects were also warned that color naming errors would be signalled to them by an audible low frequency buzz sound emitted by the computer upon the pressing by the experimenter of an error button (i.e. the letter "E" on the keyboard of the computer). Immediately afterwards, subjects were told that the experiment proper was ready to begin.

During the first half of the session, subjects had to respond to 216 stimulus presentations. The task was divided into six blocks of 36 trials, each block consisting of 12 congruent, 12 control and 12 incongruent word-color combinations randomly presented, with the restriction that no physical color was presented twice in a row. Unbeknown to subjects, only the last 5 blocks were retained for analysis, the first block serving as a practice block. The practice block was used as an opportunity by the experimenter to clear up any execution difficulties, like discouraging uses of combined color/word responses such as "bred", "yeblue", etc. For the remaining blocks of trials, subjects were reminded between blocks to keep focusing on the fixation dot and to name colors as quickly as they could without making any errors if possible. After a set of 36 trials, the computer automatically presented, as many times as necessary to reach success in color naming, each trial for which an error in color naming had been made during subject's responding. This was done for the purpose of maintaining block size at 36 trials completed without error. Likewise, trials with reaction times over 2,000 msec or under 150 msec were regarded as errors (e,g, subjects not speaking loud enough, peripheral noises from outside the testing room prematurely stimulating the voice activated relay, etc.), and were thus also automatically represented by the computer at the end of the block of 36 trials they belonged to.

The second part of the session consisted of five other blocks of 36 color naming trials. The difference was, however, that subjects received feedback by being given their average reaction time over the 12 control trials at the end of each block. Subjects were instructed to try to "beat their time" in the upcoming block of trials, even if that meant making more errors.

At the end of this session which lasted 1 hour, subjects received $7.00 for their participation in the session and were debriefed about the Stroop phenomenon. Subjects were then told that the laboratory also recruited subjects for hypnotizability measurement sessions and they were asked if they would like to participate.

Hypnotizability and other personality measures. During the first hypnosis session, which lasted approximately 1 1/2 hours, subjects filled questionnaires in the following order: an informed consent form, the Attitude Towards Hypnosis Questionnaire (Spanos et al., 1987), the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974), the Individual Differences Questionnaire (IDQ; Paivio, 1971), and finally the Paranormal Experiences Questionnaire (PEQ, Nadon et al., 1985). Directly following, subjects were assessed for their hypnotic ability on the HGSHS:A (Shor & Orne, 1962). At the end of the session, subjects completed a subject information sheet. Subjects were paid $6.00 for their participation and were invited to return for a second assessment of their hypnotizability on a different group administered scale.

Subjects who returned for a second hypnotizability assessment session were administered the ConCURSS (Perry & Pichette, unpublished scale). This session lasted about an hour. Subjects were paid $7.00 for their participation in this session and were again invited to return for a third and last individual hypnosis session.

During the third hypnotizability assessment, which lasted approximately 2 hours, subjects were administered the SHSS:C (Weitzenhoffer & Hilgard, 1962). They were paid $7.00 for their participation in this last session. Finally, subjects were thanked and debriefed regarding the entire sequence of testings.

Results

Overview of statistical considerations

Missing data and orthogonality issues. The present data set presented a number of challenges including (1) nonrandom missing data; (2) unequal number of observations per cell within the experimental design; and (3) the presence of categorical and continuous predictor variables. Cohen and Cohen's (1983) multiple regression/correlation (MRC) framework offers elegant solutions to these potential difficulties. The solution to each issue will be described in turn.

(1) Because some participants declined to participate as the research sessions progressed, data on the corresponding predictor variables were missing in a nonrandom fashion. This case is different, for example, from the situation in which data are missing due to random equipment failure. Although missing data in general present difficulties for data analysis, nonrandomly missing data offers an additional difficulty in terms of making proper inferences from the statistical analyses.

As outlined by Cohen and Cohen (1983), three popular solutions to the missing data problem are unsatisfactory. When confronted by missing data, most researchers drop *variables* that have missing data; or data is dropped for all *participants* who have any missing data (listwise deletion);

or conduct statistical tests for whatever data are available for a particular analysis, resulting in different sample sizes across analyses (pairwise deletion). The first solution is not completely satisfactory because variables that are sufficiently important to include in the design of the study are presumably sufficiently important to be retained for analysis. The second solution, dropping participants, not only lowers statistical power, but more importantly produces results that are not representative of the population if the data are missing nonrandomly. The third solution is awkward with its different sample sizes across analyses. Moreover, if predictor variable data are missing for reasons related to the criterion or to other predictors (i.e., missing nonrandomly), "one can obtain a correlation matrix from pairwise deletion... that would be mathematically impossible to obtain were the data complete" (Cohen & Cohen, 1983, p. 280).

As Cohen and Cohen (1983) reason,

> A serious flaw of all the above methods is their failure to use as potential information the *fact* that data are absent for certain subjects on certain research factors. It is desirable to represent as positive information the *absence* of data and ascertain the degree of statistical significance of the criterion relevance of this information (p. 281).

Cohen and Cohen (1983, pp. 275-300) offer a new solution to circumvent these problems. It consists in creating a missing data dummy variable (code "1" if the observation for a particular variable is missing and "0" if it is not missing) and in replacing the actual missing data by the mean of the nonmissing observations. The statistical significance of the construct measured by the predictor is assessed by a two-degree of freedom test, that is, by both the missing data dummy variable and the predictor variable simultaneously. Somewhat counterintuitively, this results in a regression coefficient for the predictor and a Y-intercept *identical* to those produced when missing data are simply excluded from the analysis. That is, the nature of the relationship between the predictor and the criterion is not affected by this analytic procedure. In this respect, nothing is lost. By contrast, a gain in statistical power results from the use of the entire sample (except in instances in which too few data points are missing to favor the use of this technique from a power perspective of a two-degree of freedom rather than a one-degree of freedom test). More importantly, as discussed above, since all relevant data are included in the analysis, more confidence can be placed in the generalizability of the effect.

A complication arises, however, when more than one predictor has missing data as in the present study. When combined in a regression equation, the often substantial intercorrelations among the missing data dummy variables generates "generally unstable MRC results owing to the loss of error *df* and high correlation among IVs" (Cohen & Cohen, 1983, p. 296), (IV standing for independent variable). "In such circumstances, the use of a single IV of 'tendency to have missing data,' ... is likely to be much superior to either all or none of them being included" (Cohen & Cohen, 1983, p. 296). This approach was applied in the present study. Subjects' records were attached a dummy code of "1" if they had data missing on any of the predictors and coded "0" if they had no missing data.

In turn, another solution had to be found for the second and third challenges represented by unequal number of subjects per cell for categorical variables and the concomitant presence of categorical and discontinuous predictors, since both result in nonorthogonal effects. This poses potential difficulties when all effects are analyzed simultaneously because the sums-of-squares for the effects overlap. In order to separate the unique sums-of-squares contributions of each predictor, a hierarchical approach is warranted and was therefore used in the present study. This approach assesses the contribution of each variable in succession after all variables already entered into the analysis are partialled out. As a consequence, any overlapping variance between two effects is assigned to the predictor that appears earlier in the hierarchy.

Language of education issue. Some participants in the present study had a mother tongue other than English or received only part of their schooling in English. While generating potential difficulties in terms of replicating

Bowers and Schacter (1990), this provides at the same time an opportunity for investigating the role of language development in implicit and explicit memory of English verbal stimuli.

Dependent variables. Two dependent variables analyzed by Bowers and Schacter (1990) were examined in the present study: number of correct stem completions (implicit memory) and number of correctly recalled words (explicit memory). Moreover, number of explicit errors were also examined. Not all stems were completed by subjects in the explicit recall test rendering, this number independent of the correctly recalled words.

Categorical predictors. For each dependent variable, independent variables pertaining to the memory testing were examined first. These analyses included within-subjects conditions (structural versus semantic encoding, tested versus untested cued recall completions), and two between-subjects variables ("Informed" and "Awareness" conditions), and their interactions. (Except where otherwise noted, for Bowers and Schacter's (1990) criteria -"BSC", "Awareness" will refer to the measure designed for the present study). Because of their primacy in the present study, these memory variables were retained for all subsequent hierarchical analyses of the continuous predictors, whether they produced statistically significant results or not.

Language of education and its interaction with other effects were also included in these initial analyses. Because they were not intrinsic to the experimental design, they were retained for subsequent between- or within-subjects analyses (as appropriate) only if they produced statistically significant effects ($p < .05$).

As mentioned earlier, sums-of-squares for the various nonorthogonal effects were assessed hierarchically. Following the tradition in experimental designs, and recommendation by Tabachnick and Fidell (1983), Model II error term was used to assess their statistical significance. This error term is obtained when all effects are present in the analysis. In consequence, all experimental memory manipulation effects and language effects were assessed against the same error term.

Continuous predictors. The inclusion of numerous additional continuous predictor variables increases the probability of generating Type I errors. If all main effects and interactions (2, 3,... multi-way) were to be analyzed, difficult-to-interpret and spurious effects would almost certainly be present. As argued by Cohen and Cohen (1983), too many predictor variables produce unstable equations. They posit that a "relatively small" number of variables is desirable. In their terms, "`less is more' - more statistical test validity, more power, and more clarity in the meaning of the results" (p. 171). It should be noted that the operational expression they use is "relatively small". Potentially meaningful terms should, however, be included in the interest of keeping Type II errors to a minimum. Moderation in both directions is therefore advisable in attempting to minimize type I and II errors.

For these reasons, continuous predictor main effects and 2-way interactions with the Informed and Awareness variables only were evaluated for each predictor. That is, interactions among the continuous variables and higher order interactions with the experimental variables were not assessed. The order of entry of the variables and their interactions for all equations is presented in **Table 3.**

The statistical significance of all effects after Step 1 was assessed by two-degrees of freedom tests. As is usual with large models of this type, statistical significance of effects was assessed hierarchically with Model I error terms, that is, with the sums-of-squares error and the degrees of freedom error diminishing with successive steps. This approach is preferred in this instance to the Model II error approach used for assessing experimental variables. The reason is that the large number of continuous predictors in the complete model may reduce the error term substantially, even if they individually are not statistically significant, leading to a spuriously small error term and a likely increase in Type I errors.

At Step 2, for example, the significance of the Stroop measure and of the Tendency to Having Missing Data variable

Table 3.

Predictor variable (between variables) entry into multiple regression analyses.

Step	Variable(s)
1	Any Language effects; Informed Condition; Awareness Condition; Informed Condition x Awareness interaction
2	Stroop performance on incongruent trials averaged across feedback and no-feedback conditions; dummy coded Missing Data variable
3	Informed Condition x Stroop measure interaction; Informed Condition x Missing Data variable
4	Awareness Condition x Stroop measure interaction; Awareness Condition x Missing Data variable
5	Harvard Group Scale of Hypnotic Susceptibility, Form A (HGSHS:A); Missing Data variable
6	Informed Condition x HGSHS:A interaction; Innformed Condition x Missing Data variable
7	Awareness Condition x HGSHS:A interaction Awareness Condition x Missing Data variable
8	Carleton University Responsiveness to Suggestion Scale: Objective Involuntary Subscale (CURSS:OI); Missing Data variable
9	Informed Condition x CURSS:OI interaction;
10	Awareness Condition x CURSS:OI interaction
11	Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C); Missing Data variable
12	Informed Condition x SHSS:C interaction
13	Awareness Condition x SHSS:C interaction
14	Absorption Scale; Missing Data variable
15	Informed Condition x Absorption interaction
16	Awareness Condition x Absorption interaction

Table 3 (cont'd).

Predictor variable (between variables) entry into multiple regression analyses.

Step	Variable(s)
17	Paranormal Experiences Questionnaire (PEQ); Missing Data variable
18	Informed Condition x PEQ interaction
19	Awareness Condition x PEQ interaction
20	Individual Differences Questionnaire (IDQ); Missing Data variable
21	Informed Condition x IDQ interaction
22	Awareness Condition x IDQ interaction
23	Attitude toward Hypnosis Questionnaire; Missing Data variable
24	Informed Condition x Attitude toward Hypnosis interaction
25	Awareness Condition x Attitude toward Hypnosis interaction

was assessed simultaneously with the error term at that step. At Step 3, the significance of the Informed Condition x Stroop interaction and the Informed Condition x Missing Data variable was assessed simultaneously with the error term at that step. The two interaction effects at Step 4 were similarly tested.

Effects subsequent to Step 4 presented a technical, although not substantial, difficulty. For example, HGSHS:A was entered at Step 5. In keeping with the missing data variable approach, the significance of this construct was determined by assessing the joint statistical significance of HGSHS:A and the Missing Data variable. At this point, however, the Informed Condition x Missing Data variable and the Awareness Condition x Missing Data variable products previously entered in the equation would be partialled <u>incorrectly</u> from the Missing Data variable associated with HGSHS:A. That is, if the two product variables that contain the Missing Data variable as one of their components remain in the equation while the Missing Data variable is itself being examined (alone or with other variables), they "would be stealing the [Missing Data variable's] rightful variance..." (Cohen & Cohen, 1983, p. 305). Accordingly, the correct mean square for the combined effect of HGSHS:A and the Missing Data variable was assessed by *deleting* the two product variables from the equation. Consistent with the hierarchical approach, however, the mean square error for the combined HGSHS:A and Missing Data effect was calculated with the two product variables *in* the equation.

In this manner, each effect was examined in turn. With numerous correlated predictor variables in the equation, however, there existed a strong possibility that an effect appeared "significant" because of its relation with other predictors rather than because of its direct relation with the criterion (suppressor effect). Otherwise, with numerous correlated variables, an effect could seem significant because of the diminished error term due to the cumulative effect of successive nonsignificant predictors already in the equation. These possibilities for Type I errors, of course, exist especially for predictors entering late in the hierarchy. In order to address this problem, effects whose probability was < .10 were retained for a second analysis with fewer variables. A probability of .10 rather than .05 was used because of the reverse possibility that a "true" effect later in the hierarchy might equally be obscured by virtue of overlapping variance with a predictor earlier in the hierarchy. For the second pass of analyses, the initial hierarchical order was retained. Because of drastically fewer variables in these equations, a Model II error term this time was used. For this second set of analyses, only results from the continuous predictor variables, will be presented.

Results for the Implicit Memory Performance

Experimentally manipulated variables. Proportions of completed stems on the implicit memory test in the various experimental conditions are shown in **Table 4** and **Table 5.** Baseline scores for the stem completion task were collected for 68 control participants who did not have prior exposure to the target words. As in Bowers and Schacter (1990), the probability of completing a stem as a study word increased above baseline in all experimental conditions [all *t*s $(67) > 7.00$, $p < .001$].

As discussed above, Language of Education was analyzed as an additional factor in the present study. Because the Partial English/Not Informed/Aware cell had only two observations, the 3-way Information Condition x Awareness x Language interaction could not easily be examined. Accordingly, only the main effect for Language of Education and 2-way interactions involving Language were examined. (*n*s for the Exclusive English cells were as follows: Informed/Aware = 12; Informed/Not Aware = 13; Not Informed/Aware = 9; Not Informed/Not Aware = 18; *n*s for the Partial English Educated cells were as follows: Informed/Aware = 9; Informed/Not Aware = 13; Not Informed/Aware = 2; Not Informed/Not Aware = 12). The analysis yielded two between-subjects effects. An effect of awareness was found; $F(1,81) = 3.91$; $p < .05$. The Aware group completed more stems ($\bar{X} = .33$, $\hat{\sigma} = .11$, $n = 32$) than

Table 4.

Mean proportion of word stems completed in indirect testing as a function of level of encoding, informed condition, and present study awareness condition.

	Level of Encoding			
	Semantic		Structural	
Informed Condition	Aware	Not Aware	Aware	Not Aware
Informed	.32 (21)	.24 (26)	.32 (21)	.31 (26)
Not Informed	.41 (11)	.27 (30)	.29 (11)	.26 (30)

Note. Cell sample sizes are in parentheses.

Table 5.

Mean proportion of word stems completed in indirect testing as a function of level of encoding, informed condition, and awareness according to the Bowers and Schacter's (1990) criterion (BSC) condition.

	Level of Encoding			
	Semantic		Structural	
Informed Condition	Aware	Not Aware	Aware	Not Aware
Informed	.28 (47)		.31 (47)	
Not Informed	.35 (21)	.26 (20)	.31 (21)	.22 (20)

Note. Cell sample sizes are in parentheses.

the Not Aware group ($\bar{X}$ = .27, $\hat{\sigma}$ = .15, n = 56).

Second, there was an Information Condition x Language of Education interaction. Interactions of this type involving categorical variables will be represented graphically by residualized cell means. As discussed by Rosenthal and Rosnow (1991, pp. 367-369), in the presence of an interaction, raw cell means reflect both main and interaction effects. Residualizing the means allows for the examination of the interaction only. This is accomplished by subtracting the row effect, the column effect, and the grand mean from the cell means. (Row effect = row marginal mean - grand mean; column effect = column marginal mean - grand mean). In this manner, the effect of one level of a particular factor in a 2x2 design is contrasted with (and is *relative to*) the effect of the other level of that factor. When considering the various residualized graphs of cell means, it is useful to note that 2x2 graphs of residualized means *always* show a crossover pattern. That is, in the presence of an interaction, residualized cell means will necessarily show improvement for one level of a particular factor across levels of the other factor and worsening for the other level. (This does not apply to graphs of residualized continuous variables however).

The residualized effects are presented in **Figure 1.** Individuals who were educated exclusively in English completed a larger proportion of stems when informed, while

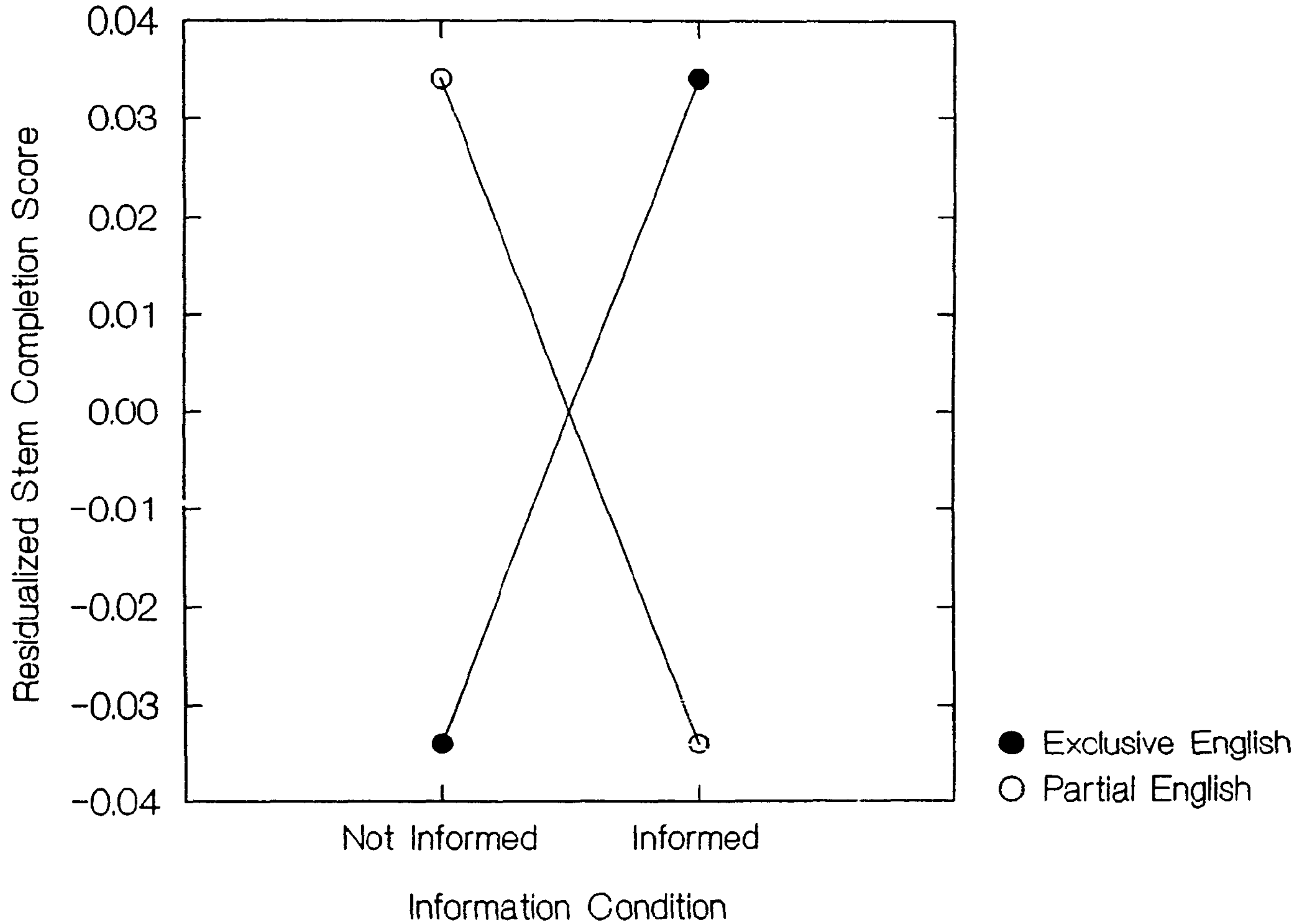


Figure 1 Prediction of the residualized stem completion performance by the residualized Information Condition x Language of Education interaction.

informing those whose education was only partially in English lead them to the same extent to complete a smaller proportion of stems. The raw cell means are presented in **Figure 2.** Because the main effects of Information and of Language were negligible, the raw effects show the same crossover pattern as the residualized effects.

As was done by Bowers and Schacter (1990), data for participants who were not informed were analyzed separately for their awareness measure. These participants were divided into two groups, according to whether or not they became aware according to the Bowers and Schacter's criteria (BSC). The BSC awareness between-subjects effect was significant; $F(1,39) = 4.52$; $p < .05$. Individuals who became aware on the BSC in the not informed condition completed more word stems ($\bar{X} = .33$, $\hat{\sigma} = .13$, $n = 21$) than those who did not become aware in the same condition ($\bar{X} = .24$, $\hat{\sigma} = .15$, $n = 20$).

Continuous predictors. Only one *between-subjects effect* was retained for analysis after the first hierarchical pass. The residualized HGSHS:A was positively related to the residualized stem completion score; $F(2,80) = 4.15$; $p < .05$. That is, once the effects of the predictors in Steps 1 through 4 (see Table 3) were partialled from both HGSHS:A and the average stem completion score of the implicit memory test, the effect of HGSHS:A was positively related to stem completion performance (see **Figure 3**). The

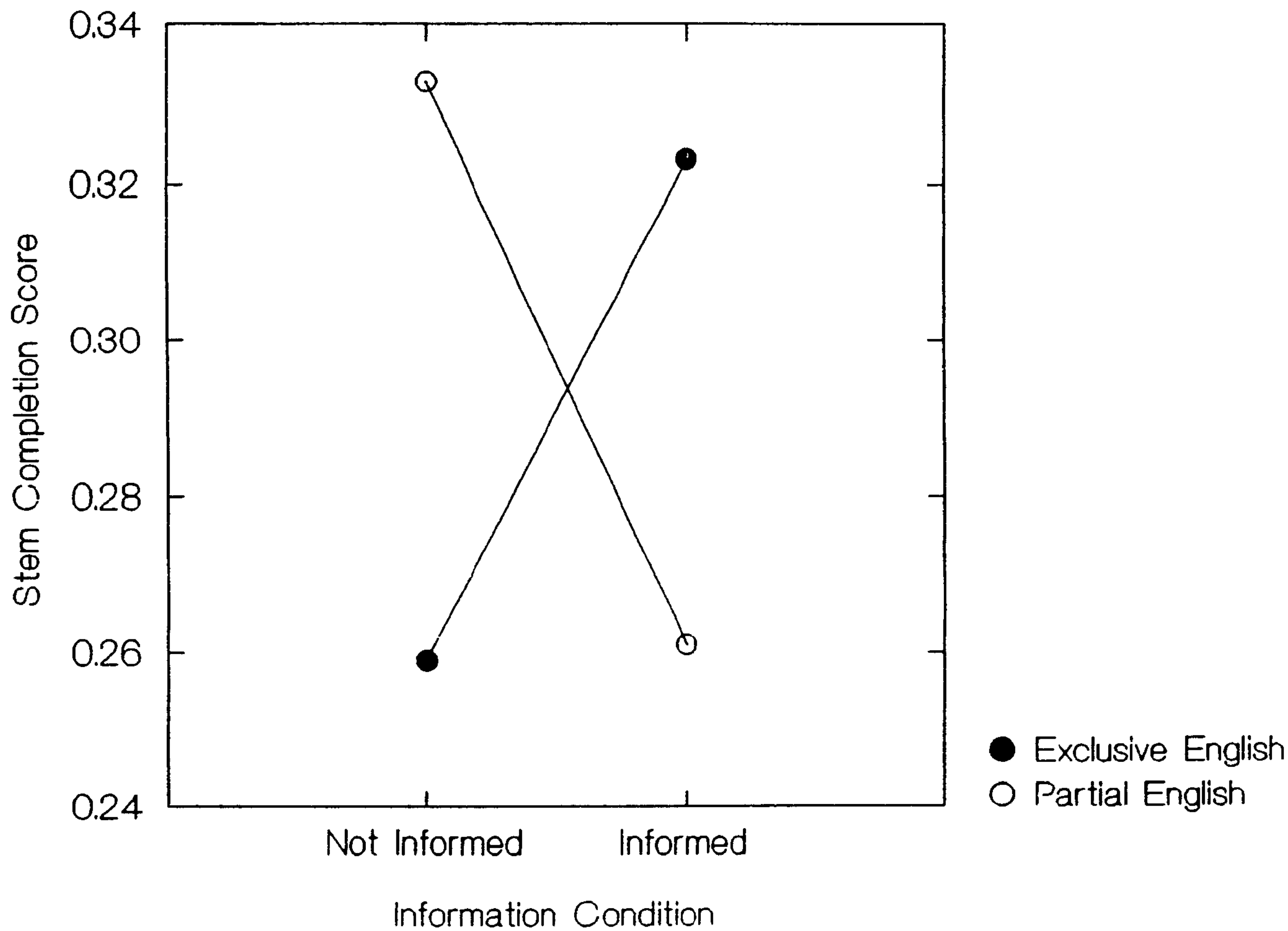


Figure 2 Prediction of stem completion performance by the Information Condition x Language of Education interaction

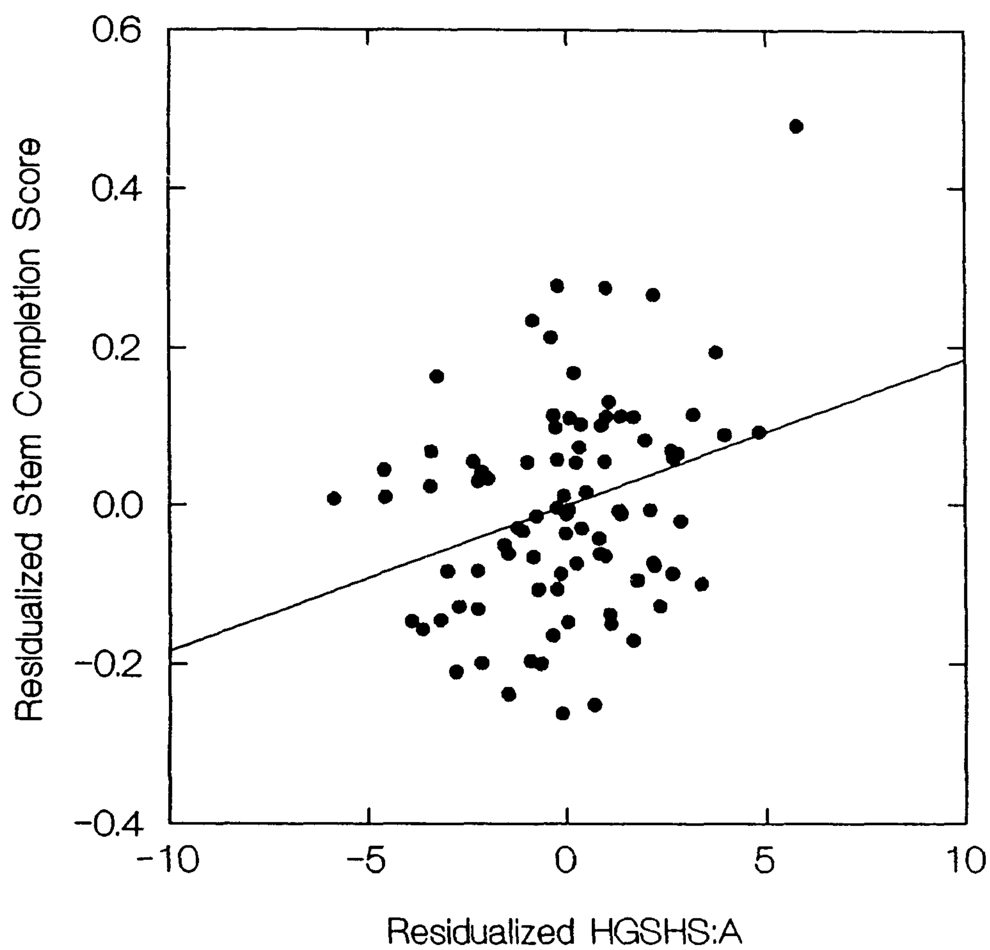


Figure 3. Prediction of the residualized stem completion performance by the residualized Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A).

unresidualized scatter plot is shown in **Figure 4**.

Regarding the *within-subjects effects*, only the Encoding x Awareness Condition x Attitude to Hypnosis interaction effect was retained after the first data analytic pass. It was not significant on the second pass; $F(2,80) = 2.42$; $p < .10$.

<u>Results for the Explicit Memory Performance</u>

<u>Experimental Design</u> (see **Table 6**). A main effect of encoding was found for explicit recall; $F(1,80) = 184.07$; $p < .001$. More semantically encoded words were recalled ($\bar{X} = .62$, $\hat{\sigma} = .20$) than structurally encoded words ($\bar{X} = .30$, $\hat{\sigma} = .17$). A main effect of awareness was found also for explicit recall; $F(1,80) = 7.75$; $p < .01$. Aware individuals completed more stems on the explicit recall test ($\bar{X} = .51$, $\hat{\sigma} = .14$, $n = 32$) than Not Aware individuals ($\bar{X} = .43$, $\hat{\sigma} = .15$, $n = 56$). These main effects, however, must be interpreted in light of an Encoding x Awareness Condition x Language of Education interaction; $F(1,80) = 4.96$; $p < .05$. This effect is shown in **Figures 5 and 6**.

Figure 5 of the residualized means shows that for semantically encoded words, individuals who have been educated exclusively in English were helped when they were not aware *relative* to when they were aware. Individuals who have received only part of their education in English were helped when they *were* aware relative to when they were not

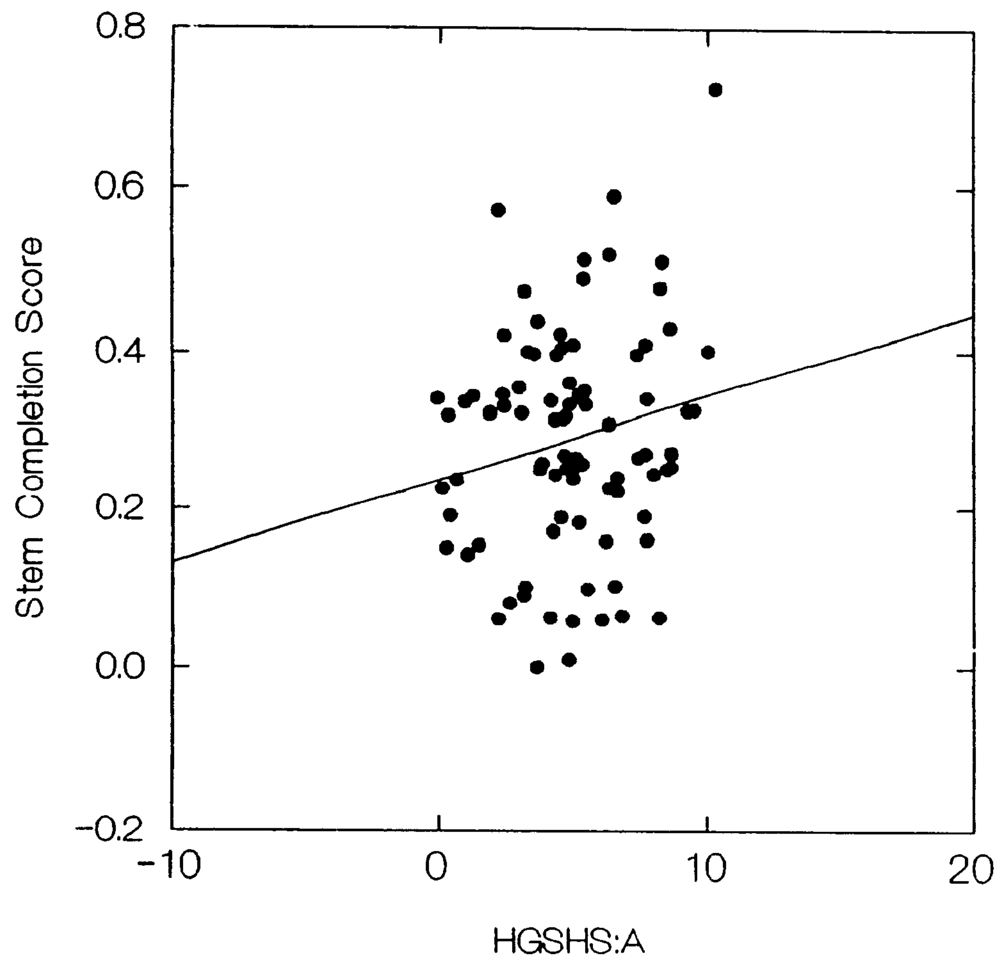


Figure 4. Prediction of stem completion performance by the Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A).

Table 6.

Mean proportion of correct recall in direct testing as a function of level of encoding, awareness at prior testing, and language of education condition.

	Language of Education			
	Exclusive English		Partial English	
Awareness at Prior Testing	Semantic Encoding	Structural Encoding	Semantic Encoding	Structural Encoding
Aware	.33 (20)	.18 (20)	.33 (12)	.15 (12)
Not Aware	.30 (31)	.11 (31)	.28 (25)	.15 (25)

Note. Cell sample sizes are in parentheses.

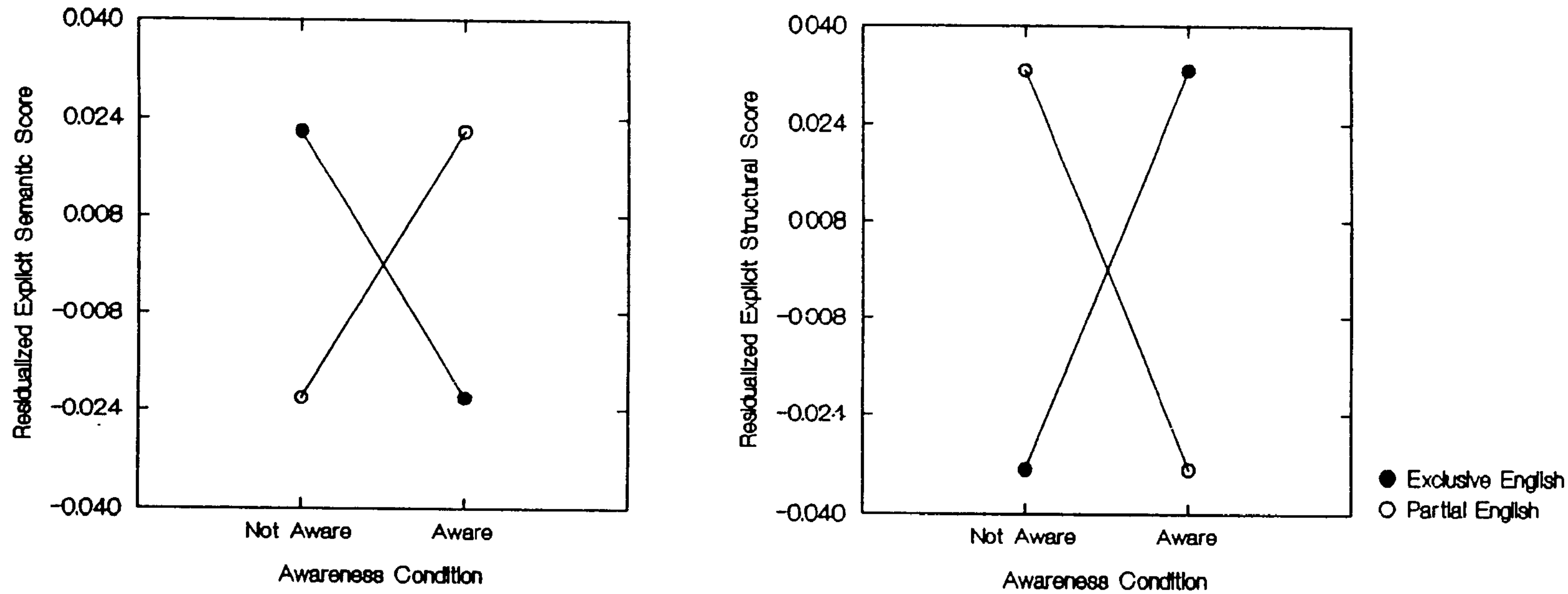


Figure 5. Prediction of the residualized explicit recall performance by the residualized Encoding x Awareness Condition x Language of Education interaction

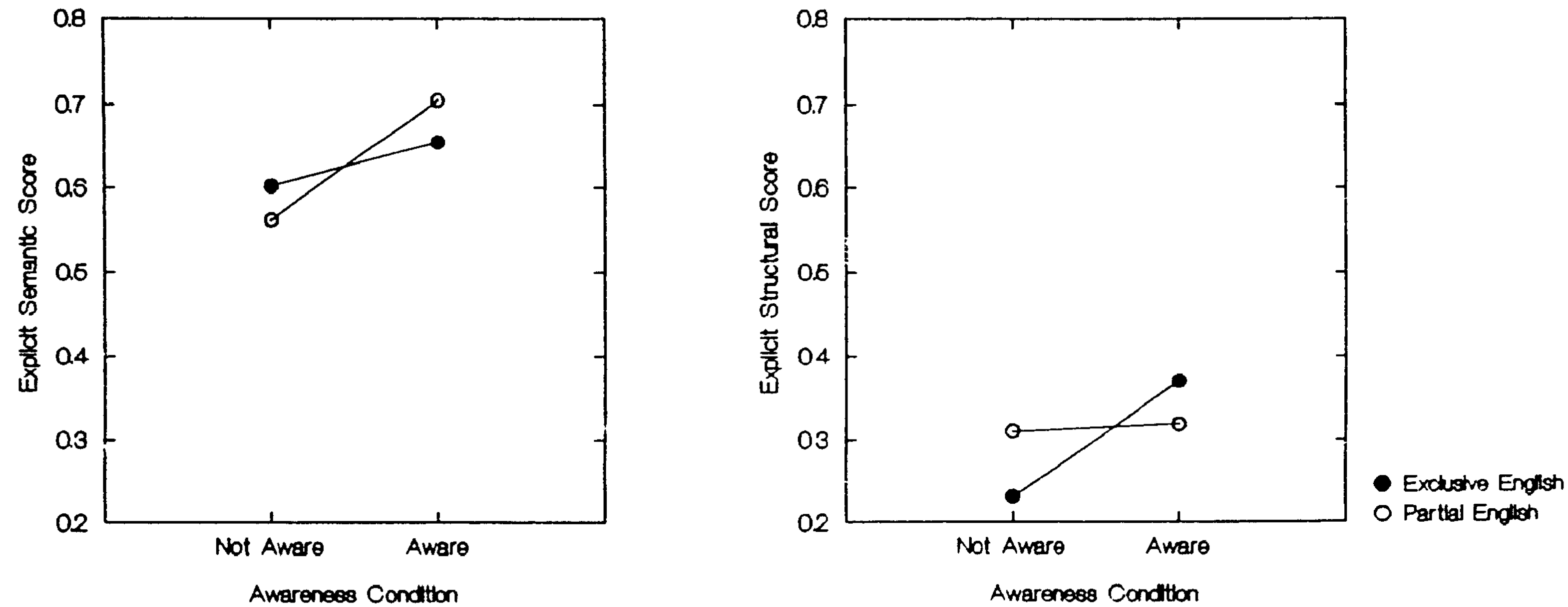


Figure 6 Prediction of explicit recall performance by the Encoding x Awareness Condition x Language of Education interaction

aware. Structurally encoded words showed the reverse pattern.

Because of the main effects of Encoding and Awareness, Figure 6 of the raw data does not show the same crossover patterns seen in Figure 5. The differences between the two figures highlight the advantages of examining both the residualized cell means and the raw cell means in the presence of an interaction. The residualized cell means in Figure 5 reflect the 3-way Encoding x Awareness x Language interaction only (i.e., main effects of Encoding, Awareness, the nonsignificant effects of Language and the various 2-way interactions partialled out) whereas the raw cell means in Figure 6 reflect all of those effects.

Continuous predictors. Concerning the *between-subjects effects*, only the Stroop performance on incongruent trials averaged across no feedback and feedback conditions effect was retained for the second analysis. Stroop performance was negatively related to explicit recall ; $F(2,79) = 5.04$; $p < .01$; see **Figures 7 and 8.**

Five *within-subjects effects* were retained for reanalysis in the second pass: Prior Testing (if cued recall stems were previously tested in implicit task or not) x CURSS:OI, Prior Testing x Information Condition x IDQ, Encoding x Absorption, Encoding x Information Condition x Attitude to Hypnosis, and Encoding x Awareness Condition x PEQ. Of these effects, only the Encoding x Absorption

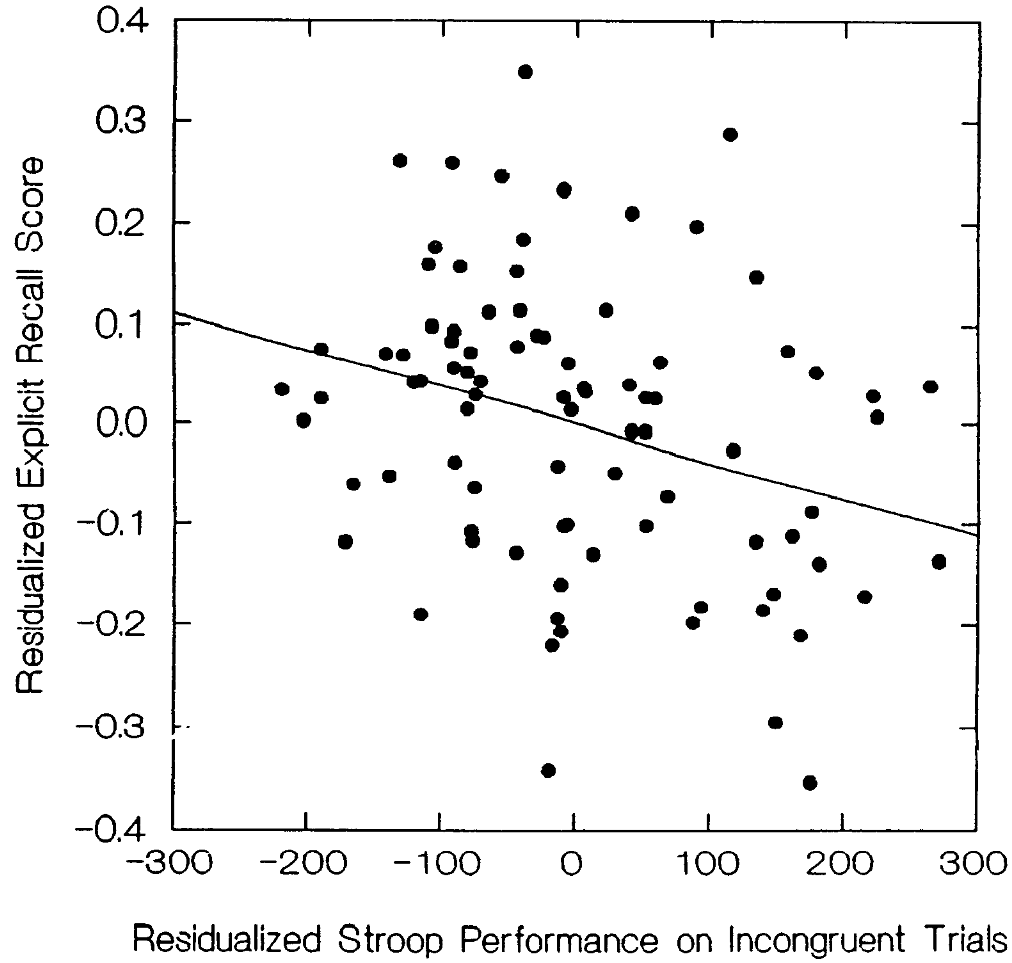


Figure 7 Prediction of the residualized explicit recall performance by the residualized Stroop performance on incongruent trials

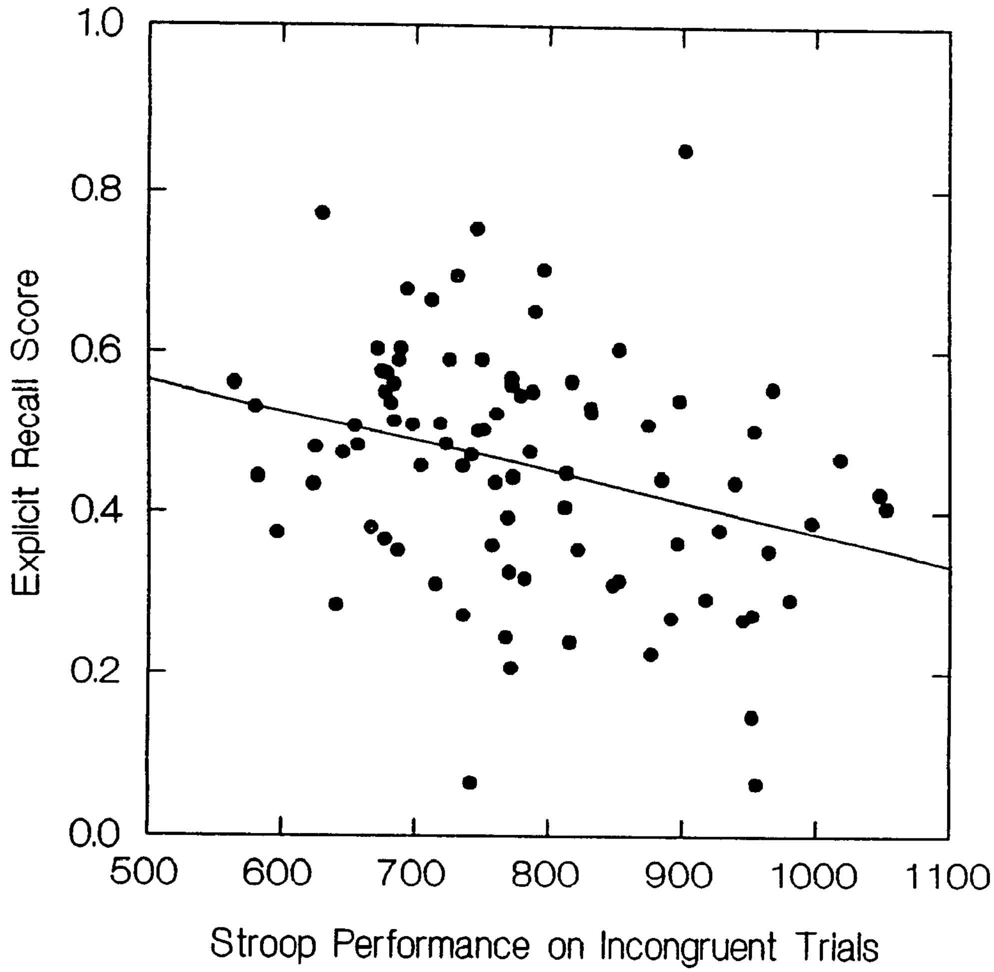


Figure 8. Prediction of explicit recall performance by Stroop performance on incongruent trials.

interaction was found to be significant; $F(2,79) = 4.64$; $p = .01$. The slopes of the regression lines predicting the explicit recall of semantically and structurally encoded words based on Absorption scores were in opposite directions. The slope was positive for semantically encoded words and negative for structurally encoded words. See **Figures 9 and 10.**

Results for the Explicit Recall Errors

Experimental Design (See **Table 7**). Main effects of Encoding [$F(1,80) = 22.04$; $p < .001$] and of Prior Testing [$F(1,80) = 4.48$; $p < .05$] on Explicit Recall Errors were found. More explicit errors occurred for structurally encoded words ($\bar{X} = .17$, $\sigma = .18$) than for semantically encoded words ($\bar{X} = .09$; $\sigma = .12$). More errors were made on words tested previously on the stem completion task ($\bar{X} = .15$, $\sigma = .15$) than words not previously tested ($\bar{X} = .12$, $\sigma = .14$).

There were also Prior Testing x Information Condition and Encoding x Prior Testing x Information Condition interactions [$F(1,80) = 4.39$; $p < .05$; $F(1,80) = 3.99$; $p < .05$, respectively]. The 3-way interaction is illustrated in **Figures 11 and 12.** Being informed led to more errors on words tested previously relative to untested words for structurally encoded words; being uninformed apparently guarded subjects against such increase in errors. No

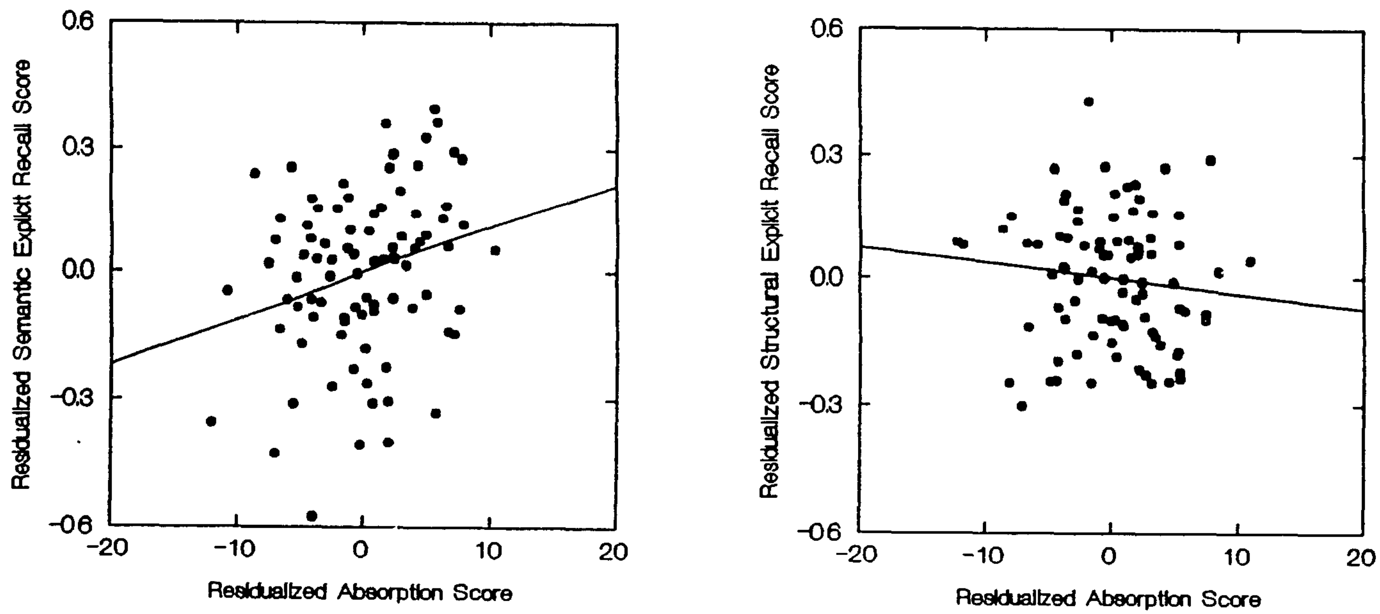
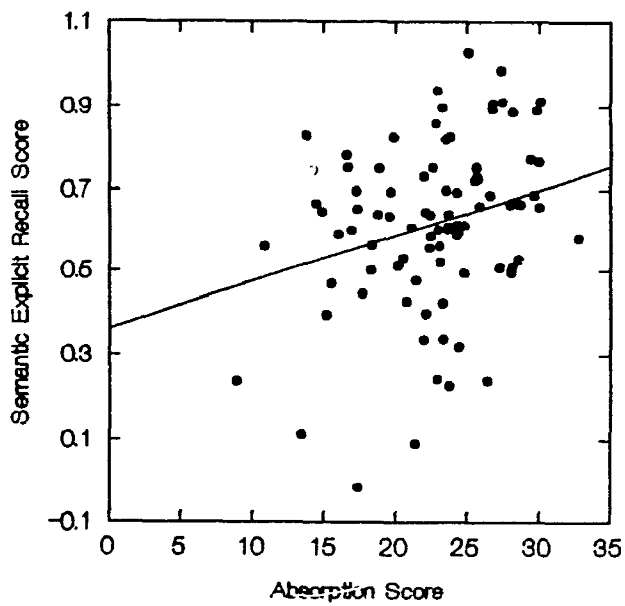


Figure 9. Prediction of the residualized explicit recall performance by the residualized Encoding x Absorption interaction.



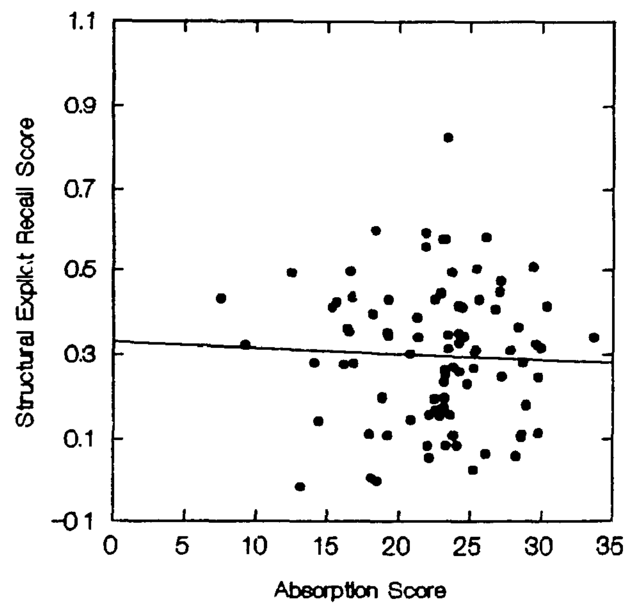


Figure 10 Prediction of explicit recall performance by the Encoding x Absorption interaction

Table 7.

Mean proportion of recall errors in direct testing as a function of level of encoding, informed condition at prior testing, and prior testing condition.

	Level of Encoding			
	Semantic		Structural	
Informed Condition at Prior testing	Tested	Not Tested	Tested	Not Tested
Informed (47)	.09	.08	.24	.13
Not Informed (41)	.11	.10	.15	.16

Note. Cell sample sizes are in parentheses.

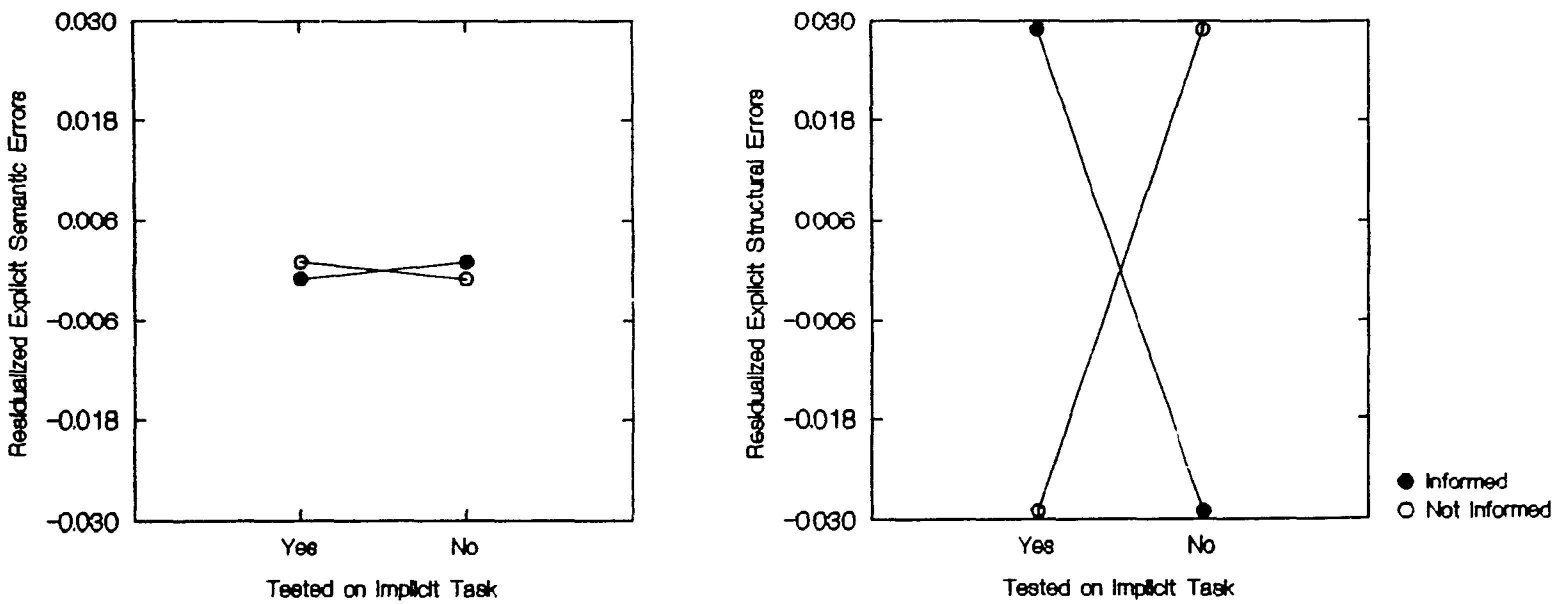


Figure 11. Prediction of residualized explicit recall errors by the residualized Encoding × Prior Testing × Information Condition interaction

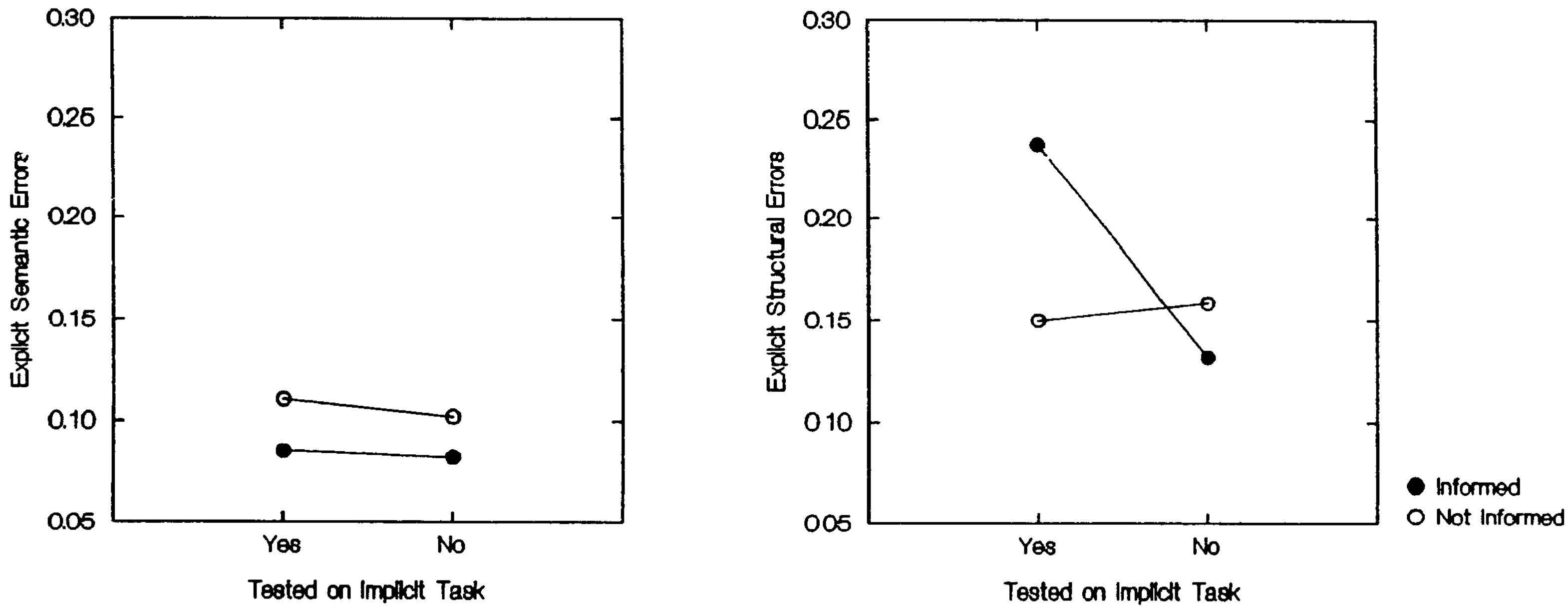


Figure 12. Prediction of explicit recall errors by the Encoding x Prior Testing x Information Condition interaction.

differential effects were observed for semantically encoded words.

Continuous predictors. There were no *between-subjects effects* of the continuous predictors for the number of explicit recall errors.

For the *Within-subjects effects*, a Prior Testing x IDQ interaction was found; $F(2,76) = 4.09$; $p < .05$ (see **Figures 13 and 14**). The slope of the regression line calculated from IDQ scores predicting explicit errors on words previously tested in the stem completion task was significantly different from the slope of the regression line predicting explicit errors on words that had not been tested previously. The slope was negative for tested words and positive for untested words.

Two 4-way interactions were also found: Encoding x Prior Testing x HGSHS:A x Information Condition [$F(2,76) = 4.91$; $p < .05$; see **Figures 15-18**] and Encoding x Prior Testing x CURSS:OI x Information Condition [$F(2,76) = 4.30$; $p < .05$; see **Figures 19-22**].

Figure 15 shows that for words previously tested in the Informed Condition, the HGSHS:A was negatively related to explicit semantic errors and positively related to explicit structural errors; the reverse pattern was observed for previously tested words in the Not Informed Condition (see also Figure 17). Figure 16 shows that for words that had not been tested previously in the Informed Condition,

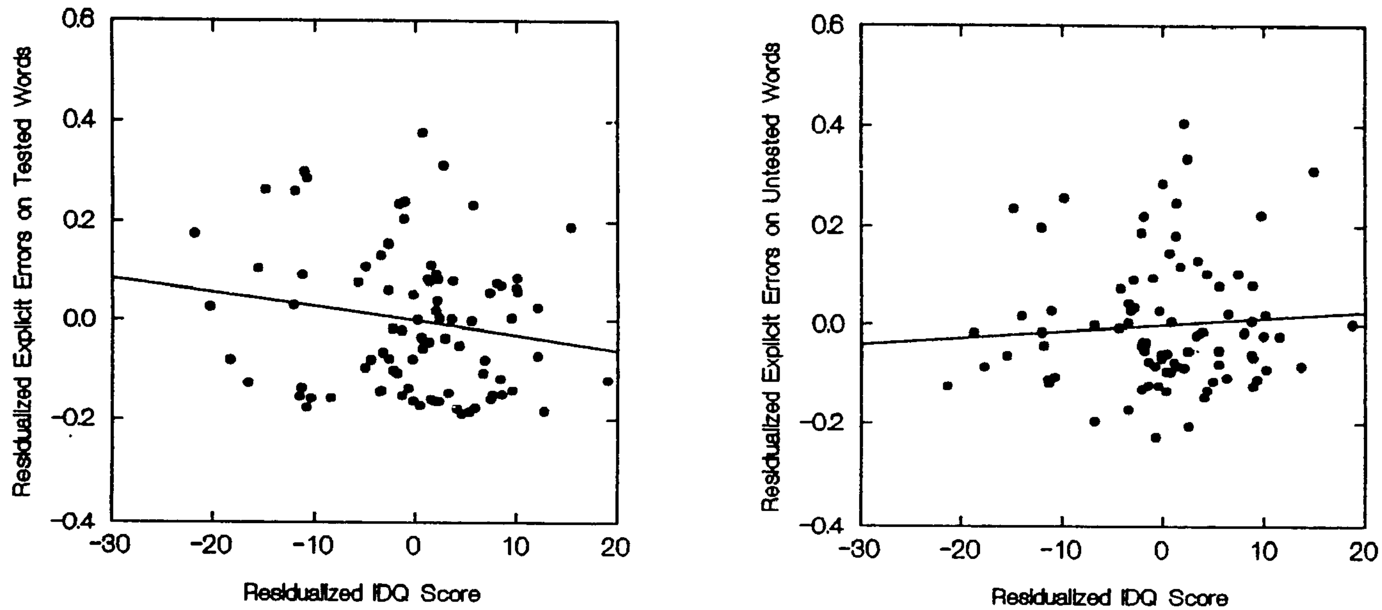


Figure 13. Prediction of residualized explicit errors by the residualized Prior Testing x Individual Differences Questionnaire (IDQ) interaction.

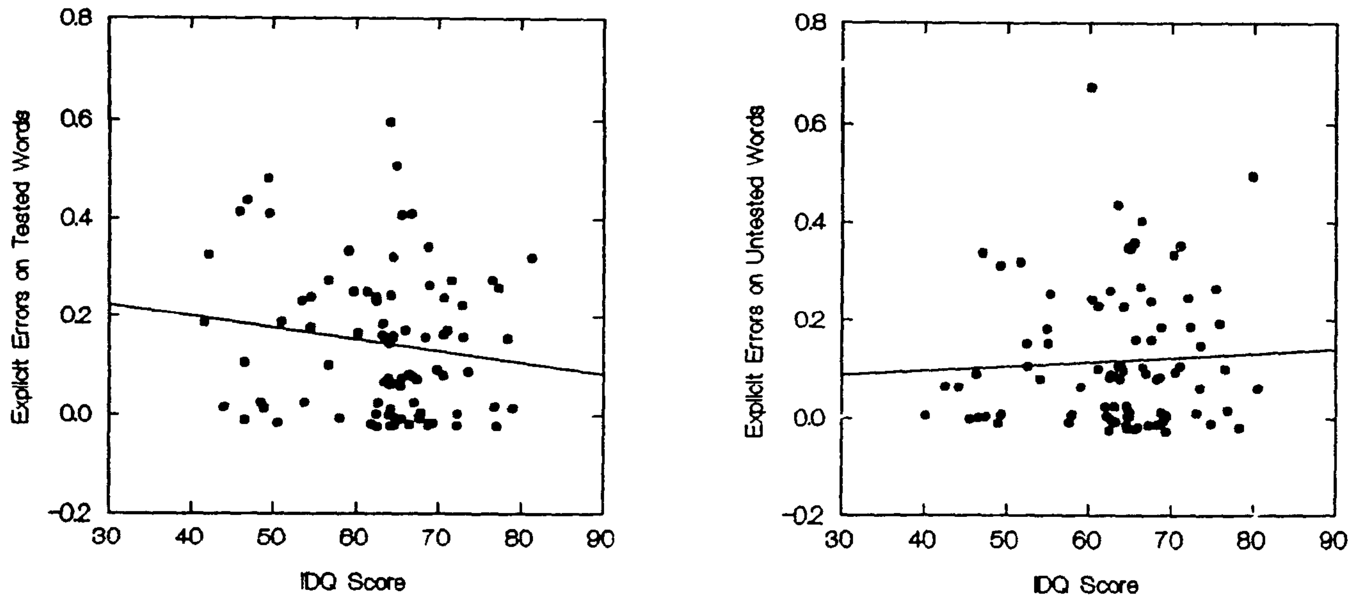


Figure 14 Prediction of explicit errors by the Prior Testing x Individual Differences Questionnaire (IDQ) interaction

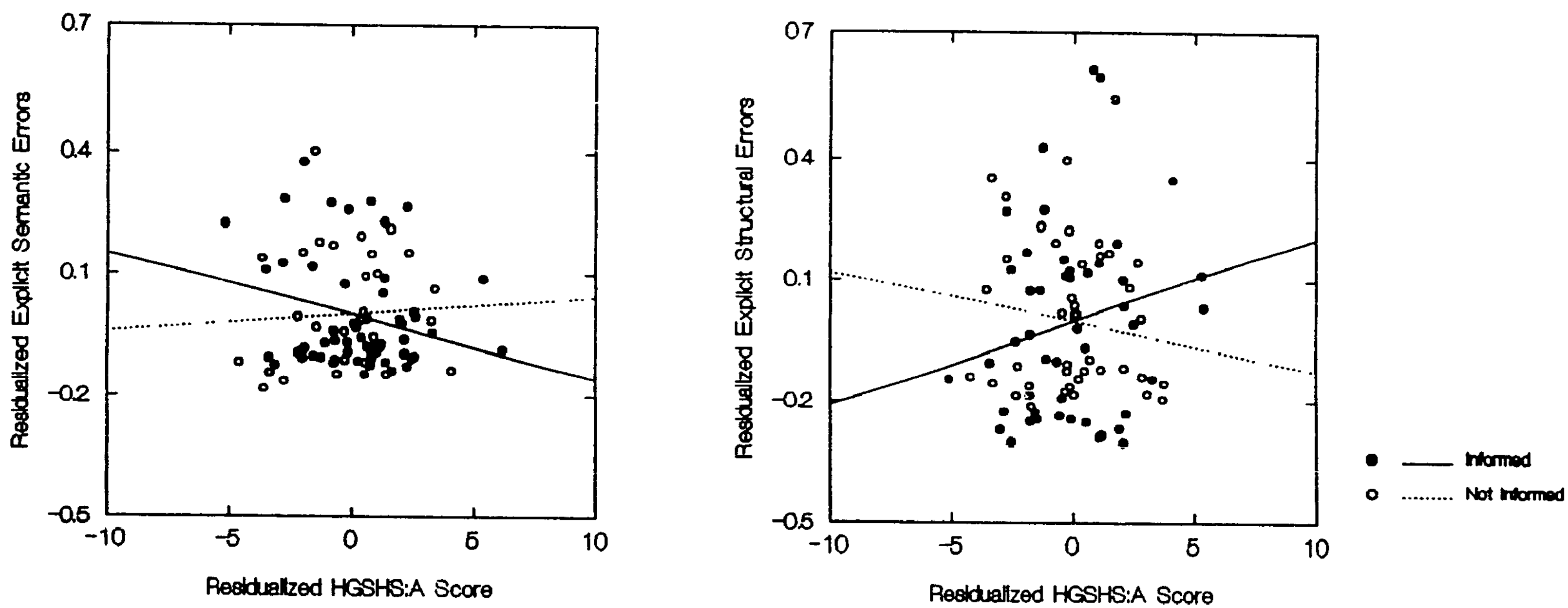


Figure 15. Prediction of residualized explicit errors on tested words by the residualized Information Condition x Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A) interaction.

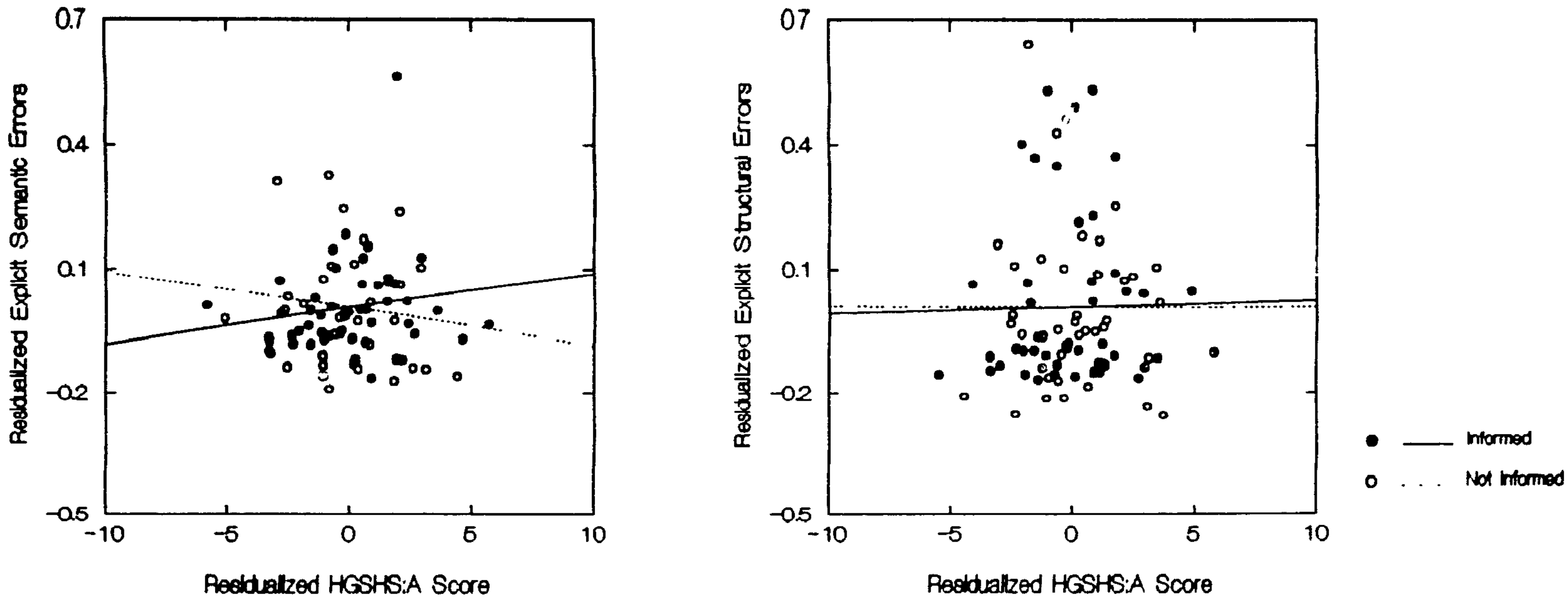


Figure 16 Prediction of residualized explicit errors on untested words by the residualized Information Condition x Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A) interaction.

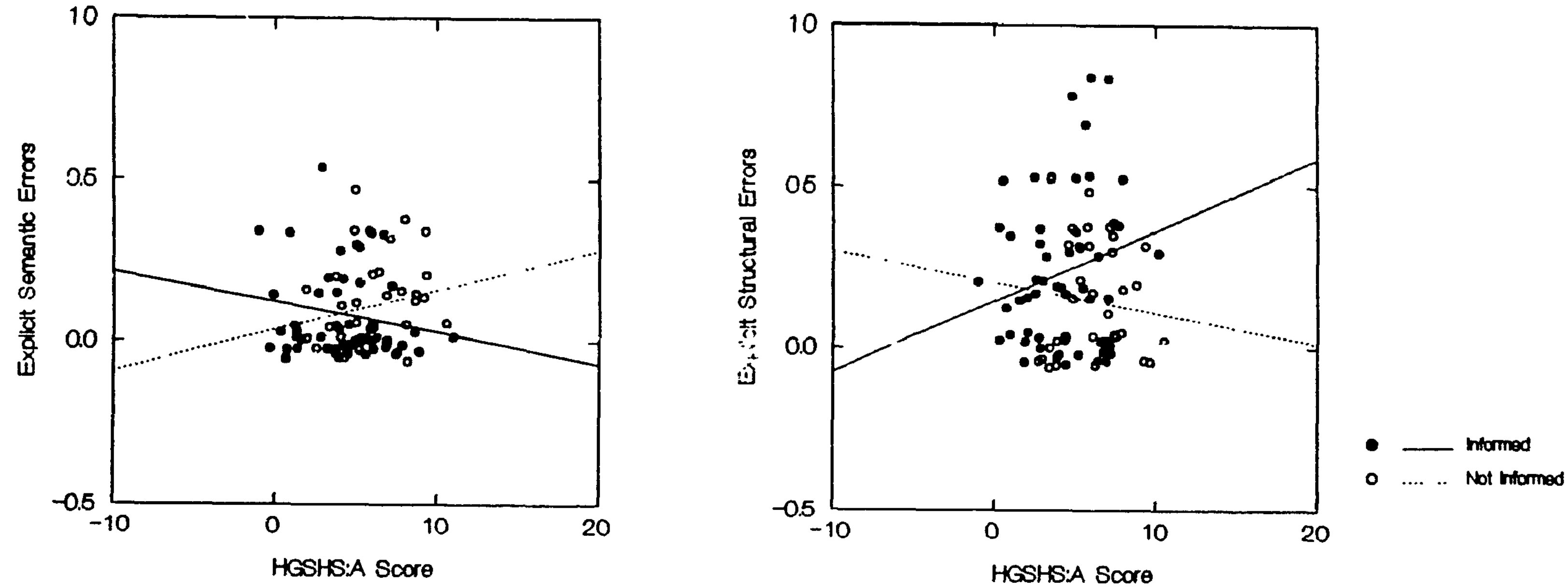


Figure 17. Prediction of explicit errors on tested words by the Information Condition x Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A) Interaction.

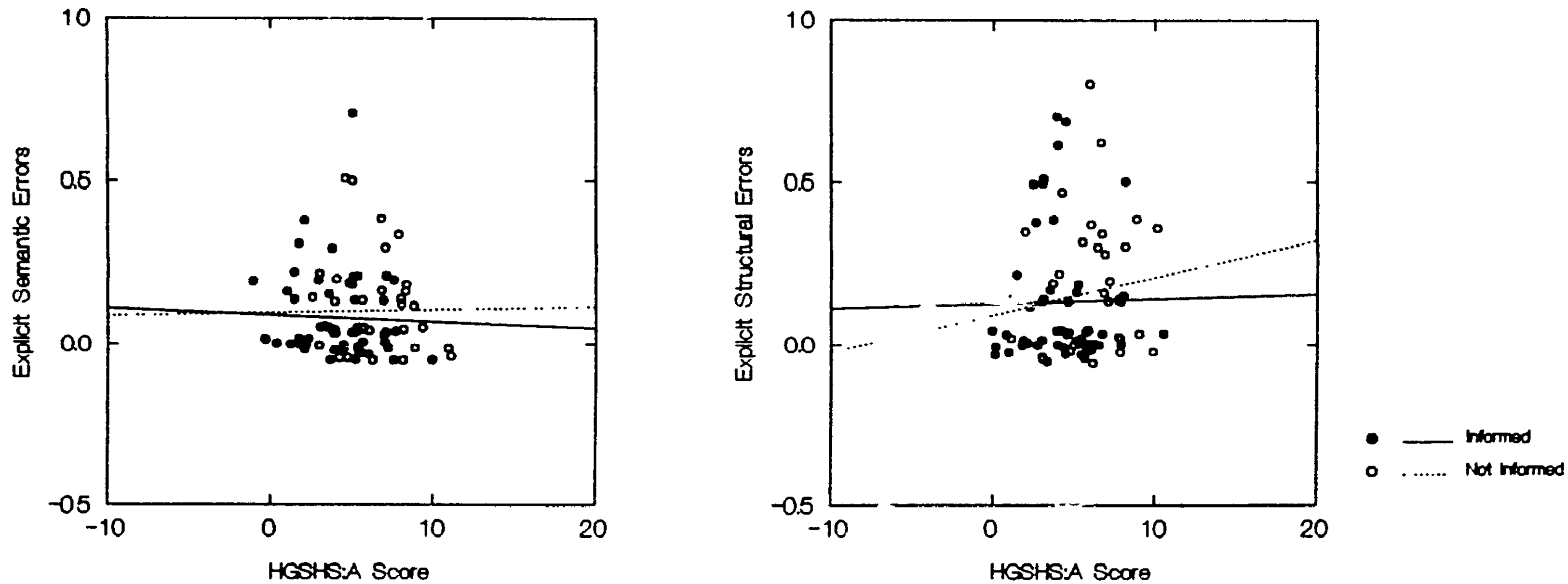


Figure 18 Prediction of explicit errors on untested words by the Information Condition x Harvard Group Scale of Hypnotic Susceptibility (HGSHS:A) interaction.

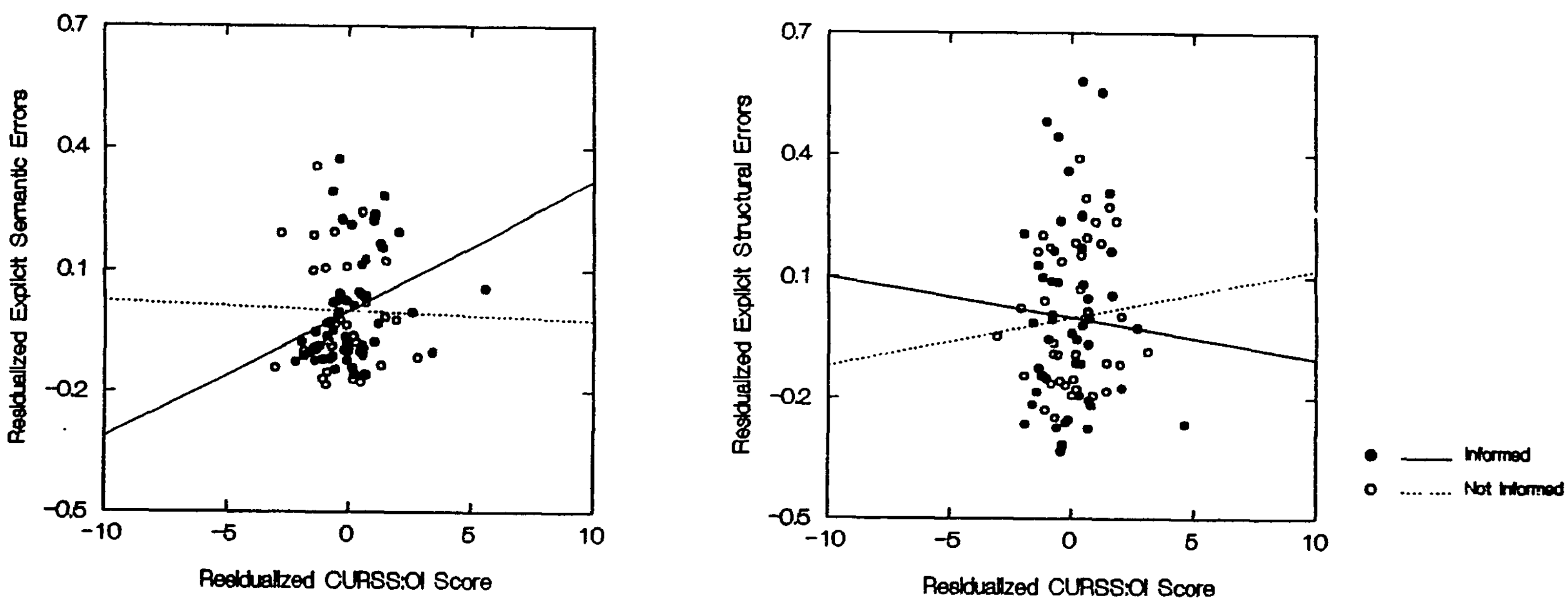


Figure 19. Prediction of residualized explicit errors on tested words by the residualized Information Condition x Carleton University Responsivity to Suggestion Scale: Objective-Involuntary Subscale (CURSS:OI) interaction.

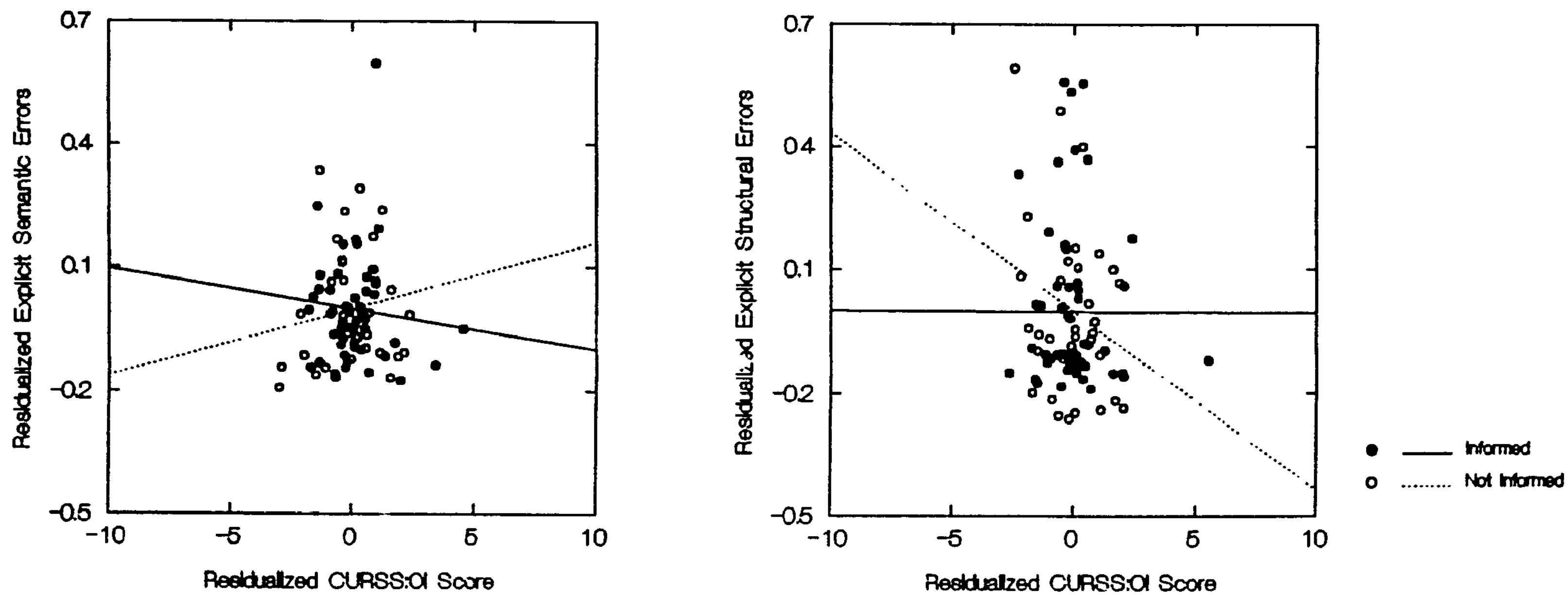


Figure 20. Prediction of residualized explicit errors on untested words by the residualized Information Condition x Carleton University Responsivity to Suggestion Scale: Objective-Involuntary Subscale (CURSS:OI) interaction.

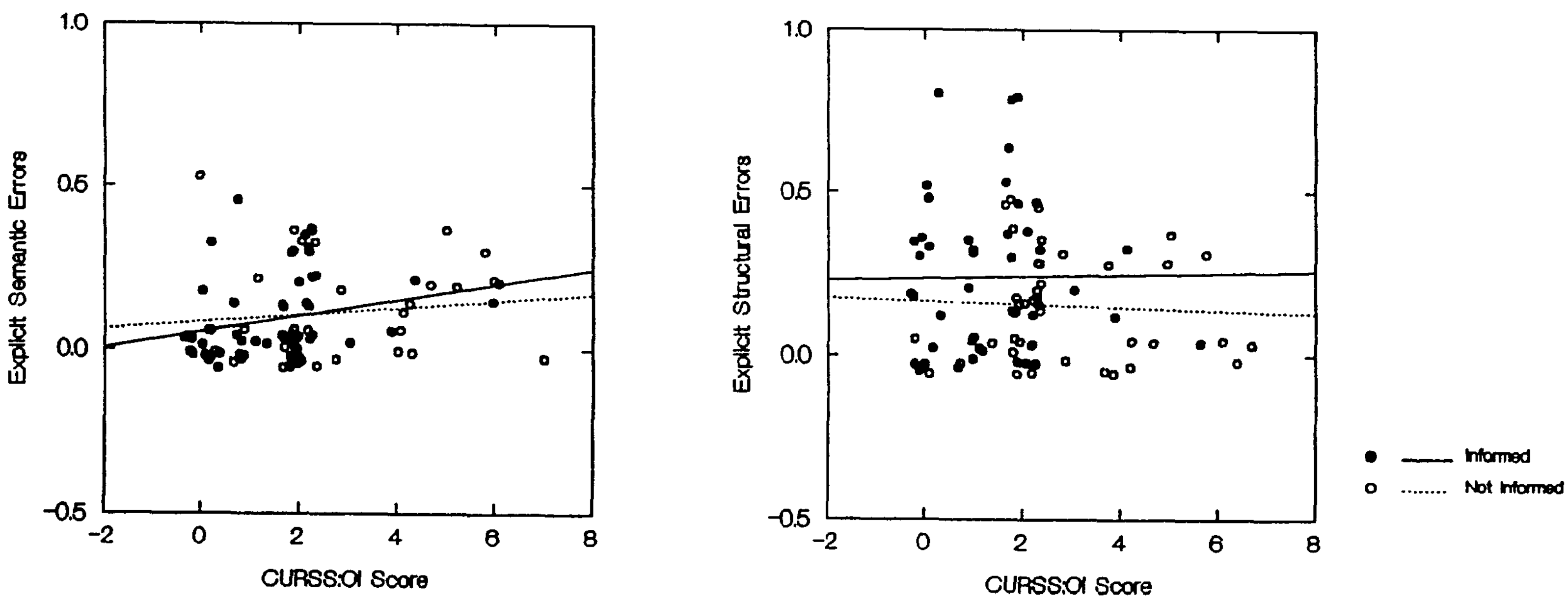


Figure 21. Prediction of explicit errors on tested words by the Information Condition x Carleton University Responsivity to Suggestion Scale: Objective-Involuntary Subscale (CURSS:OI) interaction.

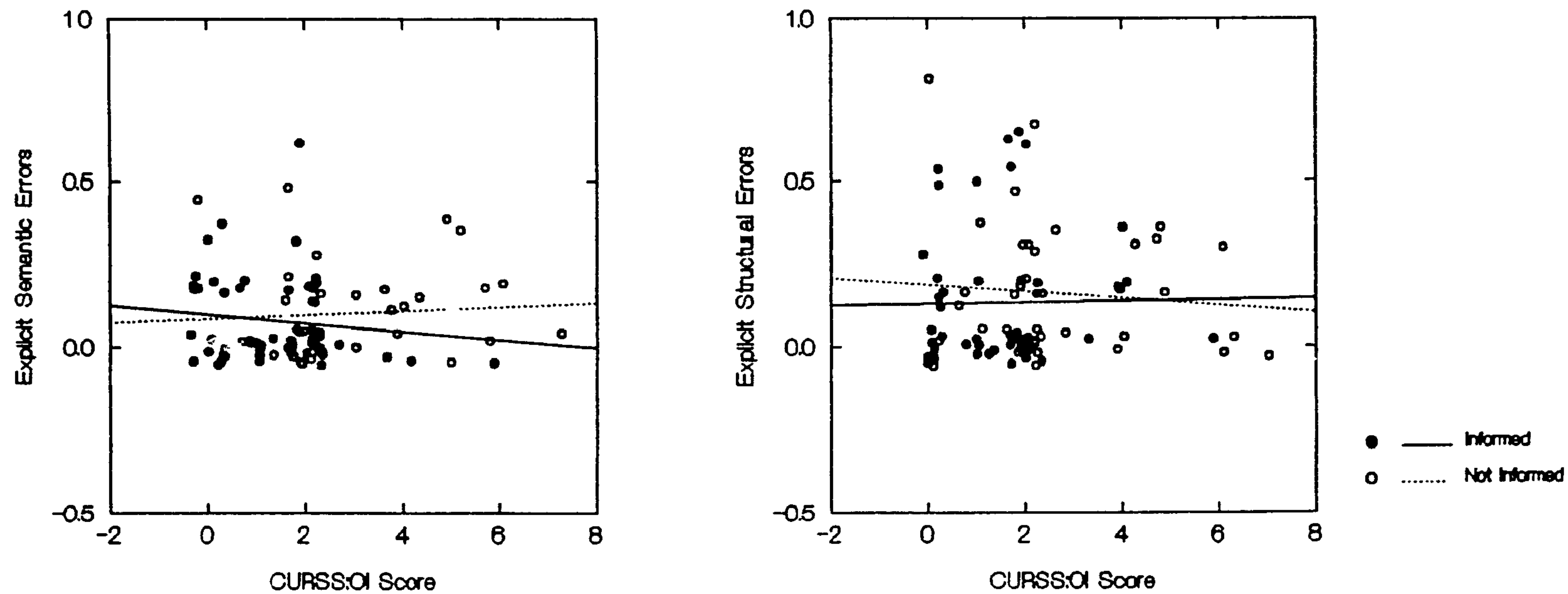


Figure 22 Prediction of explicit errors on untested words by the Information Condition x Carleton University Responsivity to Suggestion Scale: Objective-Involuntary Subscale (CURSS:OI) interaction.

HGSHS:A was positively related to explicit semantic errors and unrelated to explicit structural errors; for untested words in the Not Informed Condition, HGSHS:A was negatively related to explicit semantic errors and unrelated to structural errors (see also Figure 18).

Figure 19 shows that for words previously tested in the Informed Condition, the CURSS:OI was positively related to explicit semantic errors and negatively related to explicit structural errors; for previously tested in the Not Informed Condition, CURSS:OI was unrelated to explicit semantic errors and positively related to explicit structural errors (see also Figure 21). Figure 20 shows that for words that had not been tested previously in the Informed Condition, CURSS:OI was negatively related to explicit semantic errors and unrelated to explicit structural errors; for untested words in the Not Informed Condition, CURSS:OI was positively related to explicit semantic errors and negatively related to explicit structural errors (see also Figure 22).

Discussion

Memory Performance and Categorical Predictors

Direct priming. The results of the present study served simultaneously to corroborate, contradict and extend the work of Bowers and Schacter (1990). First, the present study supports these authors' earlier finding that direct priming effects can be observed using stem completions as testing material. This finding emerged in spite of the fact that in the present study subjects were tested in groups rather than individually as in these authors' study. In all experimental conditions, subjects who had "studied" the target items and were asked to fill stems on a stem completion test with the first word that comes to their mind, completed significantly more word stems with previously presented words than did control subjects who were never shown the study list. Further, direct priming effects emerged regardless of the applied awareness criterion [our Post-Experimental Inquiry Criterion (PEIC) or Bowers and Schacter's Criterion (BSC)], and independently of whether or not a direct reference to a prior episode was made. The above results attest to the robustness of the phenomenon that a past experience can influence performance on an indirect test of memory.

Awareness. The present study, however, does not confirm Bowers and Schacter's (1990) earlier finding that awareness has no effect on overall implicit memory performance. Following Bowers and Schacter, and analyzing only data for subjects who were not informed prior to implicit testing, we found that participants who became aware on the BSC completed significantly more stems with study words than those who did not become aware, $F(1,39) = 4.52$; $p < .05$. In addition, when using our PEIC as the awareness measure for all subjects (independently of their being informed or not), the test-aware group completed significantly more word stems with study words than the test-not-aware group, $F(1,81) = 3.91$; $p < .05$. These latter findings are in accord with those reported by Rybash and Osborne (1991).

Applying different awareness criteria led, though, to different outcomes in proportions of subjects considered as test-aware. Applying the BSC to our not informed group, we found similar outcomes as those obtained by Bowers and Schacter (1990); exactly half of their subjects (n = 20 aware/40 subjects) and half of ours (21 aware/41 subjects) became aware. When applying our awareness criterion, it was found that in the informed condition, approximately 50% of subjects became aware, {i.e., subjects appears randomly distributed between aware and unaware [$x^2(1) = .532$; $p > .05$]}. Applying the same criterion to the not informed group, however, only 26% of subjects became aware, {i.e., significantly more subjects remained unaware than became aware [$x^2(1) = 8.805$; $p < .005$]}. It can be deduced from these findings that informing subjects prior to testing (i. e., telling them that some of the stems could be completed with words from the "study" list presented earlier, but to go ahead and complete each stem with the first word that comes to mind), creates conditions which promote the development of awareness in more subjects than in a not informed group (i.e., just telling them to complete each stem with the first word that comes to their mind).

It would seem that slightly different procedures can result in different proportions of subjects becoming aware. Rybash and Osborne (1991), using the BSC to evaluate awareness in not informed subjects, found that 75% of their 20 subjects became aware of using previous study words on a stem completion task. This different finding, however, is probably dependent on the fact that these authors, contrary to us and to Bowers and Schacter (1990), tested their subjects immediately after encoding (instead of introducing 10 minutes of filler tasks) used less distractor stems at test (24 instead of 63), tested all the 24 target words, and had subjects semantically encode all the words (instead of only half of them).

In spite of the similar relationships between implicit memory performance and the two different awareness criteria, these differences in awareness outcomes depending on the awareness criteria used indicate that it should not be inferred that the two assessments of awareness are somehow operationally equivalent or interchangeable. For Bowers and Schacter (1990), informed subjects should be considered aware, even if they report immediately after testing not having realised, while responding, the existence of a link between certain stems in the completion test and certain study words. For them, only the uninformed subjects who answer negatively to all of the four post-test questions deserve to be considered as unaware. We have explored another avenue based on the tenet that it is conceivable that certain informed subjects might fail to notice that any of the stems on the completion test could be related to a previously processed word.

We feel that our awareness criteria may represent a significant improvement over Bowers and Schacter's (1990) criteria in the sense that it offers clearly defined multiple choice options (versus Bowers and Schacter's open ended questions) from which subjects can choose. Tightening up for subjects the operational definition of "awareness" led, as just reported, to the testing out of an informed versus not informed effect on awareness reports, an effect previously unreported in the literature. Finally, our awareness assessment was administered post-experimentally by a second experimenter who had no prior involvement in the experiment. This procedure was introduced to prevent subjects from unwittingly responding according to their perception of the experimenter's hypothesis (see Orne, 1959, on demand characteristics).

A possible limitation of our conclusions, however, is the fact that our awareness measure was based on self-reports. Some psychologists have expressed concern that relying on subjects to define awareness leads to as many definitions as subjects (Eriksen, 1960; Merikle, 1984). But if we accept that attributions of awareness are facts to the people who experience them, and that those facts may influence their behavior in our studies, we must acknowledge that "soft" human data can be very "hard." We believe it is entirely appropriate and even essential for awareness to be defined by subjects: self-reports of brain-damaged patients, for instance, are already considered valid.

Level of encoding. The present study only partially supports Bowers and Schacter's (1990) findings regarding the effect of level of encoding on performance in implicit testing. These authors had found, in the group of test-uninformed subjects, that the test-aware subjects completed a higher proportion of semantically encoded words than structurally encoded words; test-unaware subjects completed equal proportions of semantically versus structurally encoded words. In contrast, using our awareness criterion, we found that priming was equal in semantic and structural processing conditions, with only a non-significant tendency for test-aware subjects to complete more stems with semantically encoded words, particularly in the test-uninformed condition. In turn, in applying the BSC awareness to our data, we found identical levels of priming for structurally and semantically encoded study words wether subjects were aware or not. In explicit testing, and as expected, significantly more semantically encoded words were correctly recalled than structurally encoded words. As well, the level of encoding manipulation reflected significantly more errors for structurally encoded words than for semantically encoded words.

Interpretations of awareness and level of encoding influences. Overall, the present study is in accord with recurrent findings in the literature that level of processing does not affect implicit memory performance, but does affect explicit memory performance (e.g., Graf & Mandler, 1984; Graf et al., 1982; Jacoby & Dallas,1981; Schacter, 1989; Schacter et al., 1989; see for review, Richardson-Klavehn & Bjork, 1988). For example, using a depth of processing manipulation (rating a word's pleasantness versus counting its vowels), Graf et al. (1982; see also Graf & Mandler, 1984) found no effect on word stem completion. What was particularly interesting about their study was that, as in the present study, the stem in the implicit test and the cue in the explicit test were identical; only the instructions differed. Analogous results have been reported for lexical decision (Kirsner et al., 1983), perceptual identification (Jacoby, 1983b; Jacoby & Dallas, 1981), and fragment completion (Blaxton, 1989; Roediger & Blaxton, 1987), among others. A few exceptions to these findings have been found, however, (e.g., Hamann, 1990; Schacter & Graf, 1986, s udying memory for new associations; Srinivas & Roediger, 1990). Despite this, in the paradigm of words studied individually in a list, we can conclude with confidence that our results extend the widespread observation that elaboration, as conceived as a depth manipulation, exerts a large effect on explicit test performance and little effect on implicit test performance.

It has been suggested (e.g., Bowers and Schacter, 1990; Howard, 1988) that test-aware subjects may use an explicit strategy as soon as they realize that the stem completion test is actually a memory test, and that this awareness inflates and modifies subjects' performance on a stem completion task. Bowers and Schacter supported this contention with their finding that contrary to their test-unaware subjects, and similarly to the cued recall performance of all their subjects, their test-aware subjects completed a significantly higher proportion of semantically encoded words than structurally encoded words. The present study does not seem to support this hypothesis. In fact, in applying the BSC awareness to our data, we found identical levels of priming for structurally and semantically encoded study words for aware subjects. In applying our awareness criterion, it was found that while test-aware subjects gave greater priming effects than test-unaware subjects, test-aware subjects only tended to use higher proportions of semantically encoded words as stem completions.

This hypothesis that aware subjects use explicit strategies in indirect testing is further weakened by our subjects' self-reports collected at post-experimental inquiry. When given a full range of choices which represent possible cognitive processes during stem completion, it was found that most aware subjects reported that even after noticing a link between a study word and a particular stem, they simply continued completing the stems with the first word that came to their mind. Very few subjects reported either refraining from, or purposefully using words from the study list for the stem completions once they became aware. Analyses excluding these latter subjects produced the same results as presented earlier.

An alternative possibility, raised by Bowers and Schacter (1990), is that test-awareness results from subjects who provide a greater number of correct stem completions (i.e., who complete more stems with words from the study list). These authors expected, as derived hypothesis from this second possibility, that this sort of subject selection effect would be more prominent with stem completions derived from semantically studied words since more semantically encoded words are explicitly remembered.

Again, this subsidiary possibility is weakened by our results which indicate only a non-significant tendency for test-aware subjects to exhibit higher completion for semantically encoded words than do test-unaware subjects, particularly in the test-uninformed condition. These findings, however, do not confirm nor infirm the first part of this hypothesis (if we do not want to throw the baby with the bath water).

Bowers and Schacter (1990) reject this second possibility and, on the contrary, favor the first possibility based on their finding that their not informed group of subjects, which includes test-aware subjects, completed a significantly higher proportion of stems for semantically encoded words than their informed group of subjects, who are considered as test- aware by the authors. For them, this finding reflects the fact that aware subjects are using strategies at stem completion, while test-informed subjects do not use any. In fact, these authors consider that informing subjects before the stem completion task, represents an implicit demand for not using strategies in order to obtain higher completion rates.

Such a reasoning does not receive support from our study since it failed to demonstrate any difference in implicit responding rates for semantically encoded words between informed and not informed subjects.

Forces other than the use of explicit strategies in implicit responding by aware subjects may be at play. Rather than awareness being a prerequisite for intentional processing, awareness has been found to sometimes follow behavior and to reflect an inference or attribution process (e.g., Jacoby, Kelley & Dywan, 1989; Kelley & Jacoby, 1990). Performance on the Stroop test (1935) illustrates this point. Subjects are aware of the color words that interfere with their naming of the physical color, and yet are influenced by it against their will. In the words of MacLeod (1991, p. 190): "When people are unaware of the stimuli controlling their responses we conclude that the responses are unintentional, but when they are aware of the stimuli, the responses are not necessarily intentional."

These considerations, combined with the failure of the present data to support the hypothesis that test-aware subjects use explicit strategies in implicit testing, seem to favor c the alternative hypothesis of awareness as resulting from higher stem completion rates.

Unfortunately, results obtained for correct recall do not help resolve the dilemma between these two hypotheses. Subjects who had become test-aware on implicit memory testing later correctly recalled more studied words than did subjects who had remained test-unaware. In general, subjects intentionally remembered correctly more semantically encoded words than structurally encoded words. Using the hypothesis of subject self-selection, this could be interpreted to mean that subjects who spontaneously have access to more semantically encoded words at implicit testing are the ones who became aware and accordingly, who can intentionally recall more semantically encoded words at direct testing. In fact, subjects who were test-aware at indirect testing tended to have higher correct recall performance for semantically encoded words than subjects who had reported to have remained test-unaware at indirect testing. However, the alternative hypothesis that subjects who became test-aware strategically tried to complete stems at indirect testing with words previously studied and therefore completed more stems with semantically encoded words fits as convincingly well with the obtained results for correct recall.

The concept of awareness is an important one in helping to clarify differential performance effects observed between implicit and explicit testing and how they relate to the distinction between implicit and explicit memory respectively. It must be remembered that the former refers to the effect of an episode that is expressed automatically and without conscious intention of remembering, while the latter refers to the conscious and controlled intention of remembering. The present study represents one more step in the quest of determining if normal subjects do not use intentional retrieval strategies in implicit testing, and thus if implicit testing corresponds to expressions of implicit memory: in fact, our data seem to support these contentions.

Effects of being informed and of language of education. Considering the impact on implicit memory performance of the variable of information provided to subjects prior to testing, we obtained the same results as Bowers and Schacter (1990). Informing subjects prior to testing did not increase or decrease rates of completion with study words in comparison to not informing them. However, this statement needs some qualification when examined in the light of its interaction with Language of Education.

Comparisons of the performance on the stem completion test of subjects who have done their complete schooling in English (n = 52) and of subjects who received only a partial education in English (n = 32) were made. These indicated that level of fluency in English conferred neither an advantage nor a disadvantage on rate or type (semantically versus structurally encoded words) of stem completion when data are pooled regardless of the information received before indirect testing. But a different pattern emerges when the information received prior to testing is taken into consideration.

A significant interaction between pre-test information and language of education variables was found. When examined, it appears that individuals who were educated exclusively in English profited from being informed prior to the indirect testing and completed more stems with the study words, while subjects' performance was lower in the not informed condition. Conversely, not being informed prior testing provided an advantage to participants whose education was only partially in English, while their implicit memory performance was hindered by receiving prior to testing information.

There was no interaction between awareness and language of education, nor between level of encoding and language of education. Thus, the differential effect of information on implicit memory performance when language of education is considered does not seem to be mediated by the awareness of subjects nor by the level of processing of study words at encoding. Unfortunately, the additional information that the 3-way interaction between awareness, language of education and information conditions could have provided is not available; this 3-way interaction could not be statistically investigated due to the fact that the Partial English/Not-Informed/Aware cell had too few observations ($n = 2$).

It is possible that informing subjects prior to indirect testing biased their later report of awareness. More likely, one could hypothesize that being informed leads individuals who are fluent in the language of testing (English here) to respond to some demand characteristics somehow implied in the instructions they received, and to successfully complete more stems with study words. In contrast, for informed people less proficient in the language of testing, it is possible that unintentional or intentional search is first directed at words from their mother tongue. This competitive process would then reduce the amount of priming from target words. This last interpretation gains support from Potter, So, Von Eckardt, and Feldman (1984) who hypothesized that, for individuals less proficient in a second language than their native tongue, comprehension of a word is always mediated by access to units of the more proficient language. That is, access to and from a word in the less proficient language is always mediated by the activation of the parallel word in the more proficient language.

Conversely, it appears that in the not informed condition, individuals more fluent in the language of testing lose the advantage of being informed. Individuals less fluent in the language of testing are at an apparent advantage, perhaps by naturally letting happen whatever the process of implicit remembering is. For these latter subjects, this advantage could be provided by the fact that recently activated study words stand out more in their mind relative to a smaller number of alternative words sharing the same stems, or by being associated to fewer target words in the same language. In comparison, subjects whose primary language is the language of testing might have access to more alternative words for the same stems or more associates to the target word, and therefore might have a lower probability of completing stems with study words. Such an hypothesis regarding not informed subjects' performance receives support from studies by Nelson and his colleagues (Nelson, Canas, Bajo, & Keelan, 1987; Nelson, Keelan, and Negrao, 1989; Nelson, Schreiber, Holley, 1992). These authors found that given word stems as test cues, and regardless of wether the test instructions were direct or indirect, and independently of the levels of processing manipulated during study, recovery is less likely when the target has a large set of meaningfully related associates (for example the target GEM produces diamond, jewel, stone, and so forth) than when it has a relatively small set. This hypothesis is based on an activation view of implicit memory that stipulates that a sensory input is maintained in an activated state for a certain amount of time that allows further automatic processing (e.g., Mandler, Graf, & Kraft, 1986; Graf & Schacter, 1985). Not only the presented word, but also its closest associates, would be activated at presentation, regardless of whether subjects are rating pleasantness or counting the number of T-junctions. Depending of the number of associates activated, this activation would differentially support target recovery at implicit testing. Theoretical implications of these findings on language of education will be discussed later in more details.

This interpretation also implies that subjects instructed to "pretend" (i.e., informed subjects) must behave differently from subjects who do not receive such instruction in order to suggest some "real" implicit effect. In the words of Bowers and Schacter (1990), informing subjects at test that they may find themselves using study words is supposed to operate as a way to "prohibit subjects from using explicit strategies" (p. 409). This supposition is certainly not supported by the findings of Tzelgov, Henik, and Leiser (1990). These authors, studying the differential impact of language of testing in relation with language proficiency of their subjects on the Stroop performance, found that subjects were able to decrease the interference of the expected language in incongruent presentations when the stimulus language matched their language proficiency, but not when language of stimulus and language of proficiency mismatched. To explain their finding, these authors offer the hypothesis that proficiency of a language is a precondition for the suppression process in reduction of interference effects of incongruent presentations. Therefore, if this hypothesis is true, and contrary to what was found, informed subjects in the present study who were more fluent in the language of testing would have obtained a lower proportion of stem completions than informed subjects less proficient in the language of testing. The information instructions seem rather to act as an "implicit" demand to use a word previously learned, with the result that, in the informed condition, subjects more proficient in the language of testing completed more stems with study words.

Thus, Bowers and Schacter (1990) by not taking language of education into consideration might have been unable to demonstrate that informing subjects or not prior to testing may impact differently on implicit memory performance. Moreover, Bowers and Schacter's subjects were recruited students of the University of Toronto, which according to our knowledge, also comprises people from different national origins. If it is not a spurious finding, this new information regarding language proficiency effects should be taken seriously when, as in the present study, verbal tasks are involved. To our knowledge, the effect of language proficiency was never investigated in this manner in other studies. The present finding is certainly in need of replication, perhaps with two languages of testing being compared in groups of subjects with two different mother tongues.

We found a related, and intriguing finding for correct recall performance; a 3-way interaction between Language of Education x Awareness x Level of Encoding emerged as significant. Test-awareness at implicit testing was associated with higher later correct recall for semantically encoded words in subjects who had partial English schooling than for subjects whose schooling was totally in English. This pattern is reversed for structurally encoded words correctly recalled. Again, test-unawareness reverses these two last outcomes. As it stands, this significant interaction is not readily explained by any of the previous hypotheses and is open for further investigation.

Errors in explicit memory performance. Errors of explicit remembering also revealed some interesting findings. Significantly more errors in recall were made for structurally encoded words than for semantically encoded words. According to activation (e.g., Graf & al., 1982; Jacoby & Dallas, 1981) and multiple memory systems (e.g., Schacter & Tulving, 1982; Squire, 1987; Tulving & Schacter, 1990) views, the fact that structurally encoded words have a lower recall rate than do semantically encoded words, supports the contention that errors at recall are more likely for structurally encoded words, because the former have less episodic memory traces than the latter.

Moreover, significantly more errors in recall appeared for words tested previously on the stem completion task than for words not tested. And since not all stems were completed by subjects in the explicit recall test, rendering this number independent of the correctly recalled words, it was found in contrast that implicitly testing or not before recall, did not affect correct recall performance. It seems that indirectly testing for certain study words introduces more chance of producing errors on a later recall, while not affecting correct recall. It is possible to explain these differential findings by hypothesizing that when subjects are sure of correctly remembering a word, they correctly report it, and when subjects are not sure about the origin of a word, they generate recall errors. Moreover, previous testing would contribute to confusing subjects further about the origin of a word. This last assertion could be explained by the possibility that when certain stems at indirect testing are completed with words not originating from the study list, they are nevertheless encoded and later confused with target words. This explanation is consistent with the reality-monitoring model of Johnson and Raye (1981), in which errors in self-monitoring (Snyder, 1974) and errors in monitoring of other phenomena can be responsible for unconscious influences from the past. Within the context of the present study, it could be posited that the episodic self-generated origin of non-studied words gets confused with the episodic origin of studied words. Subjects may thus become more at risk for producing errors at recall. Alternatively, the transfer appropriate view (Roediger & Blaxton, 1987) would explain these results by stating that the generated errors at stem completion did not profit from conceptual encoding operations. The hypothesis that errors at recall are related to errors at indirect testing could be explored further in future research by stochastically comparing incorrect stem completions that are later reported in incorrect recall.

Some support for this hypothesis comes from the work of Jacoby and colleagues (e.g., Jacoby & Kelley, 1987; Jacoby, Kelley, & Dywan, 1989). They have developed an analysis of remembering in which they study the conditions under which people attribute familiarity of current conscious experience to past events (memory) or to other sources, such as the salience of the current event. They have provided many demonstrations of errors in memory; people can misattribute the familiarity caused by previous experience to a current event's perceptual salience, but under different circumstances can also misattribute the salience of a current event to its past history. Jacoby and Kelley (1987) conclude that for maximal effects of misleading postevent information, enough attention must be directed to it to integrate it, but not so much that it can be detected as discrepant and so resisted. In this vein, Tousignant, Hall, and Loftus (1986) found that subjects who paid more attention to a misleading text by reading it more slowly were later less likely to be misled. Tousignant et al. speculated that the relationship between attention to postevent information and the effects of that information may be curvilinear.

It seems that the weight of these errors at recall is carried by informed subjects, for structurally encoded words. In fact, for structurally encoded words, being informed led to significantly more recall errors on words indirectly <u>tested</u> previously relative to <u>untested</u>. Not being informed led to equal proportions of recall errors over the tested/untested conditions for structurally encoded words. No differential effects were observed for semantically encoded words.

Using the reality monitoring model, one would assume that informed subjects at indirect testing pay relatively more attention to the possible links between their completion and words studied earlier (possibly more so to completions with semantically encoded words), that they overlook the completions that do not come from study words, especially for stems aimed at structurally encoded words. So when errors are introduced as stem completions in structurally encoded word-stems, subjects may notice something familiar about them later at recall, but not so much so that their origin can be remembered. Subjects may confuse these new words with studied words and reuse them later at recall instead of the structurally encoded words. When subjects are not informed prior to indirect testing, they may focus equally on all the stem completions, including completions with new words. They would then become more conscious of the origin of new words they introduce, and be less likely to confuse them later at recall with target words. Conversely, this effect would be absent for semantically encoded words because they are more explicitly remembered and therefore less likely confused with errors generated as stem completions regardless of the informed condition of subjects. Alternatively, if one considers that recall errors are due to simple guessing, it then becomes hard to explain why informed subjects versus not informed subjects "guess" more so for structurally encoded words.

Errors at direct testing may reflect unconscious influences underlying intentional efforts of individuals, and are fertile in stimulating the development of hypotheses. Other interesting hypotheses regarding the differential processes involved in implicit and explicit memory come from some of the individual differences measured in the present study.

Memory Performance and Individual Differences

Hypnotizability and implicit memory. First, an interesting finding emerged in terms of individual capacity for hypnosis. As predicted, subjects with higher implicit memory performance obtained higher hypnotizability scores as measured by the HGSHS:A. This significant relationship argues for the likelihood that the ability to implicitly or unintentionally remember depends on a personality trait akin to the ability to experience suggestions in hypnosis as involuntary. In fact, as mentioned earlier, the ability to experience suggestion as involuntary has been demonstrated to highly correlate with certain "objective" indices of hypnotizability. Bowers (1982) has reported a high correlation between behavioral responsiveness to suggestion experienced non-volitionally as measured by their criterion and the SHSS:C. Bowers, Laurence and Hart (1988) also found that a substantial number of participants (approximately 80%) passing a test item experienced the enactment of suggestions as involving some degree of non-voluntariness. Of their participants, 32.2% reported that their response had been experienced as "happening by itself.

The finding of a positive relation between implicit memory performance and hypnotizability constitutes further support for the conceptualization of implicit memory as involving, at least in part, automatic processing. This deduction is in line with our direct priming results, even in subjects who report having been unaware at testing, and in line with other researchers' indications that automaticity is at play in implicit memory (e.g., Jacoby, 1991).

The view that implicit remembering and hypnotic responding are both sustained by automatic processing also has implications on current conceptualizations regarding differences between high and low hypnotizable subjects. It reinforces the dissociation account of hypnotic responding put forward by Hilgard, whereby mental activity goes on outside the usual stream of consciousness, outside usual cognitive controls and consequently is experienced as involuntary (Hilgard, 1977).

The present finding is, however, inconsistent with social-psychological accounts of hypnotizability differences, as it was obtained in a context outside of the hypnotic one. All memory testing was done outside of the laboratory and no mention of hypnosis was made until after memory and Stroop measures were taken. Thus, the relation between implicit and hypnotic responses cannot be explained by compliant behaviour on the part of subjects, nor could it be a context-dependent effect.

This particular result could be best understood within a synergistic account of hypnotizability. The basic premise of this approach is that hypnotizability differences are not explicable in a univariate manner. Rather, each difference in hypnotizability is seen as contributing one synergistic aspect to a multidimensional construct that is termed hypnotizability. So far, individual differences in hypnotizability have been related to underlying differences in styles of mentation, attitudes, responses to situational variables and possibly cognitive processing, among others. The present finding supports the view that the individual difference of automaticity in cognitive (here memory) processing is a contributing element of hypnotizability differences. Moreover, the present finding supports the claim made by the proponents of the synergistic approach that situational variables are not the only ones to explain hypnotizability differences.

Other considerations may make this last finding even more salient. Since the HGSHS:A was the first of three measures of hypnotizability administered, this relation between HGSHS:A scores and implicit memory performance seems strong enough to emerge even when hypnotic responding has not been practised, that is even before subjects reach their plateau level of hypnotizability. The absence of significant relation between each of the two other measures of hypnotic susceptibility and implicit memory, may simply be due to the fact that they were entered in the regression analysis after the HGSHS:A. However the obtained results are in need of replication. As suggested by Nadon et al. (1991), more robust effects may be found when using more than one hypnotizability measure, and by limiting subject selection to those who are stable on the three measures. Unfortunately, as these authors add, this type of extensive screening procedure is demanding in terms of expense, energy and time incurred on the part of the experimenters, especially within a multivariate experimental framework which requires fairly large sample size.

<u>Stroop task performance and correct explicit memory</u>. The results pertaining to the information processing

variables demonstrated that response times on incongruent Stroop trials were negatively related to explicit memory performance[1]. Subjects with higher explicit memory performance experienced on average less interference between the incongruent color-word and the physical color, while subjects with lower explicit memory performance had slower reaction time. It seems as if when an individual is more efficient at voluntarily retrieving past information, he/she is also more efficient at inhibiting competing visual word-stimuli in the Stroop tests. Intentional control of cognitive processes would represent the individual capacity involved in both performances.

This contention is supported by Tzelgov et al. (1990) who, from their work with bilingual individuals, interpreted control in a Stroop task as reflecting suppression of irrelevant activation. In turn, Lindsay and Jacoby (1992), extended the findings of others (e.g., Logan & Zbrodoff, 1979; Lowe & Mitterer, 1982; Tzelgov, Henik, & Berger, 1992) in demonstrating that subjects can exert a remarkable degree of control over "automatic" word-reading processes on the

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[1] Inherent in the incongruent trial reaction times there is, however, a certain amount of noise in this measure since it does not distinguish between slow responders, versus those with high automaticity. Therefore, even though incongruent trial reaction time is the most commonly employed measure for representing automaticity of subjects, further experimentation could use the more precise measure of the difference between congruent and incongruent trials. Larger automaticity would then equal larger differences between congruent and incongruent trials.

Stroop task. Furthermore, their results indicated that this control was not limited to peripheral input-degradation tactics (e.g., blurring one's vision or focusing away from the stimuli).

Future experiments could seek to replicate the relation between explicit memory and control effects on the Stroop task, using Jacoby's process dissociation computations for Stroop performance in conjunction with explicit memory testing in the same experiment. It could be interesting to test the hypothesis of an overarching cognitive process such as intentional control to account for performance on these tasks.

Absorption and correct explicit memory. Further support for the notion that implicit memory involves automaticity while explicit memory involves controlled processing, comes from the results related to absorption as measured by the TAS scale. Research participants with higher explicit memory performance for semantically encoded words exhibited higher absorption than participants with lower explicit memory scores for the same words. Conversely, a weaker and negative relationship for structurally encoded words emerged.

Tellegen (1981) argued that absorption is a disposition for committing focal undivided "attentional" resources to a single object or event, either internal or external, in a narrow or expansive way. Scores on TAS have been predictive of performance on a task involving focused attention. In a series of studies, Qualls and Sheehan (1979, 1981a,b) compared the electromyographic (EMG) biofeedback performance of subjects scoring high and low on TAS. High-absorption participants were less successful in reducing frontalis EMG following biofeedback than were low-absorption participants. This difference was attributed to an interference effect in the biofeedback condition (Qualls & Sheehan, 1979, 1981b). In the case of the high-absorption subjects, the biofeedback signal was interpreted to lead to an external focus of attention which interfered with the use of imaginal strategies. When the subjects were explicitly instructed to use imaginal strategies, however, this interference with the biofeedback performance for high-absorption subjects disappeared (Qualls & Sheehan, 1981a).

The current established view is that there is a relation between attention and episodic explicit memory (Nissen & Bullemer, 1987). In fact, manipulations of attention at learning have large effects on later intentional use of memory (Jacoby, 1983a). For example, Parkin and his colleagues (Parkin, 1979; Parkin, Reid, & Russo, 1990) showed that explicit memory, as measured in a recognition task, is affected by dividing the attention task during the initial learning phase. In contrast, implicit memory, as measured in a picture completion task, remains unaffected. Others (Eich, 1984; Grand & Segal, 1966; Koriat

& Feuerstein, 1976) have reported evidence that dividing attention at encoding is more disruptive for performance on direct than indirect tests of memory.

Jacoby, Woloshyn, and Kelley (1989) used an opposition strategy to investigate effects of attention on familiarity judgments. In a series of experiments, attention to a list of nonfamous names was either full or divided, requiring subjects to simultaneously monitor a string of digits presented auditorially. Dividing attention resulted in old nonfamous names later being more likely to be mistakenly called famous than new nonfamous names. In the condition of full attention, participants consciously recognized old names from the list and thus knew that they were nonfamous. Jacoby et al. interpret their experiments on recognition memory to show that an unconscious influence of memory (i.e., the use of familiarity as a basis for judgments) remains constant over manipulations of attention at learning. The effect of dividing attention at encoding is seen to limit the intentional use of memory.

In light of these studies and to the extent that the TAS as a scale of absorption is a measure of individuals' capacity to devote "attentional" resources and meaning to the encoding of study words, it is not surprising to find a positive relationship between absorption scores on the TAS and explicit memory performance for semantically encoded words. Moreover, to the extent that structurally encoded words are not processed as integrated wholes, we could assume that less attention is imparted on them at encoding. Hence, it makes sense that high absorption scores do not provide an advantage on explicit remembering for structurally encoded words. In fact, high absorption capacity may even slightly hamper such remembering to the extent that it enhances the focus of attention on individual letters at the expense of some of the capacity devoted to processing words as unitized and meaningful representations. Furthermore, the differential relationship between level of encoding and absorption in explicit remembering supports the notion that absorption exerts its effects at encoding rather than at retrieval.

Of course, such reasoning does not apply to implicit remembering. The lack of a relationship between implicit memory performance and absorption capacity is in accord with earlier findings that unconscious influences of memory are invariant across manipulations of attention. We can therefore conclude, following Jacoby et al. (1989) that controlled (explicit) uses of memory rely on attention in a way that automatic (implicit) use of memory does not.

<u>Imagery capacity and errors in explicit memory</u>. Moreover, it was found that when imagery scores as measured on the IDQ increase, errors in explicit remembering decrease for words that were previously tested on the stem completion test. This effect seems absent or slightly reversed for

words that were not tested on the stem completion task. It is as if, as imagery increases, it protects against explicit errors, but only if the words have been tested previously. The first possible explanation of this protection phenomenon is that high imagery subjects could have encoded the study words with more meaningful images attached to them. Imagery may lead to more accurate explicit recall after a task like indirect testing by preventing the introduction of errors of reality monitoring. This explanation, however, is contradicted by the finding that subjects with higher imagery capacity did not generate less errors at recall when words were not previously indirectly tested.

Another possibility is that high imagery capacity, by attaching strong images to errors generated at stem completion, protects against confusing the origin of these new words with the origin of the study words. This last proposition is even less likely, since it has been found regularly in the literature that high imagery capacity is associated with more memory creation, therefore with <u>more</u> errors in reality monitoring (for reviews see Kenney, 1989; Labelle, 1994; Tremblay, 1988).

A third interpretation is that imagery capacity reduces the proportion of recall errors by reinforcing the practice effect of successful stem completions at implicit testing, and probably more so for semantically encoded words. It is possible that the process of attaching images to perceived words requires a minimum of exposure to these words, and would become efficient only after the practice effect of a first testing before recall. Moreover, since at study subjects were busy determining the pleasantness or the number of T-junctions of the target words, they might not have had enough time or available cognitive capacity to attach sufficiently strong images to the presented words. Since other individual capacities do not shed more light on this phenomenon, and until further research is done on it, this third hypothesis appears to us, for now, the most plausible.

Hypnotizability and errors in explicit memory. Two other individual capacities, i.e., objective and subjective hypnotizability, were intriguingly related with the production of recall errors in ways that are difficult to explain. It turns out that when depth of encoding of study words (superficial/structural versus deep/semantic) and depth of focus at stem completion (not informed/less focused versus informed/focused) are matched (i.e., both low depth or both high depth), high hypnotic responding as measured on the HGSHS:A seems to offer a protection against errors at recall on words which were previously tested. Conversely, when depth of encoding of study words and depth of focus on the implicit task are mismatched, having high hypnotic capacity on the HGSHS:A seems to increase the proportion of errors made at recall on words previously tested.

However, when reports of experienced involuntariness are used as a measure of hypnotizability (i.e., CURSS:OI scores), these effects were reversed. Basically, objective hypnotizability scores on the HGSHS:A scale and involuntariness scores on the CURSS:OI scale are inversely related to proportion of recall errors.

While the HGSHS:A scale is based on subjects self-reports of objective hypnotic responding, the CURSS:OI assesses the extent to which objective responses are rated as feeling involuntary. The ability to experience suggestion as involuntary has been demonstrated to correlate highly with certain "objective" indices of hypnotizability (Crouse & Kurtz, 1984). However, since the majority of items on the CURSS are conceptually more demanding than most of items on the HGSHS:A, it is possible that a) some individuals identified as highly hypnotizable on the HGSHS:A may not have had an appropriate subjective experience of hypnosis on the CURSS scale, and/or b) may not have experienced the items passed as having an involuntary component, or c) may have been compliant on certain suggestions. In the present study, the correlation between HGSHS:A and CURSS:OI scores was moderate (.58). This seems to confirm the supposition that the two scales were addressing partly different hypnotic experiences by subjects, which might explain the reversal of results observed here.

The present patterns obtained may be too complex to be easily interpreted here, as they are the first of their kind in the literature and there were no other significant simpler effects to help to explain them.

Theoretical Implications

Results of differential effects of levels of processing on implicit and explicit memory, like the ones we found, have led to the formulation of the popular processing view. According to the version offered by Roediger and colleagues, the distinction between explicit and implicit memory tests reflects differences in the overlap between the mental operations applied at study and those applied at test (Blaxton, 1989; Roediger, 1990; Roediger & Blaxton, 1987; Roediger et al., 1989; Srinivas & Roediger, 1980). Conceptually driven tests such as free recall are assumed to benefit most from conceptual encoding operations, whereas data-driven tests such as stem completion presumably profit most from perceptual encoding operations. This is considered particularly true under incidental learning conditions where encoding operations cannot be planned and tailored according to any form of subsequent tests. Mere incidental exposure to a word, according to this framework, increases the strength of item-specific information, whereas elaboration affects the strength of relational information. Accordingly, the levels of processing manipulation predicts effects on explicit tests of memory but not on implicit tests of memory.

This approach, however, encounters problems if used to explain the results of the present study, in which level of processing effects were evaluated by using the same test cues for both implicit and explicit memory tests. As Greene (1992) argues, the processing view seems to ignore the central distinction between explicit and implicit tests: It does not address the issue of consciousness. Without conscious awareness that a particular stimulus had been experienced in a certain time and place, subjects would be unlikely to give it as a response in explicit testing. On the other hand, implicit testing is based on no conscious reference being made to a prior experience at the time of test. Our results, by demonstrating priming effects even for subjects who did not become consciously aware, confirm the assumption that implicit remembering does not rely on conscious awareness, and that the issue of a difference in awareness between implicit and explicit responding should be taken in consideration by a theoretical model.

In order to address the issue of consciousness, proponents of the processing view (Roediger & Weldon,1987; Weldon & Roediger, 1987) have made the assumption that consciousness in direct testing is related to conceptually driven processing (like reflecting on the meaning or developing an image) and not on data-driven processing.

Instead, data-driven processing in implicit memory testing is postulated to require a response to the presented data without the necessity for higher level reflection. The reasons for such a relationship are not clear, however, and the approach is still faced with the unresolved problem of explaining how the same cues can be data-driven under some conditions and conceptually driven in others. Moreover, this version of the processing view does not make any prediction regarding the influence of fluency in the language of testing on memory performance.

The different activation views (e.g., Graf et al., 1982; Jacoby & Dallas, 1981) also account for the finding that priming of preexisting task representations does not depend on depth of processing. These views hold that study tasks presumably engage a combination of activation and elaboration and differ in the emphasis placed on each type of processing. Elaboration (or controlled) processing is considered necessary for the establishment of new episodic memory traces and would sustain explicit memory performance. Conversely, direct priming effects on implicit memory are seen as depending on the temporary and automatic activation of preexisting representations, knowledge structures, or logogens (e.g., Graf et al., 1982; Graf & Mandler, 1984; Graf & Ryan, 1990; Jacoby & Dallas, 1981; Morton, 1979; Rozin, 1976). At implicit testing, an activated representation readily comes to mind, but it contains no contextual information about a stimulus occurrence as part of a recent episode and therefore does not contribute to explicit remembering of the episode. As level of encoding effects are considered to be dependent on elaborative processing, these views' prediction that these effects will be manifest at direct testing but not at indirect testing is in line with our obtained results. Although these approaches do not address directly the question of language of fluency, they link the encoding of relevant prior knowledge to the elaboration process. Meaningfully related associates of a stimulus word are presumably incorporated into its elaborative encoding. Therefore, these views would predict language of fluency effects, as related to activated meaningful associates of a target, to be more apparent in direct testing than in indirect testing. Such effects, however, were more apparent under indirect test instructions in our study. Although these approaches can explain effects related to the controlled aspects of meaningful processing, such as manipulations of level of encoding, they do not seem to provide an adequate explanation of effects related to more automatic aspects of processing such as those associated with language of fluency effects.

Finally, among the multiple memory systems views (e.g., Schacter & Tulving, 1982; Squire, 1987; Tulving & Schacter, 1990), the episodic/semantic distinction can account for priming phenomena by postulating that performance on completion and identification tests depends upon activation of the semantic memory system, whereas explicit recall and recognition depend on the episodic memory system, even when the tasks are based on the same cues. This approach does not preclude the intentional versus unintentional or conscious versus unconscious distinctions between explicit and implicit remembering. Furthermore, this approach could potentially account for our language of fluency effect since it assumes an activation of associated meaningful words upon a stimulus presentation. This activation of associate words, which would underlie our obtained effect of fluency of language, is assumed to develop context-free representations, arising in a separate system from representations concerned with more recently acquired episodic information. Direct instructions presumably provide access to the system underlying the episodic system, whereas indirect instructions increase reliance on a system underlying semantic, procedural, or implicit memory (for reviews, see Hayman & Tulving, 1989b; Richardson-Klavehn & Bjork, 1988; Roediger, 1990; Schacter, 1987). This would explain our effect of language fluency in implicit memory. It could not, however, explain the 3-way interaction obtained at explicit testing between awareness at indirect testing, level of encoding, and language of fluency. This perhaps spurious finding aside, we find nothing in the results of the present study that forces us to reject or modify the idea that implicit memory is subserved by a memory system different from the one that makes possible conscious recollection of events. This theoretical approach seems, thus far, the most useful in interpreting our results.

Conclusion

Like its model study (Bowers & Schacter, 1990), our research avoided the confound of memory processes involved in different tasks with different kinds of stimuli by using the same stimuli (stems) for both implicit and explicit memory tasks. Aside from the development of a new awareness criterion, the present study is useful in that it offers new contributions to the research on the distinction between implicit and explicit memory. Our results replicate the findings of Bowers and Schacter in suggesting that direct priming seems possible outside of intentional or conscious remembering, even in self-reportedly unaware subjects. Based on subjects' self-reports awareness seems more likely an outcome of higher levels of implicit responding. The tendency for aware subjects to complete more stems with semantically encoded words is more likely an outcome of the experimental manipulation at encoding rather than the use of intentional retrieval strategies. We found, however, that the Test-Informed/Test Not-Informed manipulation somehow differently influences implicit performance depending on the fluency of individuals in the language of testing. In the not informed condition, fluency of language was interpreted to exert its influence through differential activation of meaningful associates. Our finding of a positive relationship between hypnotizability and direct priming performance confirms the implication of automaticity in implicit remembering. It is thus as appropriate now as it was in 1819, to quote the Abbe Faria: "N'est-ce pas un paradoxe de dire que l'on influe sur nos propres actions, et que nous ne sommes pas conscients de notre influence propre?" (cited in Laurence & Brosseau, 1990). Translated meaning, "Is it not a paradox to say that we influence our own actions, yet remain unaware of our own influence on them"?

Furthermore, we found that level of encoding effects on correct explicit remembering are related to absorption, indicating that attention favors semantic encoding while disfavoring structural encoding. The importance of control in explicit remembering is emphasized by our finding that control on Stroop tasks (i.e., reduced interference on incongruent trials) is related to increases in correct recall. We also demonstrated that indirect testing before a direct test on the same words introduces more errors at recall, interpreted as unconscious errors in reality monitoring. This effect was attenuated, however, by increases in imagery ability, which exerted a reducing effect on recall errors, perhaps via a reinforcing, or practice effect, supporting more correct explicit remembering.

Beginning with the original study of Bowers and Schacter (1990), and now with ours, the concepts of awareness and of unconsciousness have made a welcome return in memory research. Although the present study does not completely solve the problem of what direct priming "is" or how it differs or does not differ from other kinds of learning and memory, it demonstrates the importance of automaticity in implicit memory and of conscious control in explicit memory. Our data also support the existence of relatively long-lasting implicit memory effects that are empirically dissociable from explicit memory performance, and thus support theoretical views that distinguish implicit from explicit modes of retrieval, especially a multiple systems view (e.g., Schacter & Tulving, 1982; Squire, 1987; Tulving & Schacter, 1990).

The findings reported here seem to us to open up a variety of additional questions concerning the relationship between implicit and explicit memory. Would the same results for implicit memory performance hold in hypnosis? Would they improve for highs in congruence with the social-psychological perspective? Would instructions of devoting more or less attention to the study list influence performance in line with absorption effects? Such investigations could inform us about the role of attention in hypnosis and memory, and of the extent to which hypnosis can be used to control attention.

By providing support for a relationship between hypnotic susceptibility and implicit memory performance, this study should stimulate future multivariate research in implicit memory which takes into account cognitive abilities in the waking state. Research on the effects of fluency in the language of testing on implicit remembering should be furthered as well. Similarly, our results could stimulate related research on the role of attentional skills, as measured by absorption, that may contribute to effects of level of encoding in explicit remembering. Relation between explicit memory and performance on Stroop tasks should be investigated further. Such a study may do well to manipulate proportions of incongruent and congruent presentations, combined with Jacoby and colleagues' process dissociation procedure as applied to Stroop performance (e.g., Jacoby et al., 1989) in relation to explicit and implicit responding. In any case, the process dissociation procedure, which estimates the separate contribution of intentional and automatic processes to the performance of a task by pitting conscious responding against unconscious influences, is in need of replication by independent researchers. Our results on errors in recall as they relate to sequential testing and to imagery should stimulate research on the relation between errors at indirect testing and errors at direct testing.

Future research could attempt to assess awareness more deeply by asking subjects to retrospectively identify the stems they were conscious of completing with study words "at the time" of completion. Hopefully, such a procedure would allow for the differentiation between subjects who just happened to notice that one of the stems was previously encountered, and those who caught on to the purpose of the experiment and used explicit strategies. Another way of verifying this last possibility (as suggested by Schacter and Graf, 1986) would be to verify if completion rates are higher near the end of implicit testing than near the beginning.

On the other hand, would individuals who exhibit higher implicit memory performance be the ones who acquire automaticity more rapidly? Or would people with higher explicit memory performance acquire control faster? To verify this, the evolution of performance on the Stroop task as designed by Macleod and Dunbar (1988) could be used. These researchers trained subjects to call each of four different white-colored random polygons by a different color name (e.g., one shape was to be called "blue", another "red", etc.). Later the shapes were presented in different colors in a shape-naming task and then in a color-naming task.

In another line of inquiry, if some words were primed twice and others primed only once, this might allow for exploring the continuum of automaticity and perhaps interference effects of the second primed word on the first. Finally, as Roediger (1984) has warned, it is dangerous to generalize results from one explicit (implicit) memory task to another task of the same general type. Variations of implicit/explicit memory tasks should be investigated to verify if the results of the present study still hold.

Since many social phenomena may be conceptualized as involving implicit memory (e.g., mood, phobias, self-concept, or opinions like stereotyping), the investigation of how implicit memory differs from and relates to explicit memory (including errors of it) is important in our understanding of what influences our behavior or decisions in ways in which we may not explicitly be aware.

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APPENDIX A

Advertisement Text For Recruitment of Subjects for the Memory Assessment Session

Advertisement Text For Recruitment of Subjects for the Memory Assessment Session

The Department of Psychology at Concordia is looking for paid volunteers to participate in a study on face and word perception. The whole session will last approximately one hour and you will be paid $6.00 for your participation.

Volunteers must have completed their studies in English. This means for us that you need to have done at least your high school education in English in order to satisfy that criteria.

If you have completed at least your high school education in English and are interested, please leave your name and phone number on the following sheet. Someone from the department will call you back to tell you more about the study and set up an appointment with you if you decide to participate.

APPENDIX B

Phonescript of Scheduling Procedure

for the

Memory Assessment Session

Phonescript of Scheduling Procedure

for the

Memory Assessment Session

Hi! My name is _____________, and I am calling you back in reference to you leaving your name for the face and word perception study. Maybe I can start by telling you a little about what we are doing and then you can tell me if you are still interested, O.K.?

First of all, you will be tested at the same time as a few other people in a group session. During the experiment, you will be asked to look at faces and words on a screen and make ratings on questionnaires on various dimensions of these words and faces. You will also be requested to complete some word puzzles.

The whole session will last approximately one hour and you will be paid $6.00 for your participation. I think it is a nice introduction to research in the field of perception.

Are you still interested?

Do you have any question?

FIELD QUESTIONS
O.K., then let's set up a time and I will tell you where to come.
Do you have a pen handy? (Set up time, date and location.)

May I have your full name and phone number (if not in hand)?

Location: Hall Building, 1455 de Maisonneuve West, between Bishop and Mackay.
Room H...., on the ...th floor, across from ...., near ....; (explain where).

One more thing I would like to mention is: since it is a group session, we ask people to try to come on time, so that we don't start without you. (Once the session is started subjects are not able to get in.)
If you need to cancel or reschedule, please call Ma-.he Tremblay at 387-2781 leaving your name on the answering machine any time, O.K.

Also: Do you mind if we call you the day before to confirm the appointment? If we don't succeed in reaching you, the session will still be held as planned.
Thanks and see you then.

APPENDIX C

Informed Consent Form

for the

Memory Assessment Session

CONSENT FORM TO PARTICIPATE IN RESEARCH
Psychology 311 Research Project
Department of Psychology, Concordia University

Title of Research: Face and Word Perception

The experiment that you are about to participate in is concerned with the perception of words and faces. In the experiment, your task will be to rate faces and words on a number of dimensions, and to complete word puzzles.

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

I understand that 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 experiment will last approximately one hour (60 minutes), that I will be paid $6.00, and that I am free to discontinue my participation at any time.

I have understood this agreement, and I freely consent and agree to participate in the experiment conducted by MARIANE LE BEAU & FRANCE SLAKO.

Signature ______________________________ Date ______________

APPENDIX D

Instructions to Subjects, Study Material and Text of Debriefing for the Memory Assessment Session

EXPERIMENTER INSTRUCTIONS

CLOSE DOOR, PUT UP "Do Not Disturb" SIGN.

Hi, my name is Marianne Le Beau. I am conducting this experiment with France Slako who will be joining us a little later on. We are undergraduate students with the department of psychology here at Concordia. Thank you all for coming today.

Before we begin, I have a consent form to hand out. Please take a moment to read it, then sign it.
(HAND OUT CONSENT + PENCILS)

INSTRUCTIONS (1)

Perception is a very broad field in psychology. Present work in perception includes many topics, such as the study of depth perception, and the study of perceived movement. This study investigates the manner in which people process information about faces and words. More specifically, the study investigates possible similarities between face and word perception.

During the experiment, you will be asked to rate faces and words on a few dimensions. These ratings may not seem meaningful to you during the test, but please take the tasks seriously. After the experiment is over, I will discuss the study in more detail, and then hopefully, the ratings will make sense.

To begin the experiment, I am going to present you with 18 faces. After viewing each portrait, you will be asked to make one of two types of judgments: FIRST, rate the pleasantness of the face on a scale from 1 to 7 (1 representing very unpleasant, and 7 representing very pleasant), and SECOND select the more distinctive of two facial features (selecting either the eyes or the mouth). I will project a face on the wall, and then I will indicate which rating you are to make. If you are to rate the pleasantness of the face, I will simply say the word "**pleasant**" out loud; alternatively, I might say the word "**feature**", and in this case, you are to select the eyes or the mouth as the more distinctive feature. You are to write your response on an answer sheet which I will hand out now.

HAND OUT PACK 1 (2 sheets... pic. and word rating sheets)

Please write your names on these as I hand them out.

Mark either a number (between 1 and 7), or a letter (either "E" for eyes or "M" for mouth) depending on the question that's asked. You'll have approximately 5 seconds to make your rating. Do you have any questions?

TURN OFF LIGHTS.
TURN ON TIMER & POWER

(1) feature ....(DURING 1st 5 SECOND BLANK) Make your rating now.

(2) feature
(3) pleasant
(4) feature
(5) pleasant
(6) pleasant
(7) feature
(8) pleasant
(9) feature
(10) pleasant
(11) feature
(12) pleasant
(13) pleasant
(14) feature
(15) feature
(16) feature
(17) pleasant
(18) pleasant ....wait 5 seconds, then ...

TURN TIMER OFF then POWER OFF
LEAVE LIGHTS OFF
CHANGE SLIDE TRAY

INSTRUCTIONS (2)

Study Uninformed

Now I will present you with a list of 32 words. Again, you will be asked to make two sorts of judgements: FIRST, rate the pleasantness of the word (rating the word from 1 to 7 -- 7 being the most pleasant), and SECOND count the number of T-junctions in a word. The notion of a T-junction can be best understood by example.

TURN POWER ON (leaving TIMER OFF)
PRESS "FORWARD" TO "H" slide

The letter "H" has 2 T-junctions.

The best way to identify a T-junction is to locate a point on the letter from which three lines extend. For example, in this letter "H", you should see a point from which lines travel in 3 directions. For example, at this point, lines travel right, upward and downward. The fact that there are three lines extending from this point makes this point a T-junction. Here is the 2nd T-junction in this H. Before you begin this task, I will present you with another example of these junctions, just to make sure the concept is clear.

The word "HAT" contains 5 T-junctions......2 in the H, 2 in A, and 1 in T.

MOVE SLIDE FORWARD TO THE BLANK
TURN POWER OFF (because it is too noisy for giving instructions)

The words will be presented as follows. First, I will say the instruction ("pleasant" or "T-junction"). Then I will present you with a word for 5 seconds. Your task is to say the word out loud (we'll say the word altogether as a group), and then respond to my question (be it either to count the number of T-junctions or to rate the pleasantness). You'll have 5 seconds to make your answer on an answer sheet.

Five seconds will be plenty of time to make a careful pleasantness rating (and please use all the available time to make pleasantness ratings), but it may not always be sufficient time to add up all the T-junctions in a word. If you run out of time in the T-junction task, simply estimate the number of T-junctions at the end of the 5 seconds. Any questions?

To repeat, I will say the instruction "pleasant" or "T-junction", a word will appear which we will all read aloud, altogether. When the word disappears, then you have 5 seconds to make your rating.

PUT **ON** TIMER, then POWER

THE FIRST TRAY MOVEMENT WILL BE A BLANK. WHEN THIS MOVEMENT COMES TO A STOP, BEGIN COUNTING 4 SECONDS IN YOUR HEAD. AT THE BEGINNING OF THE FIFTH SECOND BEGIN YOUR RATING INSTRUCTIONS (i.e., saying the number of the item and the rating). In this way, you will be saying the number **and** the instruction just **before** the slide moves. Then read the word aloud with the subjects.

LIST A/C

1- T-junction DRESSER
2- pleasant METRIC
3- T-junction GLOBE
4- pleasant PROCESS
5- pleasant AFFLUENT
6- T-junction CHAIR
7- pleasant SALT
8- pleasant SCAR
9- pleasant SHAPE
10-T-junction FRAGILE
11-T-junction HARD
12-pleasant SPIDER
13-pleasant GARDEN
14-T-junction TENNIS
15-T-junction SCOLD
16-pleasant TRAP
17-pleasant RELATE
18-T-junction DEFEND
19-pleasant LEAVE
20-T-junction ACCIDENT
21-pleasant TRIANGLE
22-T-junction RESTAURANT
23-T-junction MORNING
24-T-junction PARTY
25-T-junction RETURN
26-pleasant EXPIRE
27-pleasant FOREST
28-T-junction GRAPE
29-T-junction VIABLE
30-T-junction DIGITAL
31-pleasant HAMMER
32-pleasant LUMP............wait 5 seconds

TURN OFF POWER, AND TIMER
TURN LIGHTS ON

LIST B/D

1- pleasant DRESSER
2- T-junction METRIC
3- pleasant GLOBE
4- T-junction PROCESS
5- T-junction AFFLUENT
6- pleasant CHAIR
7- T-junction SALT
8- T-junction SCAR
9- T-junction SHAPE
10-pleasant FRAGILE
11-pleasant HARD
12-T-junction SPIDER
13-T-junction GARDEN
14-pleasant TENNIS
15-pleasant SCOLD
16-T-junction TRAP
17-T-junction RELATE
18-pleasant DEFEND
19-T-junction LEAVE
20-pleasant ACCIDENT
21-T-junction TRIANGLE
22-pleasant RESTAURANT
23-pleasant MORNING
24-pleasant PARTY
25-pleasant RETURN
26-T-junction EXPIRE
27-T-junction FOREST
28-pleasant GRAPE
29-pleasant VIABLE
30-pleasant DIGITAL
31-T-junction HAMMER
32-T-junction LUMP ....wait 5 seconds

TURN OFF POWER, AND TIMER
TURN LIGHTS ON

Original Lists Before Randomization of Presentation Order

4 primary buffer words

			Study List A	Study List B
	1	spider	p	t
	2	restaurant	t	p
	3	affluent	p	t
Will get	4	defend	t	p
Stem Test 1	5	forest	p	t
	6	fragile	t	p
	7	triangle	p	t
	8	party	t	p
	9	relate	p	t
	10	scold	t	p
	11	salt	p	t
	12	hard	t	p

			Study List C	Study List D
	13	expire	p	t
	14	morning	t	p
	15	leave	p	t
will get	16	grape	t	p
Stem Test 2	17	scar	p	t
	18	tennis	t	p
	19	shape	p	t
	20	chair	t	p
	21	trap	p	t
	22	return	t	p
	23	garden	p	t
	24	accident	t	p

4 recency buffer words

BUFFER WORDS: globe, process, lump, bright, viable, digital, hammer, dresser, metric.

INSTRUCTIONS (3)

There are a few more picture and word rating tasks. First, I will present you with 3 word tests, each 3 minutes long.

The first short task is called a fragment completion test. I will present you with words that are missing some letters. Your task is to fill in the spaces so that the completed fragments spell the names of **famous cities**.

GO TO BLACKBOARD AND WRITE "B_ST_N"

For example, the fragment "B_ST_N" can be completed as "BOSTON". You will have 3 minutes to complete as many fragments as possible.

Following this, you will be given a list of "**famous people**" fragments. Again, you will have 3 minutes to complete as many fragments as possible.

The last 3 minute test will require you to write down as many **countries** as possible that begin with the letter "A". If you cannot write down "A" countries for three minutes, you may continue with "B" countries, then "C" countries, etc.

I will present you with one test at a time. Any questions?

HAND OUT PACK 2 (cities/names/countries listing) face down.

Please write your names on these as I hand them out.

Please begin the "Famous City Fragment Completion" and read the instructions. You have 3 minutes to complete this - go ahead.

AFTER 3 MINUTES......

OK, please turn to the next page. You have 3 minutes to complete these "Famous Names" fragments.

AFTER 3 MINUTES ......

O.K, please turn to the next sheet. List as many countries as you can think of beginning with the letter A. When you can't think of any more A countries, go on to B countries, and so on, for 3 minutes. Go ahead.

AFTER 3 MINUTES.......

MAKE SURE YOU HAVE THEIR ATTENTION..........

INSTRUCTIONS (4) **TEST UNINFORMED**

The next task is called a stem completion test. For this task, I will be presenting you with the first three letters of a word: your job is to complete the stem with the first word that comes to mind.

GO TO THE BLACKBOARD AND WRITE "PSY_______".

For example, if you are given the letters "PSY_______", you might complete the stem "PSYCHOLOGY". To repeat myself, you are to complete the stems as quickly as possible, filling out each stem with the first word that comes to mind - whatever that might be. The only completion items that should be avoided are proper names. In other words, do not complete the letters "BIL____" as "BILL". Do you have any questions?

INSTRUCTIONS (4) **TEST INFORMED**

The next task is called a stem completion test. For this task, I will be presenting you with the first three letters of a word: your job is to complete the stem with the first word that comes to mind.

GO TO THE BLACKBOARD AND WRITE "PSY_______"

For example, if you are given the letters "PSY_______", you might complete the stem as "PSYCHOLOGY". To repeat myself, you are to complete the stems as quickly as possible, filling out each stem with the first word that comes to mind - whatever that might be. The only completion items that should be avoided are proper names. In other words, do not complete the letters "BIL____" as "BILL".

During this test, you may notice that some of the stems can be completed with words that you have studied earlier, that is, from the list of 32 words. This observation should not affect your responses. If the first word that comes to mind is the <u>same</u> as a studied item, <u>then write that word down</u>. If, however, you think first of a novel completion of the stem, and immediately <u>afterwards</u> you notice that the stem <u>can</u> be completed as a studies item, then write down your <u>first</u> idea, that is, <u>not</u> the studied word. You don't get a better score for completing more stems as studied items. Just write down the first word that comes to mind, whatever that might be. Do you have any questions?

HAND OUT PACK 3 (1/2 **Stem Compl'n 1 and 1/2 Stem Compl'n 2).**

WHILE YOU ARE HANDING THIS OUT SAY.........

If you find that you are stuck on a stem, just move on to the next stem and come back later to the one you had trouble with.

Again, make sure you write your name on these as I hand them to you.

WAIT FOR EVERYONE TO FINISH........

I am going to display some questions and I would like you to answer them in the space provided.

MAKE SURE TIMER IS **OFF**

TURN POWER ON

READ EACH QUESTION ALOUD.

AWARENESS QUESTIONNAIRE

1. Have you participated in a psychology experiment before?
2. Has anyone told you anything about this experiment?
3. What did you think was the purpose of the stem completion task that you just finished?
4. What was your general strategy in completing the word stems?
5. Did you notice any relation between the words that you rated earlier and the word stem completion task? If so, what is the nature of the relationship?
6. While doing the word completion test, did you notice whether you completed some of the stems with words studied in the earlier list?
7. Did you at any time deliberately try to complete stems with words from the earlier list?
8. Did you at any time refrain from writing down a word as a completion because it was in the earlier list?
9. When you were rating the words, did you think you would be given a memory test?

WAIT UNTIL EVERYONE HAS FINISHED

Now please turn to the next page.

INSTRUCTIONS (5)

The next task is a memory test. I will present you with the first three letters of the words that were displayed on slides earlier. Your task is to complete the stems with the word that you can remember. Take as long as you need. Don't worry if you don't get too many words.

WAIT FOR EVERYONE TO FINISH

Now France Slako will take over for the second part of the session. I will just be a moment (go get France)

POST EXPERIMENTAL INQUIRY INTRODUCTION

Hi, my name is France Slako. I'm an undergraduate student in psychology and I'm collaborating with Mariane LeBeau in this study.

This is the second part of the experiment. The questionnaires you have just completed represent the replication of an earlier experiment by Bowers and Schacter, psychology researchers at the University of Arizona. Replication is a very important part of science. The only truly valuable discoveries are those which can be found over and over again across different laboratories.

In this study, we are not only interested in replicating Bowers and Schacter's findings, but we are also interested in knowing what goes on in subjects' minds during the study. We have therefore designed some questions to sample what you might have been thinking during the rating tasks and word puzzles you have just done.

Although the experiment proper is completed, this next part of our investigation is just as important to us. Since we are interested in explaining perceptual and memory phenomena, and their <u>relation</u> to one another, we ask that you answer the following questionnaire as honestly as you can.

HAND OUT POST-EXPERIMENTAL INQUIRY QUESTIONNAIRE

Please fill your name in as I hand this out.

After everyone has completed this questionnaire, there will be a question and answer period in order to address any questions you might have about this study.

DEBRIEFING

As you know by now, there was a link between the 32 words presented on slides and the 75 stem completion test given later on. Many subjects make links between separate parts in an experiment and this is why we asked you so many questions about your experience in this regard.

In this study there were 2 groups. One group was given information just before the 75 stem completion test that the words presented earlier on slides <u>could</u> be used as completions, but that they should just use the first word that came to mind. Another group was also told to use the first word to come to mind, but this group was not told anything about a possible connection between the 2 parts of the experiment.

The perception part of the study has to do with using words. The memory part comes in two forms, realizing and not realizing that you are using previously learned words. The link between memory and perception that we are interested in concerns first, seeing if subjects use previously learned words, second, sorting out which subjects use the studied words without and while realizing it, and third, figuring out how often subjects from these groups (realizing and not realizing) use the studied words.

Finally, you would think that being given information about the link would mean that <u>no</u> subjects in this condition would use studied words without realizing it. But <u>equal numbers</u> of subjects said they did and did not realize when they were using studied words. Also, you would think that people who are told they can use the earlier studied words would be <u>more likely</u> to do so than subjects who are told nothing. But what Bowers and Schacter found is that they <u>don't</u>. Instead the group who is told <u>nothing</u> uses the studied words more often.

Our questions presented on slides, and in the long questionnaire were designed to find out why these counterexpectational results occur.

APPENDIX E

Response Forms

for the

Memory Assessment Session

NAME: ______________________

PORTRAIT RATINGS

After each number, enter either an M for mouth, an E for eyes, or a number from 1-7 (1 = very unpleasant, 7 = very pleasant).

1) ______________	10) ______________
2) ______________	11) ______________
3) ______________	12) ______________
4) ______________	13) ______________
5) ______________	14) ______________
6) ______________	15) ______________
7) ______________	16) ______________
8) ______________	17) ______________
9) ______________	18) ______________

WORD RATINGS

After each number, enter either a number from 1-7 (1=very unpleasant, 7= very pleasant), or the number of T-junctions.

1) ____________________

2) ____________________

3) ____________________

4) ____________________

5) ____________________

6) ____________________

7) ____________________

8) ____________________

9) ____________________

10) ____________________

11) ____________________

12) ____________________

13) ____________________

14) ____________________

15) ____________________

16) ____________________

17) ____________________

18) ____________________

19) ____________________

20) ____________________

21) ____________________

22) ____________________

23) ____________________

24) ____________________

25) ____________________

26) ____________________

27) ____________________

28) ____________________

29) ____________________

30) ____________________

31) ____________________

32) ____________________

NAME: ______________________________

FAMOUS CITY FRAGMENT COMPLETION

Complete the fragments with names of famous cities

1) M _ X _ _ O
2) AM _ _ E _ D _ M
3) _ ON _ R _ AL
4) _ IM _
5) C _ S _ _ LA _ C _
6) H _ _ FA
7) _ IS _ _ N
8) T _ E _ AN
9) K _ _ V
10) F _ O _ E _ CE
11) _ TT _ W _
12) P _ K _ NG
13) B _ M _ A _
14) _ OS _ _ W
15) PR _ G _ _
16) SOF _ _
17) M _ L _ _
18) _ ENI _ _ RA _
19) _ AD _ I _
20) M _ N _ C _
21) _ O _ DO _
22) _ O _ _
23) JE _ _ _ A _ _ M
24) _ IE _ _ A
25) IS _ _ N _ U _

FAMOUS NAMES FRAGMENT COMPLETION

Complete the fragments with names of famous people.

1) P_E_ _E T_U_EA_

2) _RAN _ S _ NAT _ A

3) C _ R _LE LO _ _ A _ D

4) J _ _ C _ A _ K

5) _ ON_LD _EA_ _ N

6) D _ N _EA __ N

7) T _ _ S _ LL _ _ _

8) FR _ _ _ _A_ _A

9) _ R_CE _PR_ _GS_E_N

10) IS _AC AS _ _ OV

11) AL_ _ _T _INS _ EIN

12) W _ LL _ AM _ A _ ES

13) _ AR _ S _ GA _

14) MOR_EC_I R_CH _ E_

15) M_RG_ _ _ _ _TW_ _ D

16) _O_ _ IR _ _ NG

17) I _AA _ _EW_ _ N

18) K _ _T WA_ _H_IM

19) W _ LL _AM _ UR _

20) _ V _ N P _ V _OV

COUNTRY LISTINGS

List as many countries as you can beginning with the letter "A." When you cannot think of any more "A" countries, list countries which begin with the letter "B", and so on for 3 minutes.

NAME: ______________________________

STEM COMPLETION

1) BAR ____________
2) TER ____________
3) CAT ____________
4) DAR ____________
5) WIN ____________
6) GLA ____________
7) VER ____________
8) BLO ____________
9) SEC ____________
10) REV ____________
11) WOR ____________
12) IMP ____________
13) POR ____________
14) REP ____________
15) DES ____________
16) COM ____________
17) TRO ____________
18) DEL ____________
19) DRI ____________
20) CHI ____________
21) SPI ____________
22) BEL ____________
23) CHE ____________
24) MOT ____________
25) SKI ____________
26) RES ____________
27) ATT ____________
28) ENT ____________
29) WHI ____________
30) CON ____________
31) AFF ____________
32) HOR ____________
33) TRE ____________
34) INV ____________
35) STI ____________
36) DEF ____________
37) PUT ____________
38) HEA ____________
39) EVE ____________
40) COO ____________
41) STA ____________
42) FOR ____________
43) SUB ____________
44) DEV ____________
45) PRI ____________
46) PLA ____________
47) FRA ____________
48) BOO ____________
49) REA ____________
50) QUE ____________
51) TOR ____________
52) TRI ____________
53) SUR ____________
54) ABO ____________
55) OBS ____________
56) ARR ____________
57) IND ____________
58) PAR ____________
59) BRA ____________
60) FIN ____________
61) CAN ____________
62) REL ____________
63) ELE ____________
64) STO ____________
65) RAN ____________
66) SCO ____________
67) REC ____________
68) ADM ____________
69) HAN ____________
70) BAL ____________
71) SAL ____________
72) BRI ____________
73) CAL ____________
74) HAR ____________
75) MIN ____________

PLEASE DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO.

NAME: ______________________

STEM COMPLETION

1) BAR __________
2) TER __________
3) CAT __________
4) DAR __________
5) WIN __________
6) GLA __________
7) VER __________
8) BLO __________
9) SEC __________
10) REV __________
11) WOR __________
12) IMP __________
13) POR __________
14) REP __________
15) DES __________
16) COM __________
17) TRO __________
18) DEL __________
19) DRI __________
20) CHI __________
21) EXP __________
22) BEL __________
23) CHE __________
24) MOT __________
25) SKI __________
26) MOR __________
27) ATT __________
28) ENT __________
29) WHI __________
30) CON __________
31) LEA __________
32) HOR __________
33) TRE __________
34) INV __________
35) STI __________
36) GRA __________
37) PUT __________
38) HEA __________
39) EVE __________
40) COO __________
41) STA __________
42) SCA __________
43) SUB __________
44) DEV __________
45) PRI __________
46) PLA __________
47) TEN __________
48) BOO __________
49) REA __________
50) QUE __________
51) TOR __________
52) SHA __________
53) SUR __________
54) ABO __________
55) OBS __________
56) ARR __________
57) IND __________
58) CHA __________
59) BRA __________
60) FIN __________
61) CAN __________
62) TRA __________
63) ELE __________
64) STO __________
65) RAN __________
66) RET __________
67) REC __________
68) ADM __________
69) HAN __________
70) BAL __________
71) GAR __________
72) BRI __________
73) CAL __________
74) ACC __________
75) MIN __________

PLEASE DO NO TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.

PLEASE ANSWER THE FOLLOWING QUESTIONS WHICH WILL BE PRESENTED ON SLIDES.

1.

2.

3.

4.

5.

6.

7.

8.

9.

PLEASE DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.
THANK YOU.

RECALL TEST

1) PAR__________
2) GRA__________
3) ACC__________
4) TEN__________
5) SPI__________
6) RET__________
7) FOR__________
8) GAR__________
9) RES__________
10) TRI__________
11) SHA__________
12) DEF__________
13) EXP__________
14) SCA__________
15) TRA__________
16) SCO__________
17) CHA__________
18) HAR__________
19) SAL__________
20) FRA__________
21) LEA__________
22) MOR__________
23) REL__________
24) AFF__________

NAME: ______________________

This study has been designed to replicate an earlier study to see if the results are reliable.

In order to understand results fully, we would like you to answer the next set of questions as honestly and openly as you can. Thank you.

Mariane LeBeau
France Slako
Marthe Tremblay, B.Sc.
Andrea Kenney, M.A.
Jean-Roch Laurence, Ph.D.

1) How do you think you performed in this study? Please circle ONE answer.

a. I felt "at my best".
b. I felt my performance was somewhat less than "my best".
c. I felt my performance was considerably less than "my best".

If you can, please elaborate the reasons for your choice

____

____

____

____

2) <u>Overall</u>, how clear were the instructions in this experiment? That is, did you know what was expected of you during the experiment? Please circle the **ONE** most representative answer for you.

<u>Overall</u>, instructions were ....

1	2	3	4	5
mostly confusing		50-50 clear & confusing		mostly clear

3) Were instructions unclear at any stage of the experiment? That is, were you uncertain about what was expected of you at **ANY** of the following points in the study? Circle the answer(s) which apply to you.

Instructions were unclear ......

a. During the face perception rating task.
b. During the word perception rating task.
c. During the city names fragment completion task.
d. During the famous names fragment completion task.
e. During the country listing task.
f. During the 75 word stem completion task.
g. During the questions presented on slides.
h. During the cued recall test.
i. Instructions were clear during all tasks.

Please explain what seemed unclear:________________________

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4) During the word stem completion task in particular (i.e.,when you were asked to complete 75 stems with the first word that came to mind), were the instructions unclear in any way?

1	2	3	4	5
mostly confusing		50-50 clear & confusing		mostly clear

Please explain what seemed unclear.______________________

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5) What do you think the purpose of the study was, and what results do you think we expected to find?____________________

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6) Now that you have finished the study and know that there was a link between the earlier 32 word rating task and the later 75 word stem completion task, please answer these more detailed questions keeping in mind how you **ACTUALLY** behaved **AT THE TIME**.

Please circle **ONE** description that is closest to the way you experienced the 75 word stem completion test. Please read all possibilities:

a. During the word stem completion test, I did not notice that any of the stems could be completed with words I had studied earlier and I completed the stems with the first word that came to mind. During the final memory test, I remained unsure if I had used the studied words to complete word stems.

b. During the word stem completion test, I did not notice that any of the stems could be completed with studied words and I completed the test with the first word that came to mind. However, during the final memory test I then realized that I had used study words to complete some of the word stems.

c. After completing a few of the stems with the first word that came to mind, I realized that some of the stems could be completed from the list of words we had studied earlier. When I came across a stem which could be completed by a study word, I continued to write down the first word that came to mind, even if it was a study word.

d. Right from the beginning of the word stem completion task I suspected that I could use studied words to fill in the stems. When I came across a stem which could be completed by a study word, I continued to write down the first word that came to mind, even if it was a study word.

e. After completing a few of the stems with the first word that came to mind, I realized that some of the stems could be completed from the list of words we had studied earlier. When I came across a stem which could be completed by a study word, I tended to use novel completions to fill in the stems.

f. Right from the beginning of the word stem completion task I suspected that I could use studied words to fill in the stems. When I came across a stem which could be completed by a study word, I tended to use novel completions to fill in the stems.

(options continue on next page)

g. <u>After completing a few of the stems</u> with the first word that came to mind, I realized that some of the words could be completed from the list of words we had studied earlier. Once I noticed this, I kept trying to think back to the study words when completing the rest of the stems.

h. <u>Right from the beginning</u> of the word stem completion task I suspected that I could use studied words to fill in the stems. So I kept trying to think back to the study words when completing the rest of the stems.

7) We would like to know at what point in the experiment you may have realized that we were in fact investigating memory as well as perception. Please try to recollect as precisely as possible <u>during which task</u> you may have <u>first</u> suspected that this was also a memory study:

a. I suspected it was a memory experiment from the beginning of the experiment.
b. During the face perception rating task.
c. During the word perception rating task.
d. During the city names fragment completion task.
e. During the famous names fragment completion task.
f. During the country listing task.
g. During the 75 word stem completion task.
h. During the questions presented on slides.
i. During the final memory test.
j. I did not surpect it was a memory experiment at all.

8) If you circled choice "7(g)" above, at what point surrounding the stem completion task did you suspect the memory aspect of the task? Please circle the **ONE** most representative answer for you.

a) Before the experimenter's instructions.
b) During the experimenter's instructions.
c) After completing a few stems, but <u>before</u> I came across a stem which could be completed with a study word.
d) After completing the <u>first</u> stem which could be completed with a study word.
e) After having completed more than one stem with a study word.

9) **AT THE TIME**, how did you think we wanted you to fill in the word stem completions?

a. With the first word that came to mind regardless of whether or not it was a previously studied word.
b. I had the feeling you wanted us to use studied words, even though you told us to use the first word that came to mind.
c. I had the feeling you wanted us not to use studied words, even though you told us to use the first word that came to mind.

10) **AT THE TIME**, how did you actually fill in the word stem completions?

a. With the first word that came to mind regardless of whether or not it was a previously studied word.
b. When I noticed that I could choose between a study word completion or a novel completion, I tended to choose study words, even though you told us to use the first word that came to mind.
c. When I noticed that I could choose between a study word completion or a novel completion, I tended to choose novel words, even though you told us to use the first word that came to mind,

11) Many people have reported that while completing the 75 word stems, they never noticed even once using studied words to complete stems. Did you experience this?

a) yes
b) no.

12) Many people have reported that when they noticed that a word stem could be completed by a studied word or by a novel completion, that they had some difficulty determining which word came to their mind first. Did you experience this?

a) yes.
b) no.

13) _If_ you noticed that a word stem could be completed with a studied word _or_ a novel completion, between which you had to choose which first came to mind, how did you choose which completion was "the first to come to mind"?

a) Of the times that this happened, about half of the time I chose the study word, and half the time I chose the novel completion.
b) Of the times that this happened, I tended to _choose the studied word_ completion over the novel completion.
c) Of the times that this happened, I tended to _choose the novel completion_ over the study completion.
d) I almost never had trouble figuring out which word was first to come to mind.

14) How often did you notice that a word stem could be completed with a studied word _or_ with a novel completion between which you had to choose which first came to mind? Please circle one approximation.

0----1-2----3-4----5-6----7-8----9-10----11-12----greater
times times times times times times times than 12 times

15) When instructed to rate the **pleasantness** of a word, did you at any time notice that you were counting T-junctions? If so, how often did this happen?

a) yes, 0---1-2---3-4---5-6---7-8---9-10---11-12---greater
times times times times times times times than 12 times

b) no

16) When instructed to count **T-junctions** in a word, did you at any time notice that you were rating the pleasantness of the word? If so, how often did this happen?

a) yes, 0---1-2---3-4---5-6---7-8---9-10---11-12---greater
times times times times times times times than 12 times

b) no

We are particularly interested in the thoughts which may have come to your mind at different stages of the experiment which are listed below in the order in which they were presented.

The next set of questions asks you to remember what you were thinking AT THE TIME of each task, regardless of what you might understand now.

I. **AT THE TIME** of the **FACE Perception** Task

"Pleasantness/Unpleasantness" Rating Section

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "Pleasant/Unpleasant" portion of the **face** perception rating task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these faces.

"Feature" Rating Section

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "distinctiveness" portion of the **face** perception rating task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these faces.

II. **AT THE TIME** of the 32 **WORD Perception** Task

"Pleasantness/Unpleasantness" Rating Section

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "Pleasant/unpleasant" portion of the **word** perception rating task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these words.

T-Junction Counting Section

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "t-junction counting" portion of the **word** perception rating task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this, but I went along.
b. I questioned what other purpose this task might be serving.
c. I better try to remember these words.

III **AT THE TIME** of the **CITY Fragment Completion** Task

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "City Fragment Completion" task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these city names.

IV **AT THE TIME** of the **FAMOUS NAMES Fragment Completion** Task

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "famous names" task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these famous names.

V **AT THE TIME** of the **City Listing** Task

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "city listing" task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these city names.

VI **AT THE TIME of the 75 WORD STEM Completion Task**

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "word stem completion" task. Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to remember these words.

VII **AT THE TIME** of the **Questions on Slides**

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

2) Listed below are various ways people experience the "awareness questionnaire". Please circle the **ONE** description that is closest to the way you experienced it.

a. I didn't understand the purpose of this at the time, but I went along.
b. At the time, I questioned what other purpose this task might be serving.
c. I better try to figure out what was going on in this study.

VIII **AT THE TIME** of the **Final Memory** task

1) How did you respond to this portion of the experiment?

1	2	3	4	5
fun	pleasant	going along	silly	unpleasant

If there are any additional observations or comments that you would like to make, or that you think might be helpful to us, please feel free to make them below.

SUBJECT INFORMATION

NAME: ______________________________

PHONE: ______________________________

AGE: __________

SEX: __________

STUDY DISCIPLINE: ______________________________

Year of Study: ______________________________

First language spoken at home: ______________________________

Language of gradeschool education: ______________________________

Language of highschool education: ______________________________

Thank you for your helpful participation. You may now collect your payment of $6.00 from the experimenter.

You may leave now or stay until everyone has finished, after which there will be a short debriefing during which you may ask questions regarding the study.

THANK YOU!

APPENDIX F

Text of Invitation

for the

Stroop Session

Text of Invitation for the Stroop Session

Phonescript

Hi! my name is Marthe Tremblay; and I believe you have recently participated in an experiment conducted by Mariane LeBeau and France Slako from Concordia's psychology department, and they were looking at the relation between face and word perception and memory? (Answer). I am presently working in the same program of studies and I was calling to invite you to participate in an experiment looking at individual differences in color and language processing; do you think you might be interested?

<u>If not</u>:

Well I respect your decision completely, and I thank you very much for your time.

<u>If yes or maybe</u>:

Well maybe I can start by telling you a little about what I'm doing, and then you can tell me if you are still interested, O.K.? In this experiment, you would be asked to view a television monitor where color-words like BLUE, RED, GREEN, or YELLOW are presented in different physical colors like blue, red, green or yellow. Your task would be to ignore the word and name the physical color of the word, out loud and as quickly as possible; this task is not only fun but also a pleasant introduction to the field of color and language processing. The entire testing session would take about one hour and you would be paid $6.00 for your participation. Are you still interested? (Answer). Do you have any questions?

Field questions:

Since good color perception is essential for this task, I must ask you whether your color-vision, is normal.

<u>If not</u>:

Well I'm sure you will understand how this could affect your performance on this task; and that your results, therefore, might not reflect your true language processing ability. So even though I unfortunately cannot recruit you for this particular experiment, this will not affect in any way your chances of being invited in other types of studies. Would that be alright with you? (Note answer). Well thank you very much for your time.

<u>If yes</u>:

O.K., then let's set up a time and I'll tell you where to come. Do you have a pen handy? (Set up a time and date). The session will be conducted at the Hall building (1455 de Maisonneuve West, between Bishop and Mackay), on the fifth floor in room 545 (explain where if necessary).

If you need to cancel or reschedule, please call me or leave a message at 387-2781, my name again is Marthe Tremblay; you can also leave a message on the lab's answering machine at 848-2213. Do you mind if I call you the day before to confirm your appointment?

Well thank you very much for your time and I'll see you then.

APPENDIX G

Informed Consent Form

for the

Stroop Session

INFORMED CONSENT FORM

Psychology Research Project

Department of Psychology, Concordia University

Name (print):______________________________

Phone, Home:__________Work:_________________

Please sign this form after reading the following section carefully and only if you understand well what you will be asked to do:

This research investigates individual differences in language processing. In this experiment, you will be asked to view a television monitor where words will be presented in different colors (blue, red, green, or yellow). The word that will be presented are the words BLUE, RED, GREEN, YELLOW, or the non-word XXXXX. You will be asked to ignore the word and name the physical color out loud and as quickly as possible, while keeping your errors at a minimum. Your reaction time for naming these colors will be recorded.

The entire testing session will take approximately 60 minutes after which you will be paid $7.00 for your participation. At this point the predicted results of the experiment will be explained to you in greater detail if you are interested. It is understood that your participation in this experiment is voluntary; that you can decide at any time to discontinue your participation if you wish without negative consequences; that your data will remain confidential even though the results of the experiment may be published; and that you may be invited to participate in future studies, again on a voluntary basis.

Date:__________________

Signature:___________________________

Experimenter's signature:_________________________

APPENDIX H

Instructions to Subjects and Debriefing Text

for the

Stroop Session

Script of Instructions to Subjects for Stroop Tasks

"No feedback" condition

Welcome the subject (S) and direct him/her to the seat beside the viewing tube where s/he is asked to read and sign the consent form. In the meantime, turn on the apparatus and type in 'RUN STROOP' and the S's name. Once the consent form is signed, help S find a comfortable and adequate viewing position, and tell S to keep his/her forehead in contact with the viewing tube during testing. Still standing beside S, tell him/her:

"O.K. can you see the white dot in the middle of the screen? That dot means that a trial is ready to begin. Now what is going to happen is that when you push this red button (point to the red button), a word will appear on the screen. This word will either be BLUE, RED, GREEN, or YELLOW, or a series of 5 XXXXX's (trace X's with your finger so that the S knows what you mean). Now these words are going to be painted in one of four different colors: blue, red, green, or yellow. All you have to do is ignore the word or the X's and just concentrate on naming the physical color of the stimulus, out loud and as fast as you can. What will happen then is the microphone behind you will pick up your voice and record your reaction time to naming the color, and this information will be stored in the computer. So before each trial the white dot will come up, you will have to press the red button to start each trial, and then just name the physical color of the paint as fast as you can without making any errors. O.K. just before we start I just want you to see what the colors look like, so the first four trials will be the X's painted in the four different colors." Go sit at the computer.

"O.K. you can press when you are ready." X's come up, and if S does not name the color, just say out loud "O.K. that was (color)", this will trigger the microphone and remove the stimulus from the screen. If S names the color then reinforce him/her, i.e., say "good." After the practice block, the message `Give color naming instructions' will appear, tell S:

"O.K. now we are ready to start. In this task it is tempting to use certain strategies to make thing easier - like blurring eyes so that you can't read the word, or focusing on the last letter of the word. These kind of strategies will change what we are trying to measure, so I am asking you not to use them. I just want you to focus your vision on the dot before each trial, and just concentrate on naming the physical color out loud and as fast as you can without making any errors. If you do make an error, I will let you know with the sound of a buzzer. O.K.? You can press when you are ready."

If S says things like things like BRED or YEBLUE, mark these as errors and the first time it happens tell S "Make sure you say only one word, because the microphone picks up every sound you make." At the end of each block, tell S to relax and take a break by looking away from the screen for a while. If s/he asks what the "building house" is, just say the computer is now randomizing the order of the trials.

<u>"Feedback" condition</u>

After all means have been printed, type in `RUN TSTROOP' and the S's name, and then tell S:

"O.K. now this is going to be a little different. You are going to do the exact same task as before only this time the computer is going to print out your reaction times at the end of each block of trials so that you will know how you are doing. So this task is sort of like a video game where you try to beat your own score each time. Just like before, though, you always have to focus on the dot before each trial and just concentrate on naming the color as fast as you can without making any errors. Again, you can start whenever you are ready".

At the end of each block, direct S's attention to his/her score in msec at the bottom of the screen and relate it to the appropriate performance category (i.e., FAIR, GOOD, GREAT). Congratulate S for the small number of errors made when it is appropriate, but also actively challenge him/her to beat this score in the next block by trying to increase color-naming speed, even if this increases the risk of making more errors.

Script for Debriefing

After the last block, begin debriefing S: "One of the things we are interested in studying is called the Stroop effect which involves the interaction between word and color processing. It appears that, as we grow up, our brain becomes faster at reading words than naming colors. So when a word like BLUE is presented in red and your task is to name only this red physical color, it is difficult for you to ignore the word BLUE because your brain is so fast at processing this word. So what happens is that the word BLUE will interfere with naming the red color, and it should take you longer to name the red color on the word BLUE than on the five XXXXX's. And the opposite effect occurs when the word and the color are the same; that is, if the word BLUE is presented in the color blue, the word will facilitate or help you to name its physical color. Therefore, it should take you a shorter amount of time to name the blue color on the word BLUE than on the five XXXXX's. We are also looking at whether giving you feedback on your performance and reaction times has any effect on this Stroop effect. Is this clear? Do you have any questions?"

Pay S, fill out the receipt, and then invite subject to future participation by saying:

<u>Invitation for future participation</u>: "Before you leave, I wanted to tell you that a number of researchers in this lab are presently working on hypnosis. So we are inviting people to participate in group hypnosis sessions in order to assess their level of hypnotizability. And I was wondering whether you might be interested in joining one of these group hypnosis sessions."

-<u>If yes or maybe</u>: tell S more about the HGSHS, screen for drugs, schedule S for a night or a day session, and take note of when s/he is scheduled. Thank S profusely.

-<u>If no</u>: tell S that you respect his/her decision completely, and thank S for today's experiment.

APPENDIX I
Informed Consent Form
for the
First Hypnotizability Assessment Using the
Harvard Group Scale of Hypnotic Susceptibility, Form A
(HGSHS:A)

HGSH:A Informed Consent Form

Background Information for Participation in Research Studies in the Hypnosis Laboratory.

Name:______________________________________

Telephone: Hm: ______________________

Wk:____________________

The research carried out with volunteer subjects in the Hypnosis Laboratory of the Department of Psychology includes a number of continuing research projects. Our studies are concerned with understanding more about the nature of hypnosis and various hypnotic phenomena. The success of our research depends upon the assistance of volunteers like yourself and we are very grateful for your participation.

Please sign this form after reading the following section:

Today I am volunteering to participate in a research study which involves the group administration of a combination for hypnotic test items (e.g., hand lowering which will be tested by holding my arm out and seeing if it moves downwards; arm rigidity, where I will be asked to imagine that I cannot bend my outstretched arm; finger lock, where I will be asked to imagine that I cannot unclasp my hands from one another). My participation will also involve answering a questionnaire concerning my experience of hypnosis. I also understand that I may be asked to participate in future sessions involving research in memory, imagery, and hypnosis.

Signature:_______________________________

Date :___________________________________

APPENDIX J

Informed Consent Form for the

Second Hypnotizability Assessment Using the

Concordia University Version of the

Carleton University Responsivity Susceptibility Scale

(ConCURSS)

ConCURSS CONSENT FORM
CONCORDIA UNIVERSITY HYPNOSIS LABORATORY

Name: ______________________________

Telephone: ___________________________

The research performed with volunteers in the Hypnosis Laboratory of the Department of Psychology involves a number of continuing research projects. Our studies are concerned with understanding the nature of hypnosis, and of various phenomena that can be elicited in it. The success of this research depends upon the assistance of volunteers such as yourself, and we are grateful to you for your participation.

Please sign this form after reading the following section:

Today, I am volunteering to participate in a research study which involves the group administration of a standardized measure of my degree of my ability to experience hypnosis (e.g. hand separation will be tested by holding my arms straight out in front of me and seeing if they move apart, and my ability to hear a musical tune, and to experience a kitten sitting in my lap will also be tested, etc.). My participation will involve undergoing seven such hypnotic items, and filling in a scoring booklet after hypnosis.

I recognize that I am free to discontinue participation in this study at any time, and that I will be paid $7.00 regardless of whether I complete it or not.

Additionally, I confirm by my signature that I am not presently using, on a scheduled basis, any anti-depressant, anti-anxiety, or anti-psychotic medication prescribed by a doctor for the control of mood, anxiety, or difficulty in focusing.

Signature: __________________________ **Date:** __________

Investigator: ________________________

APPENDIX K

Concordia University Version of the Carleton University Responsiveness to Suggestion Scale (ConCURSS)

The Concordia University Version of

THE CARLETON UNIVERSITY RESPONSIVITY

TO SUGGESTION SCALE (ConCURSS)

(GROUP ADMINISTRATION)

Prepared by Campbell Perry & Normand Pichette

November, 1991.

I would like you to close your eyes -- just close them voluntarily.... That's right. And I would like you to listen to what I am going to say to you next. Your ability to become hypnotized depends entirely upon your willingness to cooperate, and the degree to which you are able to experience the things that I will describe to you. It has nothing to do with your intelligence. As for your will-power -- if you want to, you can pay no attention to what I say to you, and remain awake at all times. On the other hand, if you pay close attention to what I say to you, and follow what I ask you, you can easily experience hypnosis. Hypnosis is nothing fearful or mysterious. It is merely a state of strong interest in some particular thing. In a sense, you are hypnotized whenever you see a good movie, and forget that you are a part of the audience, but feel, instead, that you are a part of the story. Your cooperation, your interest, is all that I ask of you. Your ability to be hypnotized is a matter of your willingness to cooperate, and your ability to experience whatever I ask you to experience. Nothing will be done to make you look or feel silly, in any way, or to cause you the least embarrassment.

Now make yourself completely comfortable... and relax.

Relax completely. Just start to relax every muscle of your body. First of all relax the muscles of your legs ....the left leg.....the left foot..... the toes of the left foot.....the left ankle..... the left calf.....the left thigh.

Then the right leg..... the right foot.....the toes of the right foot.....the right ankle.....the right calf.....the right thigh. Just let each of these muscle groups relax, and as you think about each of them relaxing, you will find that these muscle groups do relax.

Then relax the muscles of your arms -- the left arm....the left hand......the fingers of the left hand..... the left forearm.....the left elbow.....the left upper arm..... the left shoulder. Then the right arm......the right hand.....the fingers of the right hand.....the right forearm..... the right elbow..... the right upper arm..... the right shoulder.

Then relax the muscles of your head.....of your neck.....of your back.....of your chest. Your head..... your neck..... your back.....your chest..... And you are breathing freely evenly and deeply.....breathing in.....breathing out.....not too slowly.....not too quickly......freely........evenly.....deeply.

You feel pleasantly relaxed, as you continue to listen to my voice. Just keep your thoughts on what I'm saying, and you'll find that you are getting even more deeply relaxed. Soon you will feel deeply relaxed, but no matter how deeply relaxed you ever feel, no matter how deeply hypnotized you feel, you will always be able to hear my voice, and be able to pay attention to whatever I am saying to you. And you will not come out of hypnosis until I ask you to. Remember that nothing will be done that is in any way harmful to you, or in any way embarrassing.

ConCURSS...... *4.*

I want you to realize that you will be able to speak to me when you want to, to move around, even open your eyes if I ask you to, and still remain deeply relaxed -- deeply in hypnosis. No matter what happens, you will remain deeply in hypnosis until I ask you to come out of hypnosis.

I shall now begin to count from 1 - 10. At each number you will feel yourself going into a deeper, more comfortable, restful state of relaxation. One in which you will be able to do all sorts of things that I ask you to do.

One -- going deeper and deeper into hypnosis. **Two** -- down and down into a deep restful sleep, but it won't be like the sleep you have at night because you will always be able to hear my voice. **Three**-- **Four** -- more and more..... more deeply relaxed.....more deeply in hypnosis.....**Five** -- **Six**--- **Seven** -- You are sinking, sinking more deeply into hypnosis.....Nothing will disturb you.....and you will be able to hear my voice, and the things that I say to you.....**Eight** -- **Nine** -- **Ten** -- Deeply in hypnosis now.....very deeply in hypnosis. You will not come out of hypnosis until I ask you to......you will wish to just stay in hypnosis and have the experiences that I describe to you.

ConCURSS...... 5.

1. ARM LEVITATION.

Now, please extend your right arm straight out in front of you at shoulder height. **(Repeat, if needed)**.....That's right.

Leave 5 seconds.
Pay close attention to this arm, notice how it feels tingly and slightly numb. Notice too that it is starting to feel lighter. Your arm is starting to feel lighter and lighter, and as it feels lighter, it begins to rise into the air. Imagine that your arm is like a balloon. Imagine that air is being pumped into it making it feel lighter and lighter. Your arm feels lighter and lighter, lighter and lighter, and like a balloon it rises higher and higher, higher and higher into the air. It is rising, rising, getting lighter and lighter, rising higher and higher.

Leave 10 seconds.
OK, that's fine, let your arm go back to its original position. It no longer feels light and like a balloon. It feels comfortable and relaxed just like your other arm.

ConCURSS..... 6.

2. ARMS MOVING APART.

Now please extend both of your arms straight out in front of you at shoulder height with palms facing one another and with the finger tips of one hand touching the fingertips of the other hand. **(Repeat, if needed)**..... That's right.

Leave 5 seconds.
Pay close attention to your hands. Notice the sensations that you feel in your hands..... warmth.....tingly feelings.....a little heaviness. Notice also that your hands are beginning to separate and move apart. Your hands are moving further and further apart, as if they had magnetic fields in them that repel each other, moving them apart..... pushing them apart..... moving them further and further apart. Your hands feel like two magnets repelling each other, they feel that they are being forced apart.....pushed apart. Further and further apart, wider apart.....moving further and further apart.

Leave 10 seconds.
OK; that's fine. Just return your arms to their original position and let them relax.

3. ARM RIGIDITY.

Please hold your left arm straight out in front of you at shoulder length. **(Repeat, if needed)**.....That's right.

Leave 5 seconds.
Notice that your arm feels slightly numb and that it is beginning to feel tight. Your arm feels tighter and tighter. It is becoming stiff and tight, stiff and rigid. Imagine that your arm is in a splint so that the elbow will not bend. A tightly splinted arm cannot bend. Your arm feels stiff and rigid, solid and rigid.....it feels stiff..... rigid.....and unable to bend. In fact, your arm feels so stiff and so rigid that it won't bend....Test how stiff and rigid it is.....Try to bend your arm.

Leave 10 seconds.
OK, that's fine; your arm no longer feels stiff or rigid. You can once again bend it easily. There is no longer any stiffness or tightness, or tiredness or strain in your arm from trying to bend it. Just let it relax, and return it to its original position.

4. ARM HEAVINESS.

Now I want you to think about your right forearm.....(if needed) place it on your lap, with the palm of the hand facing downwards. **(Repeat, if needed)**..... That's right.

Leave 5 seconds.
Concentrate on your hand and arm. Notice that they are beginning to feel heavy.....very, very heavy. Imagine that very heavy weights have been placed on your hand and arm. The weights are very heavy and they pin your hand and arm to your laps. The weights are very, very heavy, and they make your hand and arm feel very very heavy.....very, very heavy. In fact, your hand and arm feel so heavy and so weighted down that you won't be able to lift them from you lap. Your hand and arm feel heavy.....very, very heavy.....much too heavy to lift from your lap.....too heavy even to move.... test how heavy your hand and arm are.....try to lift your hand and arm from your lap.

Leave 10 seconds.
OK, that's fine; your hand and arm no longer feel very heavy, and you can now lift them without difficulty. Let your hand and arm relax, and return them to their original position.

5. MUSIC HALLUCINATION.

Please listen to everythinq that I tell you next.

Leave 5 seconds.
I have brought a record player into the room **(no record player)** and I am now placing the record Jingle Bells on it. The volume is turned down so that you cannot yet hear the music. However, I will slowly begin to turn the volume up, and as I do, you will hear the song Jingle Bells becoming louder and clearer. You will enjoy listening to the song so much that you will move your head to keep in time with the tune. OK, I'm beginning to turn up the volume and, by listening carefully, you can probably begin to hear the tune. The volume is higher now, keep listening to Jingle Bells and let your head move in time with the tune until I ask you to stop.

Leave 15 seconds.
OK, that's fine. Stop moving your head. I've turned the record player off now, and the tune has stopped. You can no longer hear the tune of Jingle Bells, because the record player has been turned off. Just sit quietly for a moment, and let yourself relax even more.

6. KITTEN HALLUCINATION.

Leave 5 seconds.

Perhaps you don't know that we keep a pet kitten here in our lab. It's really a cute, fluffy, little kitten. You were so relaxed a moment ago that you may not have noticed that the kitten quietly crawled into your lap and is now sitting there. In fact, if you concentrate, you can feel it sitting quietly in your lap. In a moment I will ask you to open your eyes, very slowly, without becoming any less hypnotized. And I want you to look at the kitten sitting in your lap, and to pet it with your hand. It's a very friendly kitten and it likes to be petted. When I ask you to open your eyes, you'll be able to do this without becoming any less hypnotized.............Please open your eyes very, very slowly, look at the kitten, and pet it. Keep looking at the kitten until I ask you to stop.

Leave 15 seconds.

OK, please close your eyes and relax again. The kitten is no longer in your lap. In fact, it's no longer in the lab -- it's no longer here. And you can just relax once more.

7. AMNESIA.

Now please open your eyes again --- very, very slowly.......just as before, you can do this without becoming any less hypnotized.....and listen carefully. The session is not yet over, but before we go on, I want you to try your best to remember all of the suggestions I have given you thus far in the session. Please open your booklet to page 1 and write down all of the suggestions you can remember in the space provided. This task is not really difficult, and if you think back you can probably remember all or at least most of the suggestions you have been given. I will give you 2 minutes to write down all of the suggestions you can remember. If you finish before the time, please just close your eyes and wait quietly for further instructions but do not turn the page in your booklet.

Leave 2 minutes.

Please stop now, and close your eyes if you have not done so already, and listen very carefully to everything that I tell you next. Your memory for all of the suggestions you were given during this session is beginning to fade. You are becoming more and more unable to recall or remember any of these suggestions. The suggestions are fading from your mind, they are gone from your mind so that you are unable to recall or remember them in any way.....they are gone.....gone completely from your mind. It is as if all these suggestions have been erased from your mind, and you will not be able to remember them until I tap like this **(tap twice)** and say the words: "now you can remember everything". Before that time you will be unable to remember the suggestions even wher I ask you to try. Remember, until I tap and say:"now you can remember everything" all of the suggestions given in this session will be gone completely from your mind.

Leave 5 seconds.
Now, open your eyes again, very slowly, and turn to page 3. Not page 2, but page 3. Try to remember the suggestions you were given during this session and write them in the space provided. You will again have 2 minutes to do this.

Leave 2 minutes.
(Tap twice). Now you can remember everything. Please turn to page 4. Try to remember and write down all of the suggestions given during this session in the space provided. You will again have two minutes to do this. When you have finished, please turn to the next page, and close your eyes.

Leave 2 minutes.
Please turn to the next page and close your eyes, if you haven't done so already. You are going to come out of hypnosis in a few minutes. You will feel refreshed, wide awake, and in a good mood. I will count from 5 to 1 and with each count, you will become more fully aroused from hypnosis. 5--starting to come out of hypnosis slowly.......4-- starting to come out of hypnosis gently.......3--more and more aroused out of hypnosis.......2- becoming more and more aroused, alert and awake......1-wide awake. Just open your eyes.......you are completely awake, aroused and alert.

Leave 10 seconds.
Now please read page 5 carefully, and answer all of the questions on every page in the remainder of the booklet.

Concordia University Version:

The Carleton University Responsiveness

to Suggestion Scale.

PLEASE SUPPLY THE FOLLOWING INFORMATION:

Name:____

Date:____________________First Language:__________

Age:_____________________Sex:__________Telephone:__

Have you ever been a subject in a hypnosis session of any kind before? [circle one: yes no]

PLEASE **DO NOT TURN THIS PAGE**

UNTIL YOU ARE SPECIFICALLY INSTRUCTED TO DO SO

ConCURSS....   1.

Now, in your own words, please list all of the suggestions you can remember. You have two minutes to do this.

PLEASE DO NOT TURN THIS PAGE

UNTIL YOU ARE SPECIFICALLY INSTRUCTED TO DO SO

ConCURSS.... 2.

PLEASE DO **NOT** RETURN TO EARLIER PAGES

PLEASE **DO NOT TURN THIS PAGE**

UNTIL YOU ARE SPECIFICALLY INSTRUCTED TO DO SO

ConCURSS.... 3.

PLEASE DO **NOT** RETURN TO EARLIER PAGES

Now, in your own words, please list all of the suggestions you can remember.

You have two minutes to do this.

PLEASE **DO NOT TURN THIS PAGE**

UNTIL YOU ARE SPECIFICALLY INSTRUCTED TO DO SO

ConCURSS.... 4.

PLEASE DO NOT RETURN TO EARLIER PAGES

Now, in your own words, please list all of the suggestions you can remember.

You have two minutes to do this.

PLEASE DO NOT TURN THIS PAGE

UNTIL YOU ARE SPECIFICALLY INSTRUCTED TO DO SO

PLEASE DO NOT RETURN TO EARLIER PAGES

PART 1: SECTION ON OBJECTIVE, OUTWARD RESPONSES

Listed below in chronological order are the specific suggestions you were administrated following the standard hypnotic induction procedure. We wish you to estimate whether or not you objectively responded to these suggestions, that is, whether or not an onlooker would have observed that you did or did not make certain definite responses by certain specific, predefined criteria. Thus, in this section we are interested in your estimates of your outward behavior and not in what your inner, subjective experience of it was like. Later on you will be given an opportunity to describe your inner, subjective experience, but in this section refer only to the outward behavioral responses irrespective of what the experience may have been like subjectively.

It is understood that in some cases your estimates may not be as accurate as you might wish them to be and that you might even have to guess. But we want you to make whatever you feel to be your best estimates.

Beneath a description of each of the six suggestions are sets of two responses, labelled **A** and **B**. Please circle either **A** or **B** for each question, whichever you judge to be the more accurate. Please answer every question. Make sure that you do not skip any questions. Please answer every one.

PLEASE TURN TO THE NEXT PAGE AND ANSWER
EVERY QUESTION

1. Arm Rising. (Right Arm)

You were asked to extend your right arm straight out in front of you, and were told that your arm was rising into the air. Would you estimate that an onlooker would have observed that your arm had risen at least six inches (before the time you were asked to replace the arm in your lap)?

A. My arm rose at least six inches

B. My arm rose less than six inches

2. Arms Moving Apart

You were asked to extend your arms straight out in front of you with the fingers of one hand touching the fingers of the other. You were then told that your arms were moving apart. Would you estimate that an onlooker would have observed that your hands had moved apart by at least six inches (before the time you were asked to replace them in your lap)?

A. My hands had moved apart at least six inches

B. My hands moved apart less than six inches

3. Arm Rigidity (Left Arm)

You were asked to hold your left arm straight out in front of you, and were told that the arm was becoming stiff and rigid and that it would not bend. You were then asked to try to bend it. Would you estimate that an onlooker would have observed that there was less than two inches of arm bending (before you were told that your arm was no longer stiff and to replace it in your lap)?

A. My arm was bent less than two inches by then

B. My arm was bent two or more inches by then

4. Arm Heaviness (Right Arm)

You were asked to place your right hand and forearm on your lap with your hand facing down. You were then told how heavy your arm and hand felt and asked to try to lift them from the lap. Would you estimate that an onlooker would have observed that you did not lift your hand and arm at least one inch up from the lap (before being told that your arm was no longer heavy)?

A. I did not lift my arm and hand at least one inch by then

B. I did lift my arm and hand an inch or more by then

5. Experiencing Music

You were told that a record player had been brought into the room, that you would hear it playing Jingle Bells, and that you would move your head to keep time to the tune. Would you estimate that an onlooker would have observed you to make recognizable movements of the head (before you were told that the record player had been turned off)?

A. I did recognizably move my head to the tune

B. I did not recognizably move my head to the tune

6. Experiencing a Kitten

You were told that a kitten was sitting on your lap. Then you were asked to look at the kitten and to pet it with your hand. Would you estimate that an onlooker would have observed you to make a petting movement with your hand?

A. I did make a petting movement with my hand

B. I did not make a petting movement with my hand

PLEASE **TURN** TO THE NEXT PAGE

ConCURSS.... 8.

PLEASE DO **NOT** RETURN TO EARLIER PAGES

PART 2: SECTION ON SUBJECTIVE, INNER EXPERIENCES I

In this section we are interested in your inner subjective experiences instead of your outward behavior. We want to find out about what you experienced during each of the suggestions you were given. Please read each question carefully and answer it honestly. The outward response people make to a suggestion may or may not correspond to their inner experience. For example, take a person whose outward behavior is arm rising when given the suggestion that their arm is light and moving upward. In some cases a person may have experienced his/her arm as feeling light. In other cases, however, the person's arm may have moved upward even though it did not feel the least bit light. The important thing to keep in mind is that one type of experience is no better and no worse than the other. This is a scientific study, and all we are interested in is getting at the truth of what people experience. So please be honest in answering each of the following questions. Please answer <u>every</u> question. Make sure that you do not skip any questions.

For each question choose and circle the <u>one</u> alternative that best describe your experience.

PLEASE TURN TO THE NEXT PAGE AND ANSWER
EVERY QUESTION

ConCURSS.... 9.

1. Arm Rising (Right Arm)
You were told that your arm was feeling lighter and lighter and was rising in the air. You were asked to imagine that it was like a balloon and was being filled with air.

During this suggestion my arm felt light:
(a) Not at all
(b) Tc a slight degree
(c) To a moderate degree
(d) To a great degree

2. Arms Moving Apart
You were told that your outstretched arms were moving apart, and that they felt like a force was repelling them and pushing them apart.

During this suggestion my arms felt like a force was pushing them apart:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

3. Arms Rigidity (left Arm)
You were told that your outstretched left arm was becoming stiff, rigid, and unable to bend. You were asked to imagine the arm in a splint.

During this suggestion my arm felt stiff and rigid:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

4. Arm Heaviness (Right Arm)
You were told that your arm and hand were very heavy, so heavy that you could not lift them from your lap. You were asked to imagine heavy weights placed on your hand and arm.

During this suggestion my arm and hand felt heavy:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

PLEASE DO **NOT** RETURN TO EARLIER PAGES

5. Experiencing Music
You were told that you would hear the song Jingle Bells and that you would move your head in time with the music.

During this suggestion I felt like I was hearing the tune Jingle Bells:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

6. Experiencing a kitten
You were told that you would see a kitten in your lap and that you would pet the kitten.

During this suggestion I felt like I was seeing a kitten:
(a) Not at all
(b) To a slight degree
(c) To moderate degree
(d) To a great degree

7. Forgetting the Suggestions
You were told that you would be unable to remember any of the suggestions you had been given until you heard a tap and the words "Now you can remember everything". You were told that you would be unable to remember the suggestions even when you were asked to try to remember.

During this suggestion I forgot the suggestions:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

PLEASE **TURN** TO THE NEXT PAGE

PLEASE DO **NOT** RETURN TO EARLIER PAGES

PART 3: SECTION ON SUBJECTIVE, INNER EXPERIENCES II

In this section we are interested in a particular class of subjective, inner experiences. We want to find out about the extent to which you experienced your outward behavior to each suggestion as happening automatically and without a feeling of effort. For example, take a person whose outward behavior is to not bend their arm when they are told that the arm is stiff and unable to bend. Such a person may have felt that his/her arm was unable to bend. For this person it may have felt like the arm became stiff and unable to bend all by itself. In other cases, however, a person may not bend their arm even though they know that they could have bent it if they chose to. This person would have had the feeling of voluntarily choosing not to bend the arm. Remember, one type of experience is no better and no worse than the other. We are equally interested in finding out about experiences that feel automatic and also about those that feel voluntary. All we are interested in is getting at the truth about what people experience. So, please be honest in answering each of the following questions. Please answer every question. Make sure you do not skip any questions.

For each question choose and circle the one answer that best describes your experience.

PLEASE TURN TO THE NEXT PAGE AND ANSWER
EVERY QUESTION

1. Arm Rising (Right Arm)
   You were told that your arm was light and rising in the air.

   During this suggestion my arm felt like it rose in the air by itself.
   I experienced this:
   (a) Not at all
   (b) To a slight degree
   (c) To a moderate degree
   (d) To a great degree

Remember: If you chose to lift your arm voluntarily, or if your arm did not feel like it rose by itself, you should choose alternative (a).

2. Arms Moving Apart
   You were told that your outstretched arms were moving apart.

   During this suggestion my arms felt like they were moving apart by themselves.
   I experienced this:
   (a) Not at all
   (b) To a slight degree
   (c) To a moderate degree
   (d) To a great degree

Remember: If you chose to move your arms voluntarily, or if your arms did not feel like they moved by themselves, you should choose alternative (a).

3. Arm Rigidity (Left Arm)
   You were told that your outstretched arm was becoming stiff and unable to bend.

   During this suggestion my arm felt like it was unable to bend.
   I experienced this:
   (a) Not at all
   (b) To a slight degree
   (c) To a moderate degree
   (d) To a great degree

Remember: If you chose voluntarily to not bend your arm, or if your arm did not feel unable to bend, you should choose alternative (a).

PLEASE DO **NOT** RETURN TO EARLIER PAGES

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4. <u>Arm Heaviness</u> (Right Arm)
You were told that your arm and hand were too heavy to lift from your lap.

During this suggestion my arm felt <u>unable</u> to be lifted.
I experienced this:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

<u>Remember</u>: If you chose voluntarily to <u>not</u> lift your arm, or if your arm did not feel unable to lift, you should choose alternative (a).

5. <u>Experiencing Music</u>
You were told that you would hear the song Jingle Bells.

During this suggestion the tune Jingle Bells seemed to occur automatically, without any effort on my part.
I experienced this:
(a) Not at all
(b) To a slight degree
(c) To a moderate degree
(d) To a great degree

<u>Remember</u>: If experiencing the tune seemed to take a good deal of effort on your part, or if you did not experience the tune choose alternative (a).

PLEASE DO **NOT** RETURN TO EARLIER PAGES

6. <u>Experiencing a Kitten</u>
   You were told that you would see a kitten in your lap.

   During this suggestion the image of a kitten seemed to occur automatically, without any effort on my part.
   I experienced this:
   (a) Not at all
   (b) To a slight degree
   (c) To a moderate degree
   (d) To a great degree

<u>Remember</u>: If getting an image of a kitten seemed to take a good deal of effort, or if you did not get an image at all choose alternative (a).

7. <u>Forgetting the Suggestions</u>
   You were told that you would be unable to remember the suggestions you had been given.

   During this time the suggestions seemed to disappear automatically from my memory, they seemed to just go away by themselves.
   I experienced this:
   (a) Not at all
   (b) To a slight degree
   (c) To a moderate degree
   (d) To a great degree

<u>Remember</u>: If forgetting the suggestions seemed to require effort on your part, if you had to "try to forget," or if you felt that you did not forget anything, you should choose alternative (a).

APPENDIX L

Informed Consent Form for the Third Hypnotizability Assessment Using the Stanford Hypnotic Susceptibility Scale, Form C (SHSS:C)

SHSS:C INFORMED CONSENT

Background Information for Participation in
Research Studies in the Hypnosis Laboratory
Department of Psychology

Name:____

Telephone:___________________________________

The research carried out with volunteer subjects in the hypnosis laboratory of the Department of Psychology includes a number of continuing research projects. Our studies are concerned with understanding more about the nature of hypnosis and various hypnotic phenomena. The success of our research depends upon the assistance of volunteers like yourself, and we are very grateful for your participation.

Please sign this form after reading the following section:

Today I am volunteering to participate in a research study which involves the individual administration of a combination of hypnotic test items (e.g., hand lowering which will be tested by holding my arm out and seeing if it moves downward; a hypnotic dream in which I will be asked to dream about hypnosis; hypnotic age regression where I will be asked to relive a past experience, etc...). The session will be videotaped so that hypnotic susceptibility can be objectively measured, but the videotape will remain confidential. My participation will also involve discussing my experience of hypnosis. Following the session I will be paid $7.00 for my participation.

Additionally, I affirm by my signature that I am not presently using on a scheduled basis any anti-depressant, anti-anxiety, or anti-psychotic medication prescribed by a doctor for the control of mood, anxiety, or difficulty in focusing.

Signature: ________________________________

Investigator: ________________________ Date: ______________