SELF AND IMPLICIT MEMORY

by

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DEDICATION

To those who supported this work.

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ABSTRACT

Previous research has shown that information encoded self-referentially often promotes superior recall than that encoded relative to others, semantically, or perceptually. This finding has been labeled the Self-Reference Effect (SRE). However, prior investigations have only used explicit (i.e., conscious) tests of memory, neglecting the possibility that these results could be mediated by implicit (i.e., unconscious) memory processes. Moreover, there is minimal information on the neuropsychological processes that may be involved in self-referential memory, whether explicit or implicit. This study examined subjects' implicit and explicit memory for adjectives that had been encoded self-referentially, relative to an unknown other, and structurally. Furthermore, neuropsychological measures were given.

The results suggest a complex relationship between levels of self-reference, self-awareness, memory, and the general neurological areas that may support these processes. Subsequent investigations should take into account the fact that implicit memory is likely to influence self-referential encoding and retrieval. Should these findings be replicated, it could potentially influence a broad base of theoretical work in cognitive psychology and neuroscience, as well as clinical work in the areas of: traumatic brain injury, certain psychiatric disorders, amnesia, age-related memory deficits, and anosognosia (unawareness of deficits).

This puzzling problem arises when we ask, “Who is the I who knows the bodily me, who has an image of myself and sense of identity over time, who knows that I have propriate strivings? I know all these things and, what is more, I know that I know them. But who is it who has this perspectival grasp?

(Allport, 1961, p. 128)

INTRODUCTION

In a discussion of one of his female Korsakoff's patients, Claparède (1911 / 1995) commented on the self-referential or autobiographical component of memory. While describing the symptomatology of the disease process, he specifically noted that she had difficulties recalling personal experiences despite her fairly intact memory for facts. Of this particular difference between memory processes, Claparède suggested distinguishing "between two sorts of mental connections: those established mutually between representations and those established between representations and the self, the personality. In the case of purely passive associations or idea-reflexes solely, the first kind of connection operates; in the case of voluntary recall and recognition, where the self plays a role, the second kind of connection enters" (p. 372). Although, the distinction between memories for personal versus factual knowledge was noticed by a variety of philosophers theoretically or anecdotally prior to Claparède, he appears to be the first to have documented clinical evidence of multiple memory systems (Schacter & Tulving, 1994).

The bulk of clinical evidence regarding multiple memory systems started with the famous case of HM in the late 1960's, and has flourished since, demonstrating partial preservation of learning and memory in amnesic patients. After bilateral excision of epileptogenic tissue of the hippocampus and surrounding structures, HM developed an anterograde amnesia. Although unable to acquire and remember new information, his capabilities to learn new motor skills were preserved (Glisky, 1998). Reports of this phenomenon initiated a substantial body of experimental literature built upon the premise

of separable or dissociable multiple memory systems, supported by specific neuroanatomical areas. This literature received considerable support from a variety of experiments utilizing both amnesic and normal populations, revealing that successful implicit (i.e., unconscious or indirect) production of information-often words and / or pictures-despite the inability to deliberately recall or recognize those very stimuli, is often found in a variety of experimental conditions, varying task parameters, and patient populations (for review see, Schacter & Tulving, 1994; Glisky, 1998). These experimental findings suggested that human memory processes were not unitary in nature and were subject to a variety of encoding and experimental test parameters.

Since the early 1980s, when cognitive researchers started examining early neuropsychological findings regarding multiple memory systems, there has been considerable debate regarding the classification and terminology of different systems; however, the definitions proposed by Schacter & Tulving, (1994) are relatively clear. Specifically, the contrast between explicit memory, mediating intentional or conscious recall of past episodes, and implicit memory, mediating unintentional or nonconscious retrieval of past episodes does not "refer to, nor imply the existence of, two independent or separate memory systems" (Schacter, 1987, p.501). In describing human memory, Schacter & Tulving proposed that there are five major subsystems: (1) Procedural, which mediates motoric skills, cognitive skills, simple conditioning / association, and involves implicit retrieval mechanisms, (2) a Perceptual Representation System, which mediates the learning of visual and auditory word forms and other structural "formations", also involving implicit retrieval mechanisms, (3) Semantic, which mediates memory for

generic factual knowledge and may involve implicit and explicit retrieval mechanisms, (4) Primary, or working memory, operating on visual and auditory information, involving explicit retrieval mechanisms, and (5) Episodic, involved in learning personal, autobiographical, and event memory, also involving explicit retrieval mechanisms.

The distinction between personal or autobiographical memories and knowledge or facts that Claparède noticed clinically was later recognized by Tulving (1972; 1984) who argued that episodic memory (i.e., personal, autobiographical, and event memory) and semantic memory (i.e., factual information) are dissociable or separable. Tulving claimed that "the information in the episodic system refers to or represents events in the rememberer's personal past, and may thereby provide a basis for defining an individual's personal identity" (Tulving, 1984, p.225). This perspective, that it is episodic memory which enables people to remember personally experienced events, or in other words, recollection of specific autobiographical events unique to an individual, defined by particular spatial and temporal contexts, has since received considerable experimental support (for reviews see Wheeler, Stuss, & Tulving, 1997; Schacter & Tulving, 1994; Schacter, Kaszniak, & Kihlstrom, 1990). In short, "episodic remembering begins and ends with the self" (Kihlstrom, 1995, p. 384). Episodic memory is typically contrasted with semantic memory, which involves general knowledge of the world, facts, vocabulary, rules, and other knowledge that is common to many individuals. By definition, episodic memory is its relation to the self and one's ongoing personal history. Recall of an episode is: "recall of something that happened to me… something that I saw or read, or heard" (Kihlstrom, 1995, p. 383). Others have agreed on this definition of

episodic memory as supporting both personal and autobiographical memory and involving explicit retrieval mechanisms. Banks (1995, p. 369) states that "explicit memory… seems to rely on a functional and dispassionate narcissism... dating of episodes derives from a core string of events that define my personal autobiography." By contrast he argues that, "Implicit memory, on the other hand, does not rely on relation to self, and items that come to us implicitly do not carry the source information that apparently derives from relevance to the self." Therefore, according to this hypothesis, remembrance of past experiences can only occur as implicit memories if they lack connection to the self, since implicit memory does not rely on a relation to the self, whereas episodic memory is unanimously assumed to involve explicit retrieval mechanisms.

But the concept of the self's autobiographical memory aspect and the influences, both conscious and unconscious, it exerts on cognitions and behaviors have been recognized for quite some time (James, 1890, pp. 291-401). In fact, early personality and social psychologists initiated systematic experimental examination of this relationship in order to understand, albeit from a different perspective than that of cognitive memory theorists, the manner in which the self can influence information and mnemonic processing. Markus (1977) proposed that self-schema, or cognitive generalizations regarding the self that had been derived from past experience, could influence an individual's perceptions, behaviors, and even social experiences.

In order to gauge the impact of the self upon the selection and processing of information, she compared individuals having self-schemata along particular behavioral

dimensions with individuals without such self-schemata. Subjects were asked to rate themselves as "independent" or "dependent" on the Gough-Heilbrun Adjective Check List (Gough & Heilbrun, 1965 as cited in Markus, 1977) and on several other semantic differential scales describing a variety of behavioral domains. They were asked to indicate the importance of each semantic dimension to their own self-description, and were then divided into one of three categories: independents, dependents, and aschematics. Independents, rated themselves at the extreme end (points 8-11 on an 11 point scale) on at least two of the following semantic differential scales (e.g., Dependent - Independent, Conformist - Individualist, or Follower - Leader). They also rated these dimensions as important (points 8-11 on an 11 point scale), and checked themselves as "independent" on the adjective checklist. Dependents, on the other hand, rated themselves at the opposite end (points 1-4) on at least two of the aforementioned scales, rated these dimensions as important (points 8-11 on an 11 point scale), and checked themselves as "dependent" on the adjective checklist. Finally, Aschematics rated themselves in the middle range (points 5-7) on at least two of the scales, fell in the lower portion of the distribution on the importance scale, and did not check themselves as "independent" or "dependent" on the adjective check list. Three to four weeks later they were called back and presented with 69 trait adjectives on 2 x 2 inch slides, which contained 15 words related to independence and nonconformity (independent words) and 15 words related to dependence and conformity (dependent words). These 30 words were the critical schema-related stimuli, and were mixed with 30 other control words, which were schema-related adjectives about creativity and non-creativity. In each group of 30

words, 10 were relatively positive, 10 were relatively negative, and 10 were neutral according to Anderson's (1968) list of 555 trait adjectives. The remaining nine words included 3 practice adjectives, 3 adjectives which nearly all subjects had indicated were self-descriptive (e.g., honest, intelligent, friendly) and 3 adjectives which nearly all subjects had indicated were not self-descriptive (e.g., rude, obnoxious, unscrupulous). Slides of trait-adjectives were then presented to each group of subjects for two seconds and the subject was required to respond by pushing a "me" button if the word was self-descriptive or a "not me" button if the word was not. Independent subjects had shorter response latencies to independent words than dependent words, dependent subjects had shorter response latencies to dependent words than independent words, and aschematics showed no difference in response latencies for either category.

In a second experiment, individuals with independent-dependent schemata were compared to the aschematic group in order to assess how self-schema might influence the processing of information about the self, specifically whether schemas regarding a particular dimension of behavior would render an individual resistant to incongruent or counter-schematic information regarding that behavioral domain. The same subjects were called back to the laboratory three weeks later and were presented with a fictitious test of suggestibility, so that the experimenter could provide feedback that was incongruent with each subject's self-schema. The experimenter then attached (non-functioning) galvanic skin conductance electrodes to each participant's hand and a suggestibility test was administered. The electrodes were then removed while the experimenter told the independents and aschematics that they were quite suggestible, as

indicated by their score. The schematics were told the opposite. The subjects were then readministered the same battery of 69 trait adjectives on 2 x 2 inch slides, once again requiring them to respond by pushing a "me" button if the word was self-descriptive or a "not me" button if the word wasn't.

Similar to the results of the first experiment, independent subjects responded faster to independent words, dependent subjects responded faster to dependent words, while aschematic individuals demonstrated no differences in processing times. However, both independent and dependent subjects exhibited longer latencies compared to their performance on the first task. The aschematic subjects did not show any processing differences between the two phases of the study nor did they respond preferentially to either group of words. Markus interpreted these results to indicate that those with developed schema along a certain dimension were more resistant to counter-schematic information, implying that information regarding the self, as represented in memory, did indeed affect the processing of new information, either consciously or unconsciously. In fact, Markus's Self-Schema Theory postulated that cognitive representations of self (i.e., self-schemata) could be construed as "implicit theories" that assist individuals in interpreting past behavior and formulating future behaviors. Some of her contemporaries agreed that representations of information processing (i.e., memory traces) did indeed play a dynamic role in influencing cognition and behavior; and despite disparate opinions concerning the exact mechanisms of action, ample research was focused on attempting to delineate the "internal structures" responsible for encoding, representing, and expressing

information (e.g., “frames” Minskey, 1975; “scripts” Abelson, 1975; and “schemata” Stotland & Canon, 1972; cited in Markus, 1977).

The Self-Reference Effect

At approximately the same time, cognitive researchers became interested in the effects of encoding information self-referentially, and started to investigate whether or not information-processing relating to the self was really superior to mnemonic processing that was not self-referent. Early efforts by Rogers, Kuiper, & Kirker (1977) drew upon the Levels of Processing approach of Craik & Lockhart (1972) stating that semantic and associative analyses of information during encoding yield more persistent memory traces than do perceptual (i.e., shallower) analyses. Rogers, et al. hypothesized that since the self is active in organizing a person’s world, information processed relative to one’s self would be subjected to a high degree of elaboration and thus more memorable. They examined self-other differences by having subjects complete adjective checklists regarding personal information for four experimental encoding conditions: phonemic, structural, semantic, or self-referential. A subsequent free-recall task revealed that the self-referential rating task was associated with better recall performance and more elaborate memories. The authors dubbed this finding the “Self-Reference Effect” or SRE, and claimed that the self was able to “function as a superordinate schema” (p. 686), facilitating both encoding and retrieval.

Later investigations employing similar methodologies, typically an adjective rating task, yielded similar results. Using the adjective check-list personality rating paradigm,

Kuiper & Rogers (1979) performed a series of five experiments expanding upon the original work by Rogers et al., (1977), which asked participants to rate a word one of four ways: (a) structurally (i.e., "is the word long or short?") (b) semantically (i.e., "does the word have a specific meaning or relate to a specific situation?") (c) other-referentially (i.e., "does the word describe the experimenter?") (d) or self-referentially ("does the word describe you?"). Kuiper and Rogers documented further support for the SRE. Specifically, the first two experiments ruled out any mnemonic benefits due to clustering or ordering and the possibility that reference to any person whatsoever (e.g., other or self) during encoding might bolster recall, what they called " the general person hypothesis". The remaining experiments demonstrated that adjectives rated self-referentially were better remembered than in the other-referent conditions. Moreover, participants found the other-referent task to be more difficult than the self-referent task as indicated by longer reaction times for other-referent encoding. The longer reaction times caused Kuiper and Rogers to assume that processing under other-referent encoding and recall conditions appeared to be "effort-tied" whereas self-referent encoding and recall was not. Furthermore, in all five studies, words receiving a "yes" rating under the self-referent conditions were more easily recalled than words rated "no", implying that the yes responses "fit" better with the participants' concepts of self, that strong and elaborate memory traces were formed, and that self-schemas were the basis of such self-referent decisions.

Afterwards, numerous other studies produced corroborative evidence for the SRE while using different stimulus-response encoding tasks, such as self-descriptive rating

scales, autobiographical retrieval, and visual imagery (Bower & Gilligan, 1979; Brown, Keenan, & Potts, 1986). Other investigations focused on varying the to-be-remembered materials utilizing prose (Reeder, McCormick & Esselman, 1987), nouns (Klein & Loftus, 1988), and traits (Bellezza, 1984; Maki & McCaul, 1985). Still other investigations focused on varying the subject populations: children versus adults (Pullyblank, Bisanz, Scott, & Champion, 1985) and depressed versus non-depressed patients (Derry & Kuiper, 1981). This body of research appeared to support Markus's (1977) opinion, that knowledge and memory about the self was schematic, that perhaps self-referential processing somehow allowed various aspects of the self to be used as cues during encoding and retrieval, and that the effect was possibly explainable by encoding specificity (Tulving, 1973; 1984). Encoding specificity simply states that the degree of retrieval success is proportional to the degree that encoding and retrieval conditions overlap, or in other words, the degree to which encoding conditions can be reinstated during retrieval. Wells, Hoffman, & Enzle (1984) tested this particular theory by examining how the SRE was affected by encoding-specific conditions and found that participants spontaneously reinstated self-referent conditions at retrieval, regardless of whether or not retrieval and encoding were matched. In other words, even when other-referent encoding was followed by other-referent cues at retrieval, recognition memory was still higher for the self-referent encoding conditions. An auxiliary analysis showed that self-referent trait judgments were more consistent (matching 87.3% of the time) compared to other-referent judgments (matching 79.9% of the time), confirming the notion that self-schema are better organized and articulated than other-schemata. So,

even with matched conditions, self-referent encoding conditions were superior. The authors concluded that this type of encoding might facilitate better recall than other-referent encoding conditions because subjects may be generating internal retrieval cues spontaneously when the retrieval context is free of explicit cues capable of reactivating the encoding process. According to Wells et al., this was tenable due to the potential habitual tendency to process trait information in relation to one's self, a tendency that persists despite situational manipulation, perhaps even creating different encoding contexts for self-referent versus other-referent judgments. This finding was in agreement with a particular portion of Markus's (1977) original conceptualization about the SRE which proposed that, to the extent to which self-referent encoding is spontaneous or habitual, the major benefit lies not in its ability to invoke organizational or elaborative processing per se, but rather its capability to spontaneously create matching between encoding and retrieval conditions.

However, other researchers disagreed that the SRE was due solely to the fact that the self is a highly elaborated memory structure and thus characterized by special mnemonic properties, instead arguing that organization and not elaboration was responsible for the higher levels of recall associated with self-referential processing. Klein & Kihlstrom (1986) expressed concern that in many of the studies demonstrating the SRE, self-referent encoding and categorical organization had been confounded, and that the SRE could be better explained, not by imbuing the self with special mnemonic abilities, but by recognizing that organization of incoming stimulus material around the self would help improve recall. They conducted a series of experiments utilizing the familiar adjective

rating paradigm with semantic, structural, and self-referential encoding conditions; which taken together, provided convergent evidence suggesting that organizational principles rather than elaboration or special mnemonic properties of the self were responsible for the SRE. Moreover, their research also demonstrated that self-referent tasks tended to encourage greater clustering than the comparative semantic tasks, but this tended to be overlooked in previous studies because of inherent limitations in some of the statistical methods utilized. Specifically, words endorsed as "yes" are typically better recalled than words endorsed as "no" (Craik & Tulving, 1975), and in the self-referential encoding paradigms this is impossible to control since the "yes" and "no" responses vary for each individual. Consequently, interpretation of these experimental designs is often difficult because at times different absolute recall scores will yield the same adjusted recall scores for "yes" (i.e., those derived by dividing the number of "yes" recalled words by the total number of "yes" responses) and "no" responses; and it is precisely the adjusted recall scores that are often used for statistical analyses.

A short time later, Klein & Loftus (1988), published an updated opinion regarding the SRE, which endorsed a dual processing explanation of the SRE, stating that perhaps organizational and elaborative processes were both involved in the encoding of self-referential material. They drew a clear distinction between the two types of processing. Elaborative processing was assumed to result in encoding item-specific information and to benefit recall by creating multiple routes for retrieval; while organizational processing was thought to enable encoding associations among different stimuli relative to one another, thus promoting recall by establishing inter-item associative paths and category

labels, both useful during retrieval. The distinctive importance between organizational and elaborative processes was reported earlier by Einstein and Hunt (1980) who proposed that although both can facilitate recall, the efficacy of each is determined by the relatedness of the stimuli presented for study. When given a list of closely related words, subjects tend to experience more benefits from elaborative processing. On the other hand, when presented with a list whose relationships are more obscure, subjects tend to find organizational strategies more beneficial. Consequently, Klein & Loftus employed lists of nouns and a 3 x 2 factorial design, with type of task (i.e., elaborative, organizational, and self-reference) and list structure, or level of list inter-item relatedness (i.e., related words versus unrelated words), varied between subjects. A 3 x 2 analysis of variance revealed that recall scores were higher for the related than for the unrelated word list, and that self-reference produced better recall than either of the two competing tasks of category sorting or definition. They also found a significant interaction effect between list structure and task type, suggesting that the SRE was dependent upon certain experimental parameters, such as relative relationships amongst stimuli, and upon subjects' encoding and retrieval strategies. However, the authors did note that, "although not necessarily more effective than elaborative or organizational tasks, self-reference is unique in its ability to promote good retention regardless of whether stimulus conditions favor tasks promoting elaborative or organizational processing" (p. 9).

In an attempt to definitively answer whether the SRE actually facilitates recall compared to other encoding strategies, and if so, why and under what conditions, Symons & Johnson (1997) conducted a meta-analysis of over two decades of SRE research.

Because of the intense theoretical debate surrounding potential moderators of the SRE, they employed exploratory analyses in an attempt to identify variables of special interest to SRE researchers, which included: whether or not distracters were used, length of stimulus presentation, experimental design type, dependent variable type, and memory load. They then computed separate effect sizes and confidence intervals using standard meta-analytic techniques and derived several conclusions.

First, self-reference is not necessary to promote good recall, but is certainly sufficient because it promotes both item-specific and relational processing as argued by Klein & Loftus (1988). Self-reference also adheres to the rule of encoding specificity, thereby promoting compatible encoding and retrieval conditions. Second, the SRE was usually contingent upon the experimental task parameters, most importantly what group was included as the comparison group. For instance, the SRE is typically larger if the self-referent group is compared to a semantic-referent encoding group (e.g., "means the same as XXXX?") versus other-referent encoding group. Third, self-referent versus other-referent group comparisons were usually sensitive to task parameters (i.e., expectation of test), while self-referent versus semantic-referent task comparisons were typically not. Fourth, if the other-referent condition included well-known or familiar targets, the mnemonic advantage of the SRE was found to diminish. Fifth, if the comparison task included both elaboration and organization components, rather than either one alone, the SRE tends to be smaller. Sixth, as memory load was increased in most studies the magnitude of the SRE also increased, but only for self-referent versus semantic comparisons. And, seventh, self-reference may be more automatic or spontaneous in

promoting memory than other-reference. In short, they concluded that engaging in self-referential encoding does indeed pose special mnemonic advantages, but those advantages are not always consistent and are quite dependent upon task conditions.

Cognitive & Social Psychology

Shiffrin and Schneider (1977) demonstrated automatic attention responses could be learned for very frequently encountered stimuli so that attention is automatically drawn to such stimuli upon their sensation without conscious intent or effort. Because of this, Bargh (1982) stressed the importance of social information stored in memory and its effects on selection of information for subsequent encoding, arguing that people develop automatic attention or responses to self-relevant information. But, Fazio, Zanna, & Cooper (1977) had already alluded, albeit indirectly, to the necessity of accounting for memory when suggesting that Self-Perception theory is applicable to acquiring attitude-congruent behaviors and Dissonance theory is applicable to attitude-discrepant behavior. However, none of these authors, or these theories discussed potential mechanisms of interaction between the self-relevant elements accessed from memory for use in comparative evaluations, and to what extent conscious versus unconscious mnemonic contributions support such processes.

More recent developments in the social psychological literature have provided empirical evidence that these processes may be due to priming; which is the facilitation of test performance due to prior exposure to information, even though this information may not be consciously remembered (Schacter, 1987). In a series of experiments Ybarra &

Trafimow (1998) examined the distinction between private and collective self-concepts. According to them, the private self-concept consists of the self's assessment of itself, such as cognitions involving states, behaviors, and traits of an individual (e.g., "I am introverted" or "I like red wine"). On the other hand, collective self-concepts are comprised of assessments of the self by specific reference groups or some sort of collective (e.g., "My family thinks I am overworked" or "My office mates think I travel too much"). In the first experiment, subjects in the private-self priming condition were told, "For two minutes please think of what makes you different from your family and friends." In response to questions, they were then asked, "What do you expect yourself to do?" By contrast, those in the collective-self priming condition were told, "For two minutes please think of what you have in common with your family and friends." They were then asked to respond to the same questions with regard to "What do they expect you to do?" Other measures were given afterwards, but the dependent variable of interest was the subject's intention to use a condom during sex. Subjects' behavioral intentions to use a condom were regressed onto their attitudinal (i.e., evaluation of the behavior) and subjective (i.e., opinion about whether important others think the behavior should be performed) norms. Participants who were primed with the private-self condition had higher attitude beta-weighted scores than subjective norm beta-weighted scores, while participants who were primed with the collective-self condition produced the opposite pattern of scores (i.e., higher subjective norm beta-weighted scores). In two subsequent experiments, participants were asked to read passages culminating in either the private-self prime condition or the collective-self prime condition. The difference between the

passages varied only on the position of reference from the reader's point of view, the first being relative to the self (e.g., "I did X for this reason…") and the second being relative to a collective point of view (e.g., "I did X for my family…"). Afterwards, both groups were asked if they admired themselves and were again assessed for participants' intentions for condom use during sex. Once more, regression coefficients were calculated for both attitudinal and subjective norms. The previous results were supported, and the authors concluded that accessibility of self-concepts is associated with the retrieval of cognitions relevant to the self, and these particular cognitions have important implications for judgment and behavior. All three experiments indicated that behavioral intentions were more influenced by attitudes than subjective norms when the private-self was primed, but the reverse was true when the collective-self was primed, demonstrating that both private and collective self concepts can be made accessible through recent sources of activation (priming).

More recent developments in the social psychological literature have been concerned with facilitating or inhibiting effects of stereotypic information (i.e., attitudes), showing that priming individuals with a positive or negative attitude can facilitate access of consistent or related words, while inhibiting access of inconsistent or unrelated words. In a series of studies, Koole, Dijksterhuis, & Knippenberg, (2001) examined implicit self-esteem. Their first experiment sought to replicate the documented tendency for people to over evaluate letters of their own name compared to other letters of the alphabet. They found that when subjects were asked to aesthetically judge letters of the alphabet, by simply giving their first intuitive reaction to each letter, subjects preferentially evaluated

the letters in their name compared to letters that were not. The authors argued that this was evidence of implicit self-esteem. In a second experiment, they investigated whether automatic affective processing might be inhibited by cognitive load, by examining whether or not self-evaluations that comprise self-esteem would be inhibited by self-reflective thought. Once again subjects were presented with the alphabet letter evaluation task and then asked to ascetically rate the numbers 1 through 50, ranging from not at all beautiful to extremely beautiful. They were then taken to another room and asked to complete a questionnaire, which queried them as to how they judged the numbers and the letters. Most participants indicated their feelings had been important in determining their letter and number judgments. Again it was found that letters of participants' names were judged more favorably than no-name letter baseline evaluations, as were the numbers in a particular participant's birthday compared to the other numbers in the numerical sequence, even though 93% of the participants did not make any reference to their letters in their own names or numbers in their birth date when completing the questionnaire. Koole, et. al., reported this as further evidence of implicit self-esteem effects. In two subsequent studies they tested the hypothesis that high cognitive load would cause participants to have greater congruence between implicit and explicit self-evaluations than participants under low cognitive load. In both experiments, participants were required to evaluate themselves on a number of personality traits, both positive and negative. The investigator started by informing the participants that the experiment would be comprised of two unrelated studies. The first was the same name / no-name letter evaluation task of the previous two experiments and the second was a trait-rating

task. In this second study, the subjects were simply asked to press a “me” or “not-me” button relative to whether or not they felt they possessed the trait in question. Response latencies were recorded for the “me” / “not-me” trait ratings. Measures of implicit and explicit self-esteem were congruent only for participants who rendered their positive self-evaluations relatively quickly. The researchers argued that this was because people responding quickly did not have the time to engage in extensive self-reflection and were forced to rely on more automatic implicit self-evaluations, providing additional evidence of automaticity in self-evaluation.

Parallel findings from early cognitive research on human attention by Shiffrin and Schneider (1977) had previously documented that automatic attention responses could be learned for very frequently encountered stimuli, demonstrating that attention would automatically be drawn to such stimuli upon their sensation, even without conscious intent or effort. Expanding on this, Bargh (1982) assumed that people develop automatic attention responses to self-relevant information and that self-relevant stimuli receive a greater amount of automatic processing than non-relevant or other-relevant information. Since automatic processing requires minimal, or zero attentional capacity, processing resources can be directed to important stimulation whatever the ongoing conscious activity. He argued that automatic processes are inflexible and can attract attention to stimuli without conscious intent, while controlled processes are defined as: flexible, resource limited, and serving the function of regulating the contents of conscious awareness. Previously, Kahneman (1973) had already reported that expected stimuli have an advantage over other stimuli in grabbing a subject’s attention. This “perceptual

readiness" was believed to occur in either an active or passive fashion. Standard recall and recognition test instructions establish an active set or conscious expectancy for the occurrence of some environmental event, whereas priming is explainable by a passive set, defined as long-term or chronic expectancies that have evolved out of frequent and consistent experience within specific domains. Broadbent (1977) also believed that chronic expectancies are relatively permanent characteristics of the perceptual system, and that active deployment of attentional resources is not necessary for them to influence the interpretation of stimuli. Furthermore, passive or chronic processes can occur without the person's intention or awareness, similar to the idea of priming, and affect cognitive, emotional, and perceptual processes.

This is precisely what Bargh (1982) found when he had subjects perform a dichotic listening task. Two groups of subjects were selected on the basis of their responses to the independence / dependence personality trait adjectives used in the Markus (1977) experiment. Afterwards, participants were presented with two lists of 80 words simultaneously, one list consisting of common nouns, and the other consisting of adjectives from Anderson's (1968) impression formation research. The adjectives used in Markus's experiment were also included in this list. After completing a shadowing task, subjects were presented with a recognition test related to both unattended and attended channel target items. Automatic processing of the self-relevant information facilitated the shadowing task when included as part of the attended channel and inhibited performance when on the rejected or unattended channel, providing evidence for automatic processing of trait information by those who have acquired chronically accessible constructs for it.

Bargh argued that self-relevant information is capable of provoking automatic attention responses because these responses require frequent and relatively consistent experience with the environmental event or object. Moreover, because people constantly experience events with themselves as the central focus, self-relevant material is likely to be the type of information most frequently processed, leading to greater accessibility in perception and retrieval for mental representations of self compared to "non-self" material. As a result, information relevant to the self is more easily and quickly accessed than other types of information. This was confirmed by the Koole, et al. (2001) findings that automatic attention responses to self-relevant adjectives can be thought of as a type of "schematic-priming". Thus, the existence of automatic attention responses to self-relevant attention responses presented outside a subjects' conscious awareness clearly indicates that mental representations of such stimuli play an influential role in the selection of additional stimuli for further processing.

Bargh & Chartrand (1999) have argued that many important social-cognitive processes can operate without conscious guidance, including self-evaluative processes. These would be, by definition, unavailable to introspection, and therefore observable only implicitly, or indirectly, through their manifest effects. It may be that in those instances where the self is more explicitly and consciously involved in the change of behavior and / or attitudes, an individual's level of autonoetic consciousness is greater than when the self is more implicitly or indirectly involved. Autonoetic consciousness (Wheeler, Stuss, & Tulving, 1997; Tulving, 1993) has been described as being correlated with episodic memory, specifically enabling an individual to be aware of subjective experiences and

mentally represent such self-related experiences across spans of subjective time. This is consistent with Kihlstrom & Klein's (1994, p. 156) definition of the self as a "mental representation of one's own personality… an organized knowledge structure that includes what one knows about oneself". This definition encompasses both "abstract information about the person's attributes (semantic knowledge) and concrete information about the person's experiences, thoughts, and actions (episodic knowledge)". Furthermore, Banks (1995) has argued that it is volitional control that "gives the operational definition of the distinction between implicit and explicit memory." According to him, "one might argue that material from implicit memory cannot be controlled only because it lacks the autobiographical tag that allows us to identify or find it in memory" (p. 369).

In all of these different Social Psychology theories, which have been only briefly surveyed, mnemonic traces have been thought of as powerful determinants of biased information processing, capable of affecting everyday social interactions (Singer & Salovey, 1988). In the '70's, various lines of research in psychology expanded upon this fundamental notion and postulated numerous concepts that were quite similar (e.g. "frames" Minsky, 1975; "scripts" Abelson, 1975; "schemata" Bobrow & Norman, 1975; cited in Markus, 1977). However, in early social psychological experiments the theoretical framework and methodology did not exist to permit thorough investigation of the interrelatedness of self and memory and the subsequent effect upon cognitions and behaviors. Although more research has produced substantial evidence for priming certain aspects of the self, empirical evidence describing implicit memory relative to the self, and

potential neural concomitants of the relationship between self and memory, has not been addressed by the social psychological literature to date.

While most of the previously mentioned experimental methodologies involved examinations of episodic memory, they did not explicitly examine the possibility of priming for self-referential or autobiographical knowledge. Moreover, most fail to even mention possible relationships between episodic memory, self-referential processes, and autobiographical knowledge. Given the literature surveyed, it is possible that implicit memory and priming effects for self-referential or autobiographical knowledge would serve as a more parsimonious and integrative account of these experimental findings. Further evidence for the possibility of priming effects relating to self-referential knowledge may be found in the Kuiper & Rogers (1979) argument that recall under other-referent encoding and recall conditions appeared to be "effort-tied" whereas self-referent encoding and recall was not. This is consistent with Shiffrin and Schneider's (1977) demonstration that automatic attention responses to frequently encountered stimuli cause attention to be drawn automatically to such stimuli without conscious intent or effort, Bargh's (1982) assumptions that people develop automatic attention responses to self-relevant information, and with findings that self-relevant stimuli receive a greater amount of automatic processing. Moreover, the lack of explanation regarding "the interface" between self and memory in several of the major Social Psychology models surveyed is potentially explainable by priming of self-related knowledge, especially in those examples where behavioral and attitudinal changes occur without conscious awareness. Recent developments in this literature have been primarily concerned with facilitating or

inhibiting effects of stereotypic information (i.e., attitudes) by showing that priming individuals with a positive or negative attitude can facilitate access of consistent or related words and inhibit access of inconsistent or unrelated words (Koole, Dijksterhuis, & Knippenberg, 2001; Dijksterhuis & Knippenberg, 1996). These researchers have argued, as have Bargh & Chartrand (1999), that many important social-cognitive processes can operate without conscious guidance, including self-evaluative processes. These would be, by definition, unavailable to introspection and observable indirectly rather than directly. On the other hand, in those instances where the self is more explicitly and consciously involved in the change of behavior and / or attitudes, it may be that an individual's level of autonoetic consciousness is greater than when the self is more implicitly involved. This notion is consistent with the research of Craik, Moroz, Moscovitch, Stuss, Winocur, Tulving, & Kapur (1999). They examined whether neural correlates of self-referential processing, specifically localization of self-representation in right prefrontal cortex, might be mediated by frontal activation during episodic retrieval. Hypothesizing that the concept of self involves both general schematic structures and further specific components involved in episodic memory retrieval, using positron emission tomography (PET), they measured cerebral blood flow, in 8 right-handed subjects while the participants engaged in one of four tasks, or encoding conditions. In the "self" task, subjects were asked to rate how well they thought trait adjectives described themselves, whereas in the "other" task they were instructed to judge how well the trait adjectives described a famous personality. In the remaining two conditions, the "general" task and the "syllable" task subjects were requested to evaluate how socially

desirable each of the traits appeared to be and count the number of syllables in each trait adjective, respectively. Self-related encoding was associated with the fastest reaction times during a subsequent recognition task. Moreover, when frontal activation during the retrieval of the self-referential condition was compared with the retrieval of adjectives from the other three conditions it suggested that: "episodic retrieval necessarily involves the concept of self" (Craik et al., p. 32), and is specifically associated with the activation of the right pre-frontal cortex, while encoding operations tended to be associated with left pre-frontal activation. Consequently, the authors argued for support of the self-reference effect in memory, and concluded that association of episodic memory retrieval with activation of the right prefrontal cortex is attributable, in part, to the representation of self in this particular area. This hypothesis is tenable considering that lesions of the right pre-frontal cortex have been associated with disturbances of self-awareness (Stuss, 1991). It seems plausible that self-referential explicit memory should be associated with the highest level of involvement of the frontal lobes and autonoetic consciousness compared to both non-self-referential explicit memory and implicit memory. In fact, it may be that impairments in autonoetic consciousness contribute to deficits in metamemory (i.e., knowledge about one's memory) in Alzheimer's patients as described by Kaszniak & Zak (1996), who argued that memory self-monitoring may be mediated, in part, by frontal lobe mechanisms. This may be the result of degradations in an individual's capacity for autonoetic awareness.

The varieties of literature surveyed in this paper are numerous, and the neuropsychological and neurological data on the concomitants of episodic memory are

complex and just beginning to be thoroughly investigated. The subject of whether or not priming effects exist for self-referential knowledge, and if so what neurological structures critically support such processes, will likely require various data from a variety of experiments in order to answer more completely. Therefore, at present, as an initial endeavor, the purpose of the present experiment was to establish a methodology to test the basic hypothesis that there may be observable priming effects (i.e., implicit memory) for self-referential information. And, if priming effects can be observed for self-referential knowledge, do they vary relative to the degree of self-referential processing? According to Self-Awareness theory, subjects who are made more self-aware by exposure to a mirror are assumed to have more autobiographical information available and salient to them at the time of encoding. Therefore, presenting subjects with self-referential information at the time of encoding ought to make the autobiographical portion of the encoded memory more resistant to what Nielsen (1958) termed "temporal amnesia"; which he defined as loss of the autobiographical component of episodic memories. This would be consistent with Hull and Levy's notion that the "only invariant consequence of self-focused attention is an increase in the accessibility of schematically organized self-referent information" (see Pyszczynski, et al., 1991).

EXPERIMENT 1

Method

Subjects

Thirty subjects participated in the experiment. They were recruited from introductory Psychology courses, through sign-up sheets posted at the University of Arizona. Subjects were paid $10.00 and given 3 research credits for their participation. All subjects spoke English as their native language and performed normally on a Snellen eye chart vision test at an acuity rating of 14/42 and visual efficiency level of 40%. Participants were individually interviewed with a brief health questionnaire to screen for the same conditions that were screened for in an earlier study by Schacter, Kaszniak, Kihlstrom, and Valdiserri, (1991): A history of alcoholism or substance abuse; recent myocardial infarction or chronic cardiovascular disease; cerebrovascular accident; present or previous treatment for acute or chronic psychiatric illness; syphilis; brain damage sustained earlier from a known cause (e.g., hypoxia or trauma); chronic renal, hepatic, pulmonary, or endocrine disease; uncontrolled chronic hypertension; primary systemic illness; metabolic or drug toxicity; or cancer. The average age of subjects was 18.87 years old (SD = 1.53; range = 18-25), while the average number of years of education for the subjects was 12.63 years old (SD = 0.57; range = 12.5-15.5)

Materials

Composition of the cognitive memory stimulus materials required displaying two types of information during encoding, a trait adjective positioned below a digitized photograph. First, the 126 trait adjectives were taken from the list composed by Anderson (1968). All adjectives used were standardized for both likability and frequency of usage. Half had a positive affective valance, and the other half a negative valence. Although 126 different adjectives were selected, only 60 were used as experimental target items, 20 in each experimental condition (i.e., self, other, and vowel counting). Of the remaining 66 adjectives, 60 were used as foils for presentation with the target items during the retrieval tasks, while the last 6 were used as uncounted buffer items. 3 buffer adjectives preceded and followed each list of the 60 target items. Three photographs were used, one of an unknown young man, one of an unknown young woman, and one of the participating subject. The first two were used as other-referent condition photos and the latter was used as the self-referent condition photo. Both unknown persons and each participant were photographed similarly, from a distance of 3 ft, with a Pentak digital camera, in uniform lighting. All images were imported into Ulead's Video Studio software, and saved in a JPEG format. Each picture was displayed as a 4" x 4" picture and adjectives were displayed underneath, one at a time, though the use of DMDX software version 2.5.03 (Forester, 2001). During the vowel-counting task, since there was no picture to rate, a neutral gray 4" x 4" blank square was displayed on the screen, again with the adjectives shown underneath. The computer used was a Pentium 586, 333 MHz, hooked up to a Dell 17 inch color monitor, with dot pitch of .28 mm. The adjectives were all formatted in Courier New font, size 10.

Additionally, certain standardized neuropsychological and cognitive assessment instruments were used to provide indices of intellectual functioning for comparison with the assessment of self-awareness as measured by the Self-Consciousness Questionnaire (SCS: Fenigstein, Scheier, & Buss, 1975). The neuropsychological and cognitive measures included: the Wechsler Adult Intelligence Scale-Revised subtests of Information, Digit Span, and Picture Arrangement (WAIS-R: Wechsler, 1981); the Controlled Oral Word Association Task or "FAS" (COWAT: Lezak, 1983, pp. 330-332; Spreen & Strauss, 1991, pp. 219-227; Benton & Hamsher, 1983); the Trail Making Test (Lezak, 1983, pp. 556-559); the Modified Wisconsin Card Sorting Task (WCST: Hart, R. P., Kwentus, J. A., Wade, J. B., & Taylor, J. R., 1988; Nelson, 1976); Wechsler Memory Scale-Revised (WMS-R: Wechsler, 1987) subtests of Logical Memory (LM) I & II and (VR) Visual Reproduction I & II. The SCS is a 23 item self-rating scale, with a 5-point rating (i.e., 0-4) for each item. Subjects endorsing higher ratings score higher on the three factors comprising the scale: Private Self-Consciousness, Public Self-Consciousness, or Social Anxiety. These factors and the individuals test items that load on them are shown in Appendix A.

Design & procedures

The main design was a 2 (mirror vs. no mirror) x 3 (self vs. other vs. vowel counting) mixed factorial design; where mirror exposure was a between groups factor and level of self-reference was a within group factor. The independent variables of interest were self-awareness (i.e., mirror or no mirror) and degree of self-reference where each subject: (1)

rated trait adjectives self-referentially (i.e., "rate how much you think this trait describes you…"), (2) other-referentially (i.e., "rate how much you think this trait describes another person…"), (3) or counted the number of vowels in the trait adjective. The primary dependent variables were levels of explicit and implicit retrieval. In order to balance potential practice effects, presentation of the three conditions (i.e., categories of self-reference) was partially counterbalanced, with each condition appearing equally often in the ordinal position (i.e., for subjects 1 – 10 (self / other / vowel), for 11 – 20 (other / vowel / self), and for 21 - 30 (vowel / self / other). Finally, the target adjectives were randomized at the beginning of the experiment to guard against any selection or position bias. When the conditions rotated, the adjectives did not, ensuring that each list would appear in each condition equally.

Participants were introduced to the study by being told it was a test of attitudes towards self and others. First, they completed two copies of a standard consent form. They were then asked to stand in front of a solid white wall where their face was digitally photographed from a focal length of 3 feet. Afterwards, while they completed the pre-test administration of the SCS, the experimenter downloaded their photograph and set up the blocks of trials. Depending upon what group they were in, which was determined randomly, half of the participants were seated in front of a large mirror (length: 36", height: 28"), while the other half were positioned in front of a neutral picture of equal size. According to the experimental paradigms of Carver & Schier (1978; 1979) and Wicklund (1975), it is possible to enhance people's level of self-awareness by exposing them to a mirror and forcing them to become self-observers; consequently, this

manipulation is believed to reliably increase personal self-awareness. Both the mirror and picture were positioned 2 & ½ feet in front of the subjects, behind and to the side of the computer monitor that was used to present the experimental stimuli. Although the participants sat in front of the picture or mirror, they were told to face the computer screen perpendicularly, at a distance of 18 inches, thus the angle subtended between themselves and the mirror or picture was approximately 30 degrees. This allowed the mirror exposed participants to see their reflection clearly during encoding and retrieval trials.

During the computer-based encoding trials, participants were presented with 66 trait adjectives. Sixty of these were actual target items and were divided into three sets of 20, as previously described. The remaining 6 adjectives were uncounted buffer items were thrown out after the encoding trial, in order to prevent primacy and recency effects at retrieval. Prior to presentation, subjects were instructed to: (a) rate how well the trait adjective describes them, (b) rate how well the trait adjective describes an unknown person (e.g., a male and a female), or (c) count how many vowels are in the word. During the self-referent encoding condition, subjects saw a picture of themselves displayed with 20 target-items. While in the other-referent encoding condition, subjects saw a picture of an unknown man and woman displayed with 10 items each. And during the vowel-counting encoding condition, subjects weren't shown any picture, only a neutral gray 4" x 4" blank square was displayed along with 20 target-items. Each picture, or grey square, remained continuously on the screen for the entire block of target items; while underneath the target adjective appeared for 5 seconds. Once the target word disappeared, 500 ms

later a multiple choice rating scale appeared on the screen, where the adjective had been for a maximum of 5 seconds; however, the picture or grey square remained. During this time they were required to press a key to indicate their rating. Both self and other ratings were made on a 7-point scale. During the self-referential trials, the ratings consisted of the following choices: 1 = absolutely uncharacteristic of me, 2 = extremely uncharacteristic of me, 3 = moderately uncharacteristic of me, 4 = somewhat uncharacteristic / characteristic of me, 5 = moderately characteristic of me, 6 = extremely characteristic of me, 7 = absolutely characteristic of me. The ratings in the other condition were exactly the same except the word "me" was replaced by "him" or "her" for the appropriate face (i.e., unknown man or woman) for that trial. For the vowel-counting task, after the target adjective disappeared, subjects saw a rating scale, again from 1 to 7, (i.e., 1 vowel, 2 vowels, etc.) requiring them to indicate how many vowels they thought the previous word had. Participants were instructed to respond as quickly as possible, being told that their choice reaction time would be recorded, even though it was not. The important point of the encoding procedure was that <u>each subject saw each target adjective for an equal time</u> of 5 seconds in each of the 3 conditions, neither their reaction times nor responses to the rating scales were examined during the present study. Once all three blocks of target adjectives were completed, neuropsychological and cognitive measures were administered for a standard period of delay time of 60 minutes. If subjects had finished all of the measures before the full delay, they were given other filler measures, which were not scored. On the other hand, if they were not finished, the

assessment was stopped and the retrieval trials were started. Once the retrieval trials were over, the assessment measures were completed.

Subjects were administered two retrieval tasks, one implicit and one explicit. The first retrieval task was an implicit measure, administered as a perceptual identification task, requiring subjects to identify a word as it was flashed tachistoscopically. The time sequence of each trial of the priming procedure included the appearance of two parallel horizontal lines (for 1000ms) in order to cue participants' attention to where the "about-to-be-presented" word would appear. This was followed by a brief presentation of the target item (50 ms), subsequently followed by a mask (i.e., a row of XXXXXX's) for 500 ms, and then a blank screen. The subject was instructed to give his or her "best guess" in an attempt to identify the word, while the experimenter recorded the response as correct or incorrect. The subject then pressed the space bar to initiate the next trial. The perceptual identification task included all 60 previously seen target adjectives, plus 60 foils which were trait adjectives that were never seen. After the implicit retrieval task, participants were given an explicit yes / no recognition test consisting of the same 120 adjectives (i.e., 60 target adjectives and 60 foils) and asked to recognize which ones they had seen at the beginning of the experiment during encoding when they had rated the adjectives. Finally, the subjects were again given the SCS. If they happened to ask the experimenter if they had already completed this form, they were told it may or may not be the same, so they should complete this form independently without regard to the first form. Subjects were then debriefed, paid, and given their experimental credits and money.

Hypotheses

It was hypothesized that, on an implicit memory task, the highest accuracy and quickest reaction times would occur during recall of the self-referenced trait adjective while participants were in front of the mirror. It was also hypothesized that there would be two main effects: (a) mirror vs. no-mirror and (b) self versus other versus vowel analysis conditions. Moreover, it was believed there would be an interaction effect, with high self-reference (i.e., mirror and self-referential analysis) producing the greatest priming effect. On the test of explicit recognition, mirror-exposed subjects were expected to produce higher accuracy rates than non-mirror exposed subjects to self-referent target items. Finally, it was also anticipated that recall of self-referent target items would be greater than either other-referent items or words encoded in the vowel-counting condition.

Results & Discussion

Explicit Retrieval

Table 1 displays the proportions of studied adjectives recalled relative to correct rejections of non-studied adjectives (i.e. foils) during explicit retrieval as a function of encoding condition (i.e., level of self-reference) by group (i.e., mirror versus no-mirror exposure).

Table 1

Proportions of Adjectives Recognized During Experiment 1 Explicit Retrieval as a Function of Encoding Condition and Mirror Presence

	Encoding Condition / Level of Self-Reference			
Condition	Self	Other	Vowel	Foils
Mirror (n = 15)				
M	.743	.650	.477	.615
SD	.160	.229	.238	.214
No Mirror (n = 15)				
M	.693	.700	.490	.592
SD	.172	.178	.203	.169
M	.718	.675	.484	.604

During explicit retrieval, self-referent encoding condition (.718) was advantageous compared to both other-referent (.675) and vowel-counting conditions (.484). There were two main effects of interest: group (i.e., mirror vs. no mirror) and encoding condition (Self, Other and Vowel vs. Foils). Comparisons of within subjects groups, (e.g., Self versus Other versus Vowel-counting), were also of interest. This shows whether or not there is a Levels of Processing effect or Self-Reference effect, or both. A General Linear Model (GLM) Split-plot analysis with orthogonal contrast coding (Cohen & Cohen, 1983, pp. 204-209) was chosen to test for main effects and potential group by condition

interactions. Three orthogonal contrasts were created. First, the combined means of Self, Other and Vowel-counting conditions (i.e., seen target items) were tested against the mean of the Foils, or unseen items, for significant differences. Second, the combined means of Self and Other encoding conditions were tested against the mean of the Vowel-counting condition (i.e., levels - of - processing effect). And, third, the mean of the Self encoding condition was tested against the mean of the Vowel-counting task.

There were no main effects of either group (mirror vs. no mirror) or of encoding condition. Recognition of target items from both self-referent and other-referent conditions was superior to targets from the vowel counting condition, $\underline{F}(1,28) = 27.99$, $\underline{MSE} = (18.204)$, $p < .001$, indicative of a levels of processing effect (Craik & Lockhart, 1972; Craik & Tulving, 1975). Although analysis of self-referent versus other-referent target items was not significant, $\underline{F}(1,28) = 3.23$, $\underline{MSE} = (0.563)$, $p = .083$, self-referent items were recalled more than other-referent items. However, was a significant self x mirror interaction effect, $\underline{F}(1,28) = 4.30$, $\underline{MSE} = (0.750)$, $p = .048$. As hypothesized, explicit retrieval was enhanced for self-referent target items when participants were mirror exposed, which is consistent with previous findings from studies documenting mnemonic superiority for self-referential processing (Rogers, Kuiper, & Kirker, 1977; Markus, 1977; Symons, & Johnson, 1997) and enhanced self-focus due to mirror presence (Carver, & Scheier, 1978). It is notable that mirror exposure selectively enhanced the self-referent encoding compared to the other-referent encoding, rather than producing a more general enhancement of self and other encoding conditions over vowel-counting. This is not explained by the levels of processing account, which would predict

interaction effects with both encoding conditions (i.e., self & other) relative to the vowel-counting condition.

In order to examine the amount of variance contributed by each of the between and within group sources, semipartial and partial Eta-squareds were calculated. Eta-squared is equivalent of the Multiple R^2 in an ANOVA (Cohen & Cohen, 1983 & Figueredo, Petrinovich, & Ross, 2000). Through the use of Eta-squared, proportions of variance can be accounted by hierarchically partitioning the incremental variance of the different sources, in this case, both between and within groups. The between - group sources of variance of interest were mirror and subjects. Within - group sources of variance were computed for each contrast condition (i.e., C1, C2, & C3). Moreover, there were three sources, one for each group by contrast condition interaction term (C1 * mirror, C2 * mirror, & C3* mirror), and three more sources, one for each subject by contrast condition interaction term (C1 * ID, C2*ID, & C3*ID), which were also of interest. Finally, the residual error term was also included.

Table 2

Hierarchical Partitioning of Variance for Experiment 1 Explicit Retrieval

Source	*DF*	$ETA^2_{SEMIPARTIAL}$	$ETA^2_{PARTIAL}$
Between Subjects Effects			
Mirror	1	.0000	.0070
Subjects	28	.0142	.9930
Subtotal Between Subjects	29	.0143	1.0000
Within S's Effects			
(C1) Encoding	1	.0005	.0005
(C2) S & O vs. V	1	.0214	.0217
(C3) S vs. O	1	.0007	.0007
C1 * Mirror	1	.0002	.0002
C2 * Mirror	1	.0000	.0000
C3 * Mirror	1	.0009	.0009
C1 * ID	28	.1133	.1150
C2 * ID	28	.0214	.0217
C3 * ID	28	.0057	.0058
Residual	3480	.8217	.8336
Subtotal Within S's	90	.9857	1.0000
Total	3599	1.0000	

Implicit Retrieval

Table 3 shows the proportions of target items correctly identified relative to the proportions of correct rejections of foils during implicit retrieval, by encoding condition and as a function of mirror versus no-mirror groups. A pattern similar to explicit retrieval emerged during the implicit retrieval task. As hypothesized, collapsing across group, indicated there was an advantage for self-referent encoding (.710) over other-referent (.678) and vowel-counting conditions (.667).

Table 3

Proportions of Adjectives Recalled During Experiment 1 Implicit Retrieval as a Function of Encoding Condition and Mirror Presence

	Encoding Condition / Level of Self-Reference			
Condition	Self	Other	Vowel	Foils
Mirror (n = 15)				
M	.690	.653	.683	.541
SD	.254	.248	.231	.211
No Mirror (n = 15)				
M	.730	.703	.650	.600
SD	.318	.300	.291	.287
M	.710	.678	.667	.571

Although the self-referent condition produced the highest rates of successful implicit retrieval, the rates were higher for the no-mirror group compared to mirror-exposed participants. A General Linear Model (GLM) Split-plot analysis with orthogonal contrast coding (Cohen & Cohen, 1983, pp. 204-209) was again used to test for main effects and potential group by condition interactions. The orthogonal contrasts were created were identical to the explicit retrieval analysis. There was a significant main effect of encoding condition, $\underline{F}(1,28) = 44.29$, $\underline{MSE} = (11.79)$, $p < .001$. However, comparing self-referent and other-referent encoding conditions to the vowel-counting condition, indicated the difference was not significant, $\underline{F}(1,28) = 2.18$, $\underline{MSE} = (0.303)$, $p = .151$, similar to the comparison between self-referent and other-referent conditions, $\underline{F}(1,28) = 2.62$, $\underline{MSE} = (0.301)$, $p = .117$. Nevertheless, there was a significant interaction effect of mirror presence when comparing the self and other encoding conditions against the vowel-counting condition, $\underline{F}(1,28) = 4.41$, $\underline{MSE} = (0.614)$, $p = .045$. Similar to the explicit retrieval analyses of variance contributions from between and within group sources, semipartial and partial Eta-squareds were again calculated, and are displayed in Table 4.

Table 4

Hierarchical Partitioning of Variance for Experiment #1 Implicit Retrieval

Source	*DF*	$ETA^2_{SEMIPARTIAL}$	$ETA^2_{PARTIAL}$
Between Subjects Effects			
Mirror	1	.0016	.0061
Subjects	28	.2609	.9939
Subtotal Between Subjects	29	.2625	1.0000
Within S's Effects			
(C1) Encoding	1	.0140	.0190
(C2) S & O vs. V	1	.0003	.0005
(C3) S vs. O	1	.0004	.0005
C1 * Mirror	1	.0004	.0006
C2 * Mirror	1	.0007	.0010
C3 * Mirror	1	.0000	.0000
C1 * ID	28	.0089	.0120
C2 * ID	28	.0046	.0063
C3 * ID	28	.0038	.0052
Residual	3480	.7043	.9549
Subtotal Within S's	90	.7374	1.0000
Total	3599	1.0000	

In light of the original hypotheses, these data are somewhat mixed. There was a definite self-reference effect (Rogers, et. al., 1977; Markus, 1977; Symons, & Johnson, 1997), and an inconsistent levels of processing effect, evidenced by the fact that while retrieval of self and other-referent target items approached significance over the vowel-counting target items, only the self-referent condition was better than the vowel-counting condition, albeit marginally. Moreover, the presence of the mirror was only relevant in comparisons involving the self and vowel conditions, and not the other and vowel conditions, again suggestive of the SRE and successful awareness manipulation.

An interesting difference between explicit and implicit retrieval involved the vowel-counting condition which showed a pattern of asymmetrical recall. Specifically, during implicit retrieval, more vowel-counted target items were correctly identified than non-studied items, for both mirror and no-mirror groups. However, for explicit retrieval, the opposite pattern occurred, as more non-studied items were correctly rejected than studied targets correctly identified, for both mirror and no-mirror groups.

Although the adjectives in the current study have been widely used in previous literature (see Anderson, 1968), in the context of this experiment they were utilized in a novel manner with different tasks. In order to provide an estimate of the reliability of the internal consistency of each block of items within each encoding condition, Cronbach's coefficient alpha was calculated. Since encoding condition (i.e., level of self-reference) was a within-group factor, by definition, every subject was exposed to each of the three conditions and all of the items. Congruence analyses, using Cronbach's alpha, yielded nine correlation coefficients (i.e., 3 orders of presentation x 3 conditions), which ranged

from .85 - .90, and averaged .90; indicating excellent internal consistency of each stimulus block, as shown in Table 5 below.

Table 5

Internal Consistency (Cronbach's Coefficient Alpha) of Items by Encoding Condition and Order of Presentation

	Encoding Condition / Level of Self-Reference		
Subject Block	Self	Other	Vowel
1-10	.8523	.8579	.8560
11-20	.9517	.9151	.9108
21-30	.9518	.9561	.9286

Overall, the results of experiment 1 are consistent with previous studies documenting levels of processing (Craik & Tulving, 1975) and self-reference effects (Markus, 1977; Kuiper & Rogers, 1979). Examination of implicit retrieval, and the superiority of self-referent encoding over both other-referent and vowel-counting encoding conditions, illustrates findings potentially contrary to commonly accepted cognitive psychology theories stating that implicit memory does not rely on relation to self (Banks, 1995; Kihlstrom, 1995) and that the episodic memory system, which enables remembering of personal, autobiographical, and self-referential information is accessed solely by explicit retrieval strategies (Tulving, 1983). Moreover, these findings are in accord with

voluminous evidence from social psychology indicating that implicit memory processes influence recall of self-referential material, such as priming of personality-consistent traits (Dijksterhuis & Knippenberg, 1996), or unconscious self-relevant stimuli provoking automatic attention responses to additional stimuli (Bargh, 1982), or indirect priming of self-evaluations (Baldwin & Holmes, 1994).

EXPERIMENT 2

Experiment 1 tested the possibility that manipulating levels of self-reference and self-awareness might affect implicit memory performance in a standard perceptual priming task. However, considering that mnemonic representations of self are likely an aggregate of data from multiple sources, for example, physiological, affective, cognitive and social; it was decided that there may have been a less than optimal match between encoding and retrieval task types, since the encoding task was conceptual in nature, while the retrieval task was a perceptual identification task. However, both encoding specificity (Craik & Lockhart, 1972) and Transfer-Appropriate Processing (Blaxton, 1989) suggest that the degree of overlap between encoding and retrieval conditions will affect the rate of retrieval. Consequently, the design and methodology for Experiment 2 were identical to Experiment 1, except that the second experiment explored the possibility that better matching between the retrieval and encoding task types might differentially affect memory performance. Therefore, the implicit retrieval task that Experiment 2 subjects received was a conceptual priming task rather than a perceptual identification task.

Method

Subjects

Using the same recruitment procedures detailed in Experiment 1, thirty additional subjects were recruited from University of Arizona introductory Psychology courses. Subjects were each paid $10.00 and given 3 research credits for their participation. Again,

all subjects spoke English as their native language, performed normally on a Snellen eye chart, and were individually interviewed with the same brief health questionnaire used in Experiment 1. No subject demographics were significantly different from those of participants in the first experiment.

Materials

All materials, including the same 126 adjectives, neuropsychological tests, and the Self-Consciousness Questionnaire were administered in the same fashion, and in the same order, as Experiment 1. The only change was the employment of a conceptual rather than a perceptual retrieval task. While subjects in Experiment 1 saw words flashed tachistoscopically and then had to give their "best guess" at identifying the target item, Experiment 2 subjects were asked to indicate "yes" or "no", when the target word appeared on the computer screen, as to whether the word is "usually descriptive of them or not". In Experiment 2, the words were not presented tachistoscopically. Each word remained on the screen for a maximum of five seconds. However, subjects' reaction times were recorded once they pressed the appropriate mouse button. After their response the word disappeared, followed by a one second delay, and then the next word appeared, until the entire retrieval trial was completed.

Design & procedures

The design was identical to Experiment 1, a mixed 2 (mirror vs. no mirror) x 3 encoding conditions design. As before, mirror exposure was a between groups factor and

encoding condition was a within group factor. Again, the primary dependent variables were levels of explicit and implicit retrieval. In this experiment, subjects' reaction time was used as the dependent variable for both since there was no hit rate measure during the conceptual retrieval task. Practice effects were controlled for by presentation the three conditions of self-reference in a partially counterbalanced fashion, as in Experiment 1. Again, during presentation, each condition appeared in the ordinal position equally often, while target adjectives were randomized at to guard against selection or position bias.

Results & Discussion

Explicit Retrieval

A breakdown of the within-group factor of encoding condition is shown below. Table 6 displays the proportions of studied adjectives recalled relative to correct rejections of non-studied adjectives (i.e. foils) during explicit retrieval as a function of encoding condition or level of self-reference (i.e., S, O, V) for mirror versus no-mirror groups.

Table 6

Proportions of Adjectives Recognized During Experiment 2 Explicit Retrieval as a Function of Encoding Condition and Mirror Presence

	Encoding Condition / Level of Self-Reference			
Condition	Self	Other	Vowel	Foils
Mirror (n = 15)				
M	.650	.477	.383	.312
SD	.285	.223	.227	.155
No Mirror (n = 15)				
M	.593	.620	.387	.364
SD	.219	.147	.242	.217
M	.622	.548	.385	.338

Similar to the Experiment 1 explicit retrieval data, there was again an advantage for the self-referent encoding condition (.622) over other-referent (.548) and vowel-counting conditions (.385). However, unlike Experiment 1, overall recall performance of all three encoding conditions was superior to successful recognition of foils not seen (.338). A General Linear Model (GLM) Split-plot analysis with orthogonal contrast coding was used to conduct the same comparisons as detailed in the previous experiment. There was a main effect of encoding condition, $F(1,28) = 72.39$, $MSE = (29.16)$, $p < .001$, but not for mirror exposure. Similar to Experiment 1, both self-referent and other-referent

conditions were found to be significantly different from the vowel counting condition, F(1,28) = 33.63, MSE = (16.00), $p < .001$. Comparison of self-referent versus other-referent encoding condition yielded a significant advantage for self-referent processing, F(1,28) = 5.11, MSE = (1.613), $p = .032$, and a significant interaction effect of self-referent encoding and mirror presence, F(1,28) = 9.51, MSE = (3.00), $p = .005$, when compared to the other-referent task. This also was consistent with the findings from the first experiment. As before, the superiority of mirror presence and self-referent processing, over other-referent processing, demonstrated that the combination of manipulation of self-awareness and self-reference enhanced retrieval performance in a manner beyond a levels of processing effect.

Similar to the first experiment, semipartial and partial Eta-squareds were once again calculated, for both explicit and implicit retrieval tasks.

Table 7

Hierarchical Partitioning of Variance, for Experiment #2, Explicit Retrieval

Source	*DF*	$ETA^2_{SEMIPARTIAL}$	$ETA^2_{PARTIAL}$
Between Subjects Effects			
Mirror	1	.0017	.0133
Subjects	28	.1282	.9867
Subtotal Between Subjects	29	.1300	1.0000
Within S's Effects			
(C1) Encoding	1	.0330	.0380
(C2) S & O vs. V	1	.0182	.0209
(C3) S vs. O	1	.0018	.0021
C1 * Mirror	1	.0000	.0001
C2 * Mirror	1	.0002	.0002
C3 * Mirror	1	.0034	.0039
C1 * ID	28	.0128	.0147
C2 * ID	28	.0151	.0174
C3 * ID	28	.0100	.0115
Residual	3480	.7753	.8912
Subtotal Within S's	90	.8698	1.0000
Total	3599	1.0000	

Implicit Retrieval

Because the nature of the implicit memory task in Experiment 2 was conceptual identification, a score for proportion of items correctly identified (i.e., hit rate) was not recorded. The data acquired and analyzed from participants in this task of the study was the latency of response (i.e., reaction time) to the question of how well each subject thought the adjective described him or her self.

Table 8

Reaction Time (in milliseconds) of Adjectives Recalled During Experiment 2 Implicit Retrieval as a Function of Encoding Condition and Mirror Presence

	Encoding Condition / Level of Self-Reference			
Condition	Self	Other	Vowel	Foils
Mirror (n = 15)				
M	1218.20	1282.76	1343.49	1341.22
SD	354.99	432.14	430.02	345.05
No Mirror (n = 15)				
M	1477.73	1547.99	1469.17	1540.96
SD	853.65	915.88	777.32	747.05
M	1347.96	1415.37	1406.33	1441.09

Although self-referent encoding produced the shortest reaction times as predicted, there was neither a main effect of encoding condition nor mirror presence, indicated by a GLM Split-plot analysis with orthogonal contrasts. There was a tendency for mirror presence to facilitate priming during the conceptual identification (i.e., implicit retrieval) task, which only approached significance, $\underline{F}(1,28) = 3.34$, $\underline{MSE} = (4863823.711)$, $p < .079$. However, there was a significant difference between the self-referent and other-referent tasks compared to the vowel-counting task, but only when subjects were mirror – exposed, $\underline{F}(1,28) = 4.53$, $\underline{MSE} = (5709008.56)$, $p < .042$. The difference between self-referent and other-referent encoding conditions was not significant. An analysis of semipartial and partial Eta-squareds for Experiment 2, implicit reaction time data, are listed in Table 9 below.

Table 9

Hierarchical Partitioning of Variance, for Experiment #2, Implicit Retrieval

Source	*DF*	$ETA^2_{SEMIPARTIAL}$	$ETA^2_{PARTIAL}$
Between Subjects Effects			
Mirror	1	.0013	.0064
Subjects	28	.2004	.9936
Subtotal Between Subjects	29	.2017	1.0000
Within S's Effects			
(C1) Encoding	1	.0000	.0000
(C2) S & O vs. V	1	.0000	.0000
(C3) S vs. O	1	.0000	.0001
C1 * Mirror	1	.0005	.0006
C2 * Mirror	1	.0006	.0001
C3 * Mirror	1	.0002	.0003
C1 * ID	28	.0041	.0051
C2 * ID	28	.0036	.0044
C3 * ID	28	.0038	.0048
Residual	3480	.7855	.9839
Subtotal Within S's	90	.7983	1.000
Total	3599	1.0000	

EXPERIMENTS 1 & 2 COMBINED

Combined Explicit Recognition Reaction Time Data

All of the data for the cognitive memory tasks for Experiments 1 and 2 were analyzed separately since the retrieval measures were different (i.e., perceptual and conceptual). In the first experiment hit rate was recorded for both explicit memory tasks, and reaction time was collected during explicit retrieval but not during implicit retrieval. Whereas, in the second experiment, hit rate was recorded for explicit retrieval only, while reaction time was collected for both explicit and implicit retrieval. Thus, in both experiments reaction time was measured during explicit recognition. Similarly, the neuropsychological and Self-Consciousness Scale measures were also given during both experiments. Therefore, these data were aggregated across both experiments and analyzed together, increasing the sample size from 30 to 60. Once more a GLM Split-plot analysis, with orthogonal contrast coding, was used to test for effects of individual encoding conditions on reaction time during explicit retrieval. Subjects' reaction times for the previously seen items in all conditions were significantly lower than the reaction times to the unseen items, $F(1,30) = 36.15$, MSE = (62047254.54), $p < .001$. Subjects' reaction times were also significantly lower for both self and other-referent tasks compared to the vowel-counting task, $F(1,30) = 22.45$, MSE = (30806435.52), $p < .001$. Comparison of the self-referent and other referent encoding conditions revealed a significant self x mirror interaction effect, $F(1,30) = 4.58$, MSE = (4801588.37), $p = .041$,

but no significant difference between encoding conditions when participants were not mirror exposed.

Combined Self-Consciousness Scale Data

Fenigstein, et al., (1975) performed a principal components factor analysis using varimax rotation on the 23 items of the Self Consciousness Scale (SCS). Their analyses yielded three factors, (i.e., Private Self-Consciousness, Public Self-Consciousness, and Social Anxiety), with a different number of test items loading on each. Specific item loadings for each factor reported by Fenigstein, et al., are shown in Appendix A, in Table A1.

Before analyzing subjects' performance from both experiments (n = 60) across each of three factors of the SCS, their raw scores were first standardized by converting to z-scores. Three unit-weighted factor scores were derived by using the mean of each set of standardized scores, for both pre- and post-test administrations of the SCS, yielding six unit-weighted factor scores total. The means of these six standardized unit-weighted factor scores are listed below, in Table 5.

Repeated measures ANOVAs were used to test whether mirror presence had an effect on subjects' pre- and post-test Self Consciousness subscales scores. The main effect of mirror exposure on the Public Self Consciousness subscale, was not significant, $F(1,58) = 3.58$, $MSE = (3.050)$, $p = .064$. Moreover, there was no significant variation in subjects' pre and post-test SCS subscale scores for the Private Self Consciousness, Public Self Consciousness, and Social Anxiety subscales. This is consistent with Fenigstein, et al.'s

(1978) report of high test-retest correlations for each SCS subscale. With a two week interval between administrations, test-retest correlations for the subscales were: public self-consciousness (.84); private self-consciousness (.79); social anxiety (.73); and total score (.80).

Table 10

Experiments 1 and 2 Unit – Weighted Factor Scores for Individual Factors of the Self-Consciousness Scale, for Pre-Test and Post-Test Administrations, as a Function of Mirror / No Mirror Conditions

	Subscales of the Self Consciousness Scale					
Condition	Private – Self Consciousness		Public - Self Consciousness		Social Anxiety	
Mirror (n=30)	Pre	Post	Pre	Post	Pre	Post
M	.048	.077	.213	.220	.056	.018
SD	.383	.042	.605	.659	.497	.678
No Mirror (n=30)						
M	-.111	-.050	-.106	-.098	.027	.036
SD	.483	.575	.686	.705	.487	.540

Combined Self-Awareness & Neuropsychological Data

Correlations were used to examine the relations between the SCS and neuropsychological measures. As with the SCS subscale scores, the neuropsychological measures were standardized, and included: the total score and total number of animals named on the Controlled Oral Word Association Task, raw scores from Trail Making Test forms A & B, and the number of perseverative errors and categories obtained from the Wisconsin Card Sorting Task. It should be noted that since the Modified Wisconsin Card sorting task (Hart, et al., 1988; Nelson, 1976) was used, the number of perseverative errors were equal to the number of perseverative responses. Tests often used as indices of temporal lobe functioning were also included: the WMS-R LM I & II and VR I & II subscales, (Bigler et al., 1996; Naugle et al., 1993), and the WAIS-R Picture Arrangement subtest (Lezak, 1983, pp. 283-284). Table 11 shows the significant correlations between Individual Factors of the Self-Consciousness Scale, for both pre-test and post-test administrations and neuropsychological measures. Consistent with the proposal that episodic memory is defined by autonoetic or self consciousness (Wheeler, et al., 1997), and is somewhat dependent upon frontal lobe functioning, the WCS perseverative and non- perseverative errors were both found to be negatively correlated with private self-consciousness subscale performance. Moreover, pre-test social anxiety SCS scores were negatively correlated with Trail forms B, while post-test Social Anxiety SCS scores were negatively correlated with Trail forms A. Fenigstein, et al. (1975) have defined social anxiety as a reactionary process that involves attentional switching; specifically, a person first “becomes aware of him or her self as a social object, may evaluate him or her self,

and then become apprehensive" (p. 523). The Trail Making test; is assumed to measure visual conceptual and visuomotor tracking, motor speed, attentional functions, the ability to respond to a complex visual array, mental sequencing (i.e., dealing with more than one thought or stimulus at a time) and flexibility of shifting during ongoing activity (Lezak, pp. 556-558).

Table 11

Pearson Correlation Coefficients for Individual Factors of the Self-Consciousness Scale, for Pre-Test and Post-Test Administrations and Neuropsychological Measures

	Subscales of the Self Consciousness Scale					
Neuropsych-ological Subtest	Private – Self Consciousness		Public - Self Consciousness		Social Anxiety	
	Pre	Post	Pre	Post	Pre	Post
LM1						r = -.340, $p < .008$
LM2			r = -.257, $p < .048$	r = -.276, $p < .032$		r = -.250, $p < .054$
VR1			r = -.261, $p < ..044$			
VR2			r = -.257, $p < .048$			
WCSPE	r = -.254, $p < .050$					
WCSNPE	r = -.255, $p < .049$					
WAISINF				r = -.252, $p < .052$	r = -.342, $p < .007$	r = -.328, $p < .011$
WAISPA						r = -.380, $p < .003$
TRAILS A						r =-.302, $p < .019$
TRAILS B					r = -.352, $p < .006$	

Both forms A and B were negatively correlated with the pre-test social anxiety scale. Most, if not all, of these activities are arguably involved in persons' monitoring of themselves, others, and relevant social feedback during public interactions. Furthermore, Stuss and Benson (1986) have argued that prefrontal functioning supports self-awareness

and the ability to introspect on one's own thoughts, especially in relation to one's self and surrounding social environment. This idea is developed even further in Wheeler et al.'s view that autoneotic consciousness, and resultant awareness of self, is largely dependent on the frontal lobes; and that it is this "highest form of consciousness that makes episodic memory possible" (p.335). Interestingly, Carver and Glass (1976) documented an unexpected finding that social anxiety correlated negatively with IQ ($r = -.21$, $p < .04$). They argued that more intelligent people might be more socially competent and less socially anxious. However, one alternative explanation suggested by the present results is that the more intelligent group's attentional processes were more efficient, making them more adept at tracking social information about themselves and their surrounding environment. Anxiety has been shown to have a detrimental effect on attention (Wine, 1971; Sarason, 1972), to decrease apprehension span (Broen & Storms, 1961; Easterbrook, 1959), and to negatively impact memory performance (Kaye, Kirschner, & Mandler, 1953). Therefore, subjects' tendencies to think or worry about themselves will certainly interfere with these processes (Geller, V. & Shaver, P., 1976).

After Pearson's correlation coefficients were calculated, six regression analyses were conducted in order to predict subjects' performance on pre and post measures for each SCS subscale score. Neuropsychological tests frequently administered for purposes of evaluating frontal lobe or temporal lobe performance, were used as predictors, and each SCS subscale score was used as a dependent variable. These tests were aggregated into two factors based on their standard usage by researchers and clinical practioners when assessing neuropsychological performance. The first, a "frontal lobe factor", was

comprised of: COWAT total score, Trail Making Test forms A & B, WCST perseverative errors and total categories completed, WAIS-R Digit Span forward and backward scores, and WAIS-R Picture Arrangement score. The second, a "temporal lobe factor", was composed of: WMS-R Logical Memory I & II and Visual Reproduction I & II subscale scores. All of the neuropsychological variables used in the analysis were standardized (i.e., mean = 0, standard deviation = 1) to correct for different scales of measurement. A third factor, "Group" (i.e., mirror versus no-mirror) was also included as an independent variable.

When group, frontal and temporal lobe factors were regressed against overall SCS performance, the effect of the frontal lobe test only approached significance, $\underline{F}(1,56) = 2.14$, $\underline{MSE} = (.359)$, $p = .149$. On the other hand, temporal lobe tests were found to be a significant predictor of overall SCS performance, $\underline{F}(1,56) = 7.35$, $\underline{MSE} = (.106)$, $p = .009$. Subsequently, both factors were used to predict individual SCS subscale performance, of both pre and post-test administrations. Both temporal lobe and group (i.e., mirror vs. no mirror) factors significantly predicted pre-test public self-consciousness subscale performance, $\underline{F}(5,54) = 3.94$, $\underline{MSE} = (1.54)$, $p = .052$ and $\underline{F}(5,54) = 3.78$, $\underline{MSE} = (1.47)$, $p = .057$, respectively. There was also a significant interaction effect (i.e., temporal lobe x mirror) $\underline{F}(5,54) = 3.08$, $\underline{MSE} = (1.20)$, $p < .085$. A similar pattern of results was found for post-test public self-consciousness subscale performance, with both group membership (e.g., $\underline{F}(5,54) = 3.51$, $\underline{MSE} = (1.51)$, $p = .067$) and the temporal lobe factor (e.g., $\underline{F}(5,54) = 3.92$, $\underline{MSE} = (1.694)$, $p = .053$) as significant predictors. Once again there was an interaction effect between temporal lobe test performance and group membership, $\underline{F}(5,54)$

= 4.08, MSE = (1.76), p = .049. A different pattern of results emerged for the social anxiety self-consciousness subscale performance. Here the frontal factor was a significant predictor of both pre- and post-test scores, F(5,54) = 8.46, MSE = (1.807), p = .005 and F(5,54) = 4.31, MSE = (1.447), p < .042, respectively. An interaction effect between group presence and the frontal factor only approached significance, F(5,54) = 2.83, MSE = (.949), p = .099. But, the temporal lobe factor was indeed a significant predictor for post-test, but not pre-test Social Anxiety subscale performance, F(5,54) = 3.73, MSE = (1.25), p = .059.

GENERAL DISCUSSION

The purpose of this present experiment was an attempt to provide an alternative view for seeming disparities between cognitive memory and amnesia research arguing that "implicit memory does not rely on relation to self", (Banks, 1995; see also Kihlstrom, 1995) and evidence of implicit memory processes influencing recall of self-referential material from other areas of research; for example, priming of personality-consistent traits (Dijksterhuis & Knippenberg, 1996), unconscious self-relevant stimuli provoking automatic attention responses to additional stimuli (Bargh, 1982), and indirect priming of self-evaluations (Baldwin & Holmes, 1994). The episodic memory system, which enables remembering of personal, autobiographical and self-referential information, is considered to be accessed solely by explicit retrieval strategies (Schacter & Tulving, 1994); thus, retrieval of self-referential material is only through explicit mechanisms (Tulving, 1983). Although priming may reflect the influence of newly created episodic associations, these are considered to be inaccessible to conscious remembering (Graf & Schacter, 1985; Jacoby, 1984; Moscovitch, Winocur, & McLachlan, 1986; Schacter, 1989). The results of the present studies indicate there are complex relations between self-reference, implicit and explicit memory, the tests used to assess performance on these tasks, and the feasibility of awareness manipulations. In both experiments, participants exposed to the mirror yielded the highest rates of explicit retrieval for self-referential target items. However, recall of self-referent target items, when participants were exposed to the mirror, was higher than the other–referent encoding condition but not so

when participants were not mirror exposed, which was consistent with the original hypothesis that there would be a significant interaction of self-referent processing and mirror exposure. Both levels - of - processing and self-reference effects explanations are not sufficient to account for this finding of successfully manipulating self-awareness through mirror exposure, since self-referent processing was greater overall, and with mirror exposure, but with changes in other-referent processing occurring only in the absence of mirror exposure. Since retrieval rates for the other-referent target items were higher when in the no mirror group, regardless of task, it could be that mirror presence exerted some sort of suppression of other-referent information.

Because of the experimental designs of the current studies, it was not possible to aggregate and analyze subjects' implicit retrieval performance across both experiments, since hit rate was recorded as a dependent variable in Experiment 1, while reaction time was recorded as a dependent variable in Experiment 2. Nevertheless, despite differences in measured dependent variables during implicit retrieval tasks across both experiments, participants' trends of performance were similar. There was a significant main effect of encoding condition during the implicit task in the first experiment, but during the conceptual implicit task, this effect only approached significance. However, self-referential target items producing the highest retrieval rates for both mirror and no-mirror groups (i.e., Experiment 1), and the shortest overall and mirror-exposed reaction times (i.e., Experiment 2). Moreover, data from both implicit tasks yielded condition by mirror interaction effects, which implies that although results from both tasks (i.e., perceptual and conceptual) demonstrate a levels - of - processing effect, indicated by both self and

other encoding conditions being superior to vowel-counting encoding, this is not sufficient to explain the main effect of group in the second experiment, nor the interaction effects of encoding condition by mirror. In fact, considering both explicit and implicit retrieval, across both experiments, almost all encoding condition by mirror interaction effects were isolated to the self-referent encoding condition, except for reaction time measurements during Experiment 2 implicit retrieval. Consequently, the priming effects for the self-referent condition, whether measured by hit rate in Experiment 1, or by lowest reaction times in Experiment 2, lend support to the original hypotheses of effects of self-awareness through mirror exposure and self-reference on implicit memory performance.

Extends SRE Findings

The present results confirm previous findings that information encoded self-referentially promotes superior recall when encoded relative to others, semantically, or perceptually. While prior investigations have only used explicit tests of memory in order to investigate the SRE, present results unequivocally support these previous studies, and further suggest that investigations of self-reference effects on mnemonic processing should take into account self-awareness and possible influences of implicit memory. Furthermore, manipulations of self-awareness, in this case through mirror exposure, do impact mnemonic performance for both explicit and implicit tasks. Although self-referential encoding in both experiments was generally the most successful, there is a difficulty in comparing and thus interpreting performance across both experiments during implicit retrieval, as previously discussed. However, when data from explicit retrieval

from both experiments was aggregated and analyzed together, it was found to confirm the original hypothesis that self-reference and mirror-exposure would interact to maximize mnemonic performance during explicit recognition. There was not only a significant difference between self and other encoding conditions versus vowel-counting, $\underline{F}(1,30) = 22.45$, $\underline{MSE} = (30806435.52)$, $p < .001$, but more importantly, there was a significant interaction effect of self-referent encoding and mirror presence producing superior recall to other-referent encoding, $\underline{F}(1,30) = 4.58$, $\underline{MSE} = (4801588.37)$, $p = .041$. Interestingly, in both experiments, when subjects were exposed to the mirror, self-referent encoding produced the lowest reaction times; otherwise, when not seated in front of a mirror, other-referent encoding condition was associated with the lowest reaction times. This clearly demonstrates that awareness manipulations, in this case with mirror exposure, can <u>selectively</u> enhance self-referent encoding and retrieval, compared to other-referent encoding, or even perceptual processing. This corroborates previous research employing self-awareness manipulations (e.g., Carver & Scheier, 1978). Wheeler, Stuss, & Tulving, (1997) defined episodic memory by the type of awareness accompanying retrieval rather than a form of memory, such as event memory or autobiographical memory, since the latter both derive their definition from the material they operate on. In fact, they specifically argue that, "although episodic memory is clearly related to these varieties of memory, they should not be equated" (Wheeler, et al., 1997, p. 333). Given the significant results of shorter reaction times during explicit retrieval of previously seen self-encoding target items, and the interaction effect with mirror exposure, it is tenable that mirror presence facilitates both perceptual and conceptual enhancement of aspects of

self, supporting Bellezza & Hoyt's (1992) argument that mnemonic properties of self-related visual images and verbal labels support self-referent learning. In the present experiments, autobiographical mental cues, produced by mirror exposure, were available at both encoding and recall since the mirror was present throughout the experiment; perhaps magnifying salient portions of the self and augmenting the SRE. In fact, early research (Hull & Levy, 1979) emphasized the effect of self-awareness on self-relevant encoding processes, and argued that variations in dispositional self-consciousness were correlated with differing tendencies to encode information as self-relevant. This view was subsequently expanded by changing the focus from the effects of self-awareness on self-relevant encoding processes, to the ability of self-awareness to cause activation of self-knowledge, or in other words, "prime self-referential processes" (Hull, et al., 1988, p. 453). Thus, self-consciousness increases the accessibility of self-knowledge. Consequently, in the current studies, the interaction effects of mirror exposure and self-referential processing may indicate increased autobiographical information at encoding and retrieval, through self-awareness manipulations, thus enhancing activation of self-knowledge, evidenced by the shortest reaction times (in both experiments) during explicit retrieval occurring for mirror exposed participants while recalling self-referential targets.

Priming Effects and Self-Referential Material

Priming has been defined as an increase in the probability of identification of previously encountered targets, or as reductions in the latency of identification responses (Tulving & Schacter, 1990). As previously discussed, reduced latencies (i.e., reaction

times) during explicit retrieval were found in both experiments for self-referential material and mirror-exposure. Typically, however, priming effects are discussed in relation to implicit or indirect tests. Interpretation of implicit memory results from both experiments is less clear than the explicit memory data. First, it is impossible to equate the perceptual and conceptual implicit memory tasks, not only due to the different nature of the tasks, but also because of the different type of data recorded (i.e., retrieval rate versus reaction time). Second, while there was a main effect of encoding condition in the first experiment, this was only marginally significant in the second. Third, there was a marginal main effect of mirror exposure in the second experiment, but not the first. However, this was not observed in the conceptual implicit retrieval task. Nevertheless, in both studies, mirror exposure, a proven self-awareness manipulation, significantly interacted with self and other-referent encoding to promote superior retrieval compared to vowel-counting; whereas only in the first study was self-reference and mirror exposure superior to other-referent processing, and that only marginally. As a whole the results document a potentially complex and subtle relationship between implicit memory processes, self-reference, awareness, and task manipulations which deserve further exploration.

The results suggest a potentially tenable and conciliatory view of disparate results from numerous investigations with diverse methodologies examining priming and self-related processing. Superiority of self-referent encoding, and enhancement of aspects of self-awareness through mirror manipulation, certainly corroborate previous findings of priming of personality-consistent traits (Dijksterhuis & Knippenberg, 1996), quicker

access of self-relevant information over other types of information (Markus, 1977; Ross & Sicoly, 1979), provocation of automatic attention responses to subsequent stimuli for additional processing by self-relevant stimuli processed outside of conscious awareness (Bargh, 1982), activation of self-evaluations by subliminal primes (Baldwin & Holmes, 1994) and effects on social cognition by unconsciously-activated semantic information (Greenwald, Klinger, & Liu, 1989; Marcel, 1983; Newberg, 1988; Perdue & Gurtmann, 1990). The present interaction effects of mirror exposure and self-reference also support previous arguments that situational manipulations of self-awareness function as cognitive primes to increase the level of activation of knowledge about self, demonstrating that trait accessibility can influence subsequent impression formation (Bargh, Lombardi, and Higgins, 1988; Bargh and Peitromonaco, 1982; Bargh and Thein, 1985). However, these previous investigations did not formally invoke implicit memory to account for effects of self-consciousness facilitating processing of self-relevant stimuli by activation of self-knowledge. Typically, individual differences in self-consciousness have been associated with differences in the activation level of self-relevant knowledge, either by defining a stable or chronically higher activation level of self-relevant knowledge or by suggesting a more elaborate network of associative connections that function to spread activation of self-knowledge (Hull, Van Treuren, Ashford, Propsom, & Andrus, 1988). Nevertheless, in light of numerous other studies, the present results suggest that viewing self-referential memory processes as an exclusive domain of the episodic memory system, retrievable only explicitly (Tulving, 1983), may underestimate the complexity of self-reference, memory, awareness, test and cognitive process contamination. In fact, Jacoby (1991) has

argued that performance on indirect tests of memory can be contaminated by intentional usages of memory.

Process Impurity

By definition, an implicit task involves unintentional or non-conscious retrieval of past episodes; however, mirror exposure heightens self-awareness, making more elements of the self conscious. This may have enhanced explicit retrieval, as suggested above, while also contaminating the purity of the implicit retrieval tasks. In fact, Kihlstrom & Schacter, (1995) have proposed that every memory task is actually composed of both implicit and explicit components. Moreover, others have argued similarly that automatic memory processes can assist recall on direct tests, while consciously controlled memory processes can contaminate performance on indirect measures (Schmitter-Edgecombe, 1999; Jacoby, 1991; Jacoby & Dallas, 1981). Although disparate performances across various types of memory tasks (i.e., task dissociations) are frequently interpreted as evidence for concomitant process dissociations, Jacoby and Dallas (1981) have argued that this is problematic since it is based on the assumption that the tasks provide pure (i.e., valid and reliable) measures of the mnemonic processes in question. In fact, Jacoby (1991) developed a process dissociation procedure to estimate separate contributions of automatic (i.e., non-conscious) and intentional (i.e., conscious) processing that are potentially involved in both recall and recognition. An alternative view of process impurity is suggested by transfer-appropriate processing (Blaxton, 1989), which underscores the importance of clearly matching the mental operations required of subjects

at both encoding and retrieval. Also known as "encoding specificity" and "the processing account", transfer-appropriate processing basically states that the memory performance will be enhanced to the degree which conditions at encoding overlap with those at test. Prior to conducting the present investigations, Kihlstrom (personal communication) had pointed out the potential difficulties inherent in the disparity of the predominantly conceptual processing required of subjects at study (i.e., rate yourself or another) and primarily perceptual testing situation (i.e., a repetition priming lexical decision task) at recall. Subsequently, the second experiment was conducted to explore this possibility, employing a conceptual implicit memory test (i.e., indicate how applicable the adjective is to you or another). Transfer-appropriate processing would predict that the effect would be eliminated, or at least, attenuated in the first experiment but not in the second. However, this is not what happened. During implicit retrieval in the first experiment, the self-referent by mirror interaction was only marginally superior to the other-referent encoding condition; however, this was not the case in the second study. The complexity of this procedure and current hypotheses were not setup to specifically test for interpreting such process and task dissociations, especially with problems arising from equating particular processes with particular tasks, and questions of process purity. Consequently, the possibility of process contamination will need to be followed up with methodologies designed to test these specific hypotheses, particularly to what degree, if any, perceptual versus conceptual aspects of self impact self-referential mnemonic processes.

Methodology

Consistency across both experiments was, however, revealed by the eta squareds, which indicated that high systematic individual variability was present in both studies, and in both implicit and explicit tasks. These large individual differences suggest that the participants interacted with the test items in each of the three conditions rather differently. This issue has been both referenced as a serious limitation of standard psychological research design, and been put forth in support of utilizing psychometric approaches in conjunction with standard experimental design. Although cognitive – memory research has well documented test by subject interaction effects, these findings seem to be lost amongst the vast majority of studies reporting nothing but group mean differences, without further detail.

Some researchers (Figueredo, Ross, & Petrinovich, 1992) have argued for ongoing integration of quantitative psychometric and standard experimental approaches, in future investigations of human behavior, because of the rigor afforded by such methodologies, and the gains to be had in convergent validity and resultant construct validation. This approach guards against the inherent limitations of null hypothesis significance testing, which has been criticized for being uninformative when unaccompanied by mean or effect size estimates (Anderson, Burnham, & Thompson, 2000). Moreover, with null hypothesis significance testing, in studies where effects are found to be of marginal or dubious significance, further analyses are often required to further interpret the data. However, in many cases these analyses are lacking. In the present study, partial and semi-partial eta-squareds were calculated to further examine the effects, including the

non-significant trends, revealing that systematic inter-individual subject differences interacted significantly with the encoding conditions.

CONCLUSIONS

The diverse evidence from social psychology and studies on the SRE, suggest the feasibility of implicit memory for self-referential information; a hypothesis generally supported by the present results. Although there is a rich literature documenting priming effects for material related to one's self, there appears to be no clear consideration that many of the findings may be due, at least in part, to implicit memory effects. More generally, there is ample room for integration of experimental results regarding self-awareness, self-reference, and memory; an endeavor that could likely benefit from consideration of the role of implicit memory in processing information relative to one's self. Furthermore, attempts to relate self-awareness, self-reference, and memory to corresponding potential neural and neuropsychological concomitants, are harder to come by, with most of these attempts coming, not from social psychology, but rather from the domains of cognitive memory research and neuroscience. Research will continue to provide data on mechanisms and / or processes of differential processing of self-referential and social information. Considering the investigations surveyed across the multiple literature domains: cognitive, memory, social (e.g., private self, collective self, and implicit attitudes), consciousness and awareness, the current study provides and example of a framework for future research to utilize, that incorporates both psychometric and experimental assessments. Furthermore, the present investigation suggests that future research should examine more closely the impact of systematic inter-individual differences, especially when investigating subtle cognitive processes.

However, the purpose of the present study was an initial attempt to unify some of these diverse research efforts with the hope of establishing a methodology capable of examining the possibility that there is implicit memory for self-referential or autobiographical knowledge, a tentative hypothesis that much of the reviewed research appears to suggest. The results of the present study clearly show that the relationship between levels of self-reference, self-awareness, and memory are complex and prove the utility of utilizing cognitive memory methodologies to investigate both implicit and explicit influences of memory upon self-reference and self-awareness. Previously, the Self-Reference Effect had been investigated exclusively through the use of explicit memory paradigms. However, the present data not only extend the findings of the SRE, but also point to the feasibility of demonstrating implicit memory, in the form of priming, for self-referential or autobiographical knowledge, which may be mediated by situational or dispositional changes in levels of self-awareness or self-reference.

Although this data is preliminary, it suggests, as Wheeler, et al. have already claimed, that self-awareness may be important in further investigations of episodic memory, and that the ability of personal introspection and recognition of the relationships of one's self to one's social environment may prove fruitful upon investigation. Certainly, further research is needed to replicate and explore the effects that were observed in the current study, with a larger sample size of participants. Moreover, given the non-matching nature of the implicit retrieval tasks, and the data generated, direct comparisons of task type, and the implications thereof will also require further research. Moreover, the current

methodology was not designed to explicitly test for potential confounds due to process impurity.

The foregoing data suggest that the results of previous social psychological literature regarding the existence of priming effects for self-related material (i.e., attitudes and cognitions), automatic processing for self-referential material, and several major social psychology theories (i.e., Self-Awareness theory, etc.) should be accounted for by cognitive-memory research. They also extend the parameters of the SRE and clearly demonstrate that awareness manipulations can interact with encoding to moderate differing degrees of success on both explicit and implicit retrieval tasks. This suggests that those accounts insisting that episodic memory retrieval be explicit, thus subsuming autobiographical information entirely under episodic memory, should consider the previously referenced findings and the obvious mnemonic impact of self-awareness or autonoetic consciousness, as Wheeler, et al. have proposed. Likewise, strict interpretations of the implicit / explicit memory dichotomy arguing that retrieval of implicit memories can only occur if they lack connection to the self; in other words, that implicit memory does not rely on a relation to the self (Banks, 1995; Kihlstrom, 1995), may underestimate the complexity of the relationships between awareness, memory, and the self.

The present findings demonstrate that future research should be aware of systematic individual differences and should supplement typical experimental methodologies with psychometric approaches. Much of the literature on these subtle or tenuous processes (e.g., awareness, automatic processing, and implicit memory) could benefit from

combining and incorporating these two methodologies, and recognizing that subject by treatment interactions may present serious issues for these types of investigations. Recognizing the need to account for individual differences will assist in generalizing research subsequent results to real – world situations, and provide additional data beyond the overly familiar mean group comparisons.

The current results and methods impact multiple literatures, and raise numerous questions for future study. For example, are there functional significances due to these individual differences in processing self versus other referent information, that drive people to process social data differently? Given that automatic processing is less effortful, more efficient and that stimuli outside of awareness can attract attention and be operated on, there are incredible efficiencies gained by unconscious / automatic processing. Perhaps, certain careers rely on differential capabilities (e.g., a public relations agent who processes other-referent information well) or different psycho-social styles evolve out of predispositions to process information in one fashion versus another. Furthermore, individuals more adept at processing self-referential information may excel at impression management, helping them to have greater control over the social impressions they create. More efficient processing of social information ought to make social mobility easier, since establishing an accurate self – other relationship is fundamental to any social interaction. In fact, most psych-social disorders involve some sort of problem or issue maintaining accurate and proper self / other relations.

Moreover, given that there was substantial systematic individual differences, evidenced by the semipartial and partial eta-squareds, cognitive memory and social

psychology researchers have to consider these, if they want to truly understand some of these processes. Additional information on implicit versus explicit self-referential information processing may provide clues to how people process trauma and the coping mechanisms, or lack of, that they develop. Maybe people with high self referential processing develop less psychopathology or stress related disorders. In fact, they might do better with biofeedback and may even exhibit a lower stress response to uncomfortable stimuli, because they would more "in tune" with information regarding their personal information. Further contributions can be envisioned with regard to Theory of Mind and social psychology literature, regarding to how and what kind of impressions people remember about themselves and others; consciously, unconsciously, and / or automatically. It is tenable that there are adaptive significances to being able to differentially process these types of information differentially relative to one's context. For example, knowing when one's self is threatened, so as to be better able to avoid harm; or even how to be more accurate at reading others to enhance communication and language development. Nevertheless, given the current findings of the importance of individual differences, future researches, especially in the areas of cognitive-memory, social, personality, self, and psychotherapeutic research must do more than pay lip service to such differences.

APPENDIX A

Fenigstein, Scheier, & Buss's (1975) Factor Analysis of the Self-Consciousness Questionnaire

Table A1.

The following table displays each of the 23 items on the Self-Consciousness Questionnaire, with the number of that item indicated in parentheses, and each item's factor loading on one of the three factors derived by a Principal Components factor analysis using Varimax Rotation.

Items and Factor Loadings of the Self-Consciousness Scale

	Private	Public	Social Anxiety
Private self-consciousness:			
I'm always trying to figure myself out. (1)	.65		
Generally, I'm not very aware of myself. (3)	-.48		
I reflect about myself a lot. (5)	.73		
I'm often the subject of my own fantasies. (7)	.45		
I never scrutinize myself. (9)	-.51		
I'm generally attentive to my inner feelings. (13)	.66		
I'm constantly examining my motives. (15)	.62		
I sometimes have the feeling that I'm off somewhere watching myself. (18)	.43		
I'm alert to changes in my mood. (20)	.55		

APPENDIX A - *Continued*

I'm aware of the way my mind works when I work through a problem. (22)	.46
Public self-consciousness:	
I'm concerned about my style of doing things. (2)	.47
I'm concerned about the way I present myself. (6)	.65
I'm self-conscious about the way I look. (11)	.61
I usually worry about making a good impression. (14)	.72
One of the last things I do before I leave my house is look in the mirror. (17)	.51
I'm concerned about what other people think of me. (19)	.73
I'm usually aware of my appearance. (21)	.60

APPENDIX A - *Continued*

Social Anxiety:			
It takes me time to overcome my shyness in new situations. (4)			.76
I have trouble working when someone is watching me. (8)		.26	.45
I get embarrassed very easily. (10)			.70
I don't find it hard to talk to strangers. (12)			-.66
I feel anxious when I speak in front of a group. (16)	.21		.46
Large groups make me nervous. (23)			.69

APPENDIX B

Adjectives for Present study Derived from Anderson's (1968) List of Personality Traits:

Target Items:

Self-Referent	Other-Referent	Vowel-Counting
1. Cultured	1. Perfectionistic	1. Open – minded
2. Authoritative	2. Self – controlled	2. Mathematical
3. Level – Headed	3. Unimaginative	3. Self - sufficient
1. Sincere	1. Modest	1. Confident
2. Honest	2. Progressive	2. Entertaining
3. Truthful	3. Capable	3. Wholesome
4. Trustworthy	4. Sensible	4. Congenial
5. Cheerful	5. Sympathetic	5. Studious
6. Thoughtful	6. Respectable	6. Interesting
7. Optimistic	7. Attentive	7. Deliberate
8. Competent	8. Tender	8. Amusing
9. Brilliant	9. Decent	9. Literary
10. Productive	10. Inventive	10. Grateful
11. Undecided	11. Troublesome	11. Reckless
12. Wasteful	12. Resentful	12. Superstitious
13. Pessimistic	13. Boisterous	13. Hesitant
14. Dissatisfied	14. Antisocial	14. Cunning
15. Meddlesome	15. Irritating	15. Unimaginative
16. Radical	16. Impolite	16. Stubborn
17. Unlucky	17. Offensive	17. Impractical
18. Shallow	18. Bragging	18. Dependent
19. Disagreeable	19. Annoying	19. Pompous
20. Aimless	20. Crude	20. Immature
4. Unconventional	4. Hot-tempered	4. Unskilled
5. Forgetful	5. Nonchalant	5. Middleclass
6. Old – fashioned	6. Extravagant	6. Short – tempered

APPENDIX B - *Continued*

Foil Items:

1. Cultured
2. Authoritative
3. Level – Headed

1. Perfectionistic
2. Self – controlled
3. Unimaginative

1. Open – minded
2. Mathematical
3. Self - sufficient

1. Prudent
2. Understanding
3. Wise
4. Responsible
5. Helpful
6. Creative
7. Amiable
8. Original
9. Progressive
10. Courageous
11. Unromantic
12. Insecure
13. Messy
14. Showy
15. Anxious
16. Obstinate
17. Gloomy
18. Indifferent
19. Withdrawn
20. Discourteous

1. Easygoing
2. Lively
3. Punctual
4. Congenial
5. Efficient
6. Ingenious
7. Poised
8. Vivacious
9. Refined
10. Enterprising
11. Petty
12. Abusive
13. Disturbed
14. Helpless
15. Excitable
16. Scientific
17. Boastful
18. Sloppy
19. Belligerent
20. Argumentative

1. Sophisticated
2. Enthusiastic
3. Fashionable
4. Polite
5. Diligent
6. Vigorous
7. Cordial
8. Sensitive
9. Silly
10. Observant
11. Materialistic
12. Noisy
13. Foolish
14. Somber
15. Conventional
16. Vain
17. Satirical
18. Inaccurate
19. Demanding
20. Incompetent

4. Unconventional
5. Forgetful
6. Old – fashioned

4. Hot-tempered
5. Nonchalant
6. Extravagant

4. Unskilled
5. Middleclass
6. Short – tempered

REFERENCES

Allport, G. W. (1961). Patterns and growth in personality (p. 128). New York: Holt, Rinehart & Winston.

Anderson, N. H. (1968). Likableness ratings of 555 personality-trait words. Journal of Personality and Social Psychology, 9(3), 272-279.

Anderson, D. R., Burnham, K. P., & Thompson, W. L. (2000). Null hypothesis testing: Problems, prevalence, and an alternative. The Journal of Wildlife Management, 64 (4), 912-923.

Baldwin, M. W. & Holmes, J. G. (1987). Salient private audiences and awareness of the self. Journal of Personality and Social Psychology, 52(6), 1087-1098.

Banks, W. P. (1995). Implicit memory. Consciousness and Cognition, 4, 369-370.

Bargh, J. A. (1982). Attention and automaticity in the processing of self-relevant information. Journal of Personality and Social Psychology, 43(3), 425-436.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. American Psychologist, 54, 462-479.

Bellezza, F. S. (1984). The self as a mnemonic device: The role of internal cues. Journal of Personality and Social Psychology, 47, 506-516.

Bellezza, F. S., & Hoyt, S. K. (1992). The self-reference effect and mental cueing. Social Cognition, *10*(1), 51-78.

Benton, A. L., & Hamsher, K. (1983). Multilingual Aphasia Examination. Iowa City: AJA Associates.

Bem, D. J. (1967). Self-perception: An alternative interpretation of cognitive dissonance phenomena. Psychological Review, 74(3), 183-200.

Bower, G. H., & Gilligan, S. G. (1979). Remembering information related to one's self. Journal of Research in Personality, 13, 420-432.

Broadbent, D. E. (1977). The hidden pre-attentive process. American Psychologist, 32, 109-118.

Broen, W. E. & Storms, L. H. (1961). A reaction potential ceiling and response decrements in complex situations. Psychological Review, 68, 405-415.

Brown, P., Keenan, J. M., & Potts, G. R. (1986). The self-reference effect with imagery encoding. Journal of Personality and Social Psychology, 51, 897-906.

Carver, C. S. (1979). A cybernetic model of self-attention processes. Journal of Personality and Social Psychology, 37(8), 1251-1281.

Carver, C. S., & Glass, D. C. (1976). The self-consciousness scale: A discriminant validity study. Journal of Personality Assessment, 40(2), 169-172.

Carver, C. S., & Scheier, M. F. (1978). Self-focusing effects of dispositional self-consciousness, mirror presence, and audience presence. Journal of Personality and Social Psychology, 36(3), 324-332.

Cohen, J., & Cohen, P. (1983). Bivariate correlation and regression. In Applied multiple regression / correlation analysis for the behavioral sciences (pp. 25-78). Hillsdale, NJ: Erlbaum.

Cohen, J., & Cohen, P. (1983). Nominal or Qualitative Scales. In Applied multiple regression / correlation analysis for the behavioral sciences (pp. 181-222). Hillsdale, NJ: Erlbaum.

Claparède, E. (1911). Recognition et moiieté. [Recognition and Selfhood]. Archives de Psychologie, 11, 79-90. (Anne-Marie Bonnel, Trans.) In Consciousness and Cognition (1995), 4, 371-378.

Conway, M. A. (1991). In defense of everyday memory. American Psychologist, 46(1), 19-26.

Craik, F. I. M., & Lockhart, R.S. (1972). Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 11, 671-684.

Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. Journal of Experimental Psychology: General, 104, 268-294.

Craik, F. I. M., Moroz, T. M., Moscovitch, M., Stuss, D. T., Winocur, G., Tulving, E., & Kapur, S. (1999). In search of the self: A PET study. Psychological Science, 10(1), 26-34.

Derry, P., & Kuiper, N. (1981). Schematic processing and self-reference in clinical depression. Journal of Abnormal Psychology, 90, 286-297.

Dijksterhuis, A., & Knippenberg, A. V. (1996). Trait implications as a moderator of recall of stereotype-consistent and stereotype-inconsistent behaviors. Personality and Social Psychology Bulletin, 22(4), 425-432.

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. Psychological Review, 66, 183-201.

Einstein, G. O., & Hunt, R. R. (1980). Levels of processing and organization: Additive effects of individual items and relational processing. Journal of Experimental Psychology: Human Learning and Memory, 6, 588-598.

Fazio, R. H., Zanna, M. P., & Cooper, J. (1977). Dissonance and self-perception: An integrative view of each theory's proper domain of application. Journal of Experimental Social Psychology, 13(5), 464-479.

Fenigstein, A., Scheier, M. F., and Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. Journal of Consulting and Clinical Psychology, 43(4), 522-527.

Festinger, L. (1957). A theory of cognitive dissonance. Stanford, CA: Stanford University Press.

Figueredo, A.J., Petrinovich, L., and Ross, D. (2000). The quantitative ethology of the zebra finch: A study in comparative psychometrics. Multivariate Behavioral Research, 27 (3), 435-458.

Forester, J. C., (2001). DMDX (Display Presentation Software). University of Arizona.

Geller, V., & Shaver, P. (1976). Cognitive consequences of self-awareness. Journal of Experimental Social Psychology, 12, 99-108.

Glisky, E. L. (1998). Differential contribution of frontal and medial temporal lobes to memory: Evidence from focal lesions and normal aging. In N. Raz (Ed.), The Other Side of the Error Term. Elsevier Science B. V.

Hart, R. P., Kwentus, J. A., Wade, J. B., & Taylor, J. R. (1988). Modified Wisconsin sorting test in elderly normal, depressed and demented patients. The Clinical Neuropsychologist, 2(1), 49-56.

Hull, J. G., Van Treuren, R. R., Ashford, S. J., Propsom, P. & Andrus, B. W. (1988). Self-consciousness and the processing of self-relevant information. Journal of Personality and Social Psychology, 54(3), 452-465.

Iverson, G. R., & Norpoth, H. (1987). Analysis of variance. (2nd ed.). Newbury Park, CA: Sage Publications, Inc.

Jacoby, L. L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. Journal of Memory Language, 30, 513-541.

James, W. (1890). The principles of psychology (pp. 291-401). New York: Holt, Rinehart & Winston.

Kahneman, D. (1973). Attention and effort. Englewood Cliffs, NJ: Prentice-Hall.

Kaszniak, A.W., & Zak, M. G. (1996). On the neuropsychology of metamemory: Contributions from the study of amnesia and dementia. Learning and Individual Differences, 8(4), 355-381.

Kaszniak, A.W., Nussbaum, P. D., Berren, M. R., Santiago, J. (1988). Amnesia as a consequence of male rape: A case report. Journal of Abnormal Psychology, 97(1), 100-104.

Kaye, D., Kirschner, P., & Mandler, G. (1953). The effect of test anxiety on memory span in a group test situation. Journal of Consulting Psychology, 17, 265-266.

Keppel, G. (1991). Design and analysis: A researcher's handbook (pp. 68-73). New York: Prentice Hall.

Kihlstrom, J. F. (1995). Memory and Consciousness: An appreciation of Claparède and recognition et moiité. Consciousness and Cognition, 4, 379-386.

Kihlstrom, J. F., & Schacter, D. L. (1995). Functional Disorders of autobiographical memory. In A. D. Baddeley, B. A. Wilson, & F. N. Watts (Eds.), Handbook of Memory Disorders (pp. 337-364). New York: Wiley & Sons, Ltd.

Klein, S. B., Loftus, J., & Kihlstrom, J. F. (1996). Self-knowledge of an amnesic patient: Toward a neuropsychology of personality and social psychology. Journal of Experimental Psychology: General, 125(3), 250-260.

Klein, S. B., & Loftus, J. (1988). The nature of self-referent encoding: The contribution of elaborative and organizational processes. Journal of Personality and Social Psychology, 55, 5-11.

Klein, S. B., & Kihlstrom, J. F. (1986). Elaboration, organization, and the self-reference effect in memory. Journal of Experimental Psychology: General, 115, 26-38.

Koole, S. L., Dijksterhuis, A., & Knippenberg, A. V. (2001). What's in a name: Implicit self-esteem and the automatic self. Journal of Personality and Social Psychology, 80(4), 669-685.

Kupier, N. A., & Rogers, T. B. (1979). Encoding of personal information: Self-other differences. Journal of Personality and Social Psychology, 37, 499-514.

Lezak, M. D. (1983). Neuropsychological assessment. (pp. 283-559). New York: Oxford University Press.

Maki, R. H., & McCaul, K. D. (1985). The effects of self-reference versus other reference on the recall of traits and nouns. Bulletin of the Psychonomic Society, 23, 169-172.

Markus, H. (1977). Self-schemata and information processing about the self. Journal of Personality and Social Psychology, 35(2), 63–78.

Mueller, J. H. & Overcast, T. D. (1976). Free recall as a function of test anxiety, concreteness, and instructions. Bulletin of the Psychonomic Society, 8, 194-196.

Nelson, H. E. (1976). A modified card test sensitive to frontal lobe deficits. Cortex, 12, 313-324.

Nielsen, J. M. (1958). Memory and amnesia. Los Angeles: San Lucas Press.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: verbal reports on mental processes. Psychological Review, 84, 231-257.

Pullyblank, J., Bisanz, J., Scott, C., & Champion, M. A. (1985). Developmental invariance in the effects of self-knowledge on memory. Child Development, 56, 1447-1454.

Pyszczynski, T. A., Hamilton, J. C., Greenberg, J., & Becker, S. E. (1991) Self-awareness and psychological dysfunction. In C. R. Snyder & D. R. Forsyth (Eds.), Handbook of Social and Clinical Psychology (pp. 138-157). New York: Pergamon Press.

Reeder, G. D., McCormick, C.B., & Esselman, E.D. (1987). Self-referent processing and recall of prose. Journal of Educational Psychology, 79, 243-248.

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. Journal of Personality and Social Psychology, 35, 677-688.

Sarason, I. G. (1972). Experimental approaches to test anxiety: Attention and the uses of information. In C. D. Spielberger (Ed.), Anxiety: Current trends in theory and research (Vol. 2). New York: Academic Press.

Schacter, D. L., & Tulving, E. (1982). Amnesia and memory research. In Cermack, L. S. (Ed.), Human memory and amnesia (pp. 1-33). Hillsdale, NJ: Lawrence Erlbaum Associates.

Schacter, D. L., (1987). Implicit memory: History and current status. Journal of Experimental Psychology: Learning, Memory, & Cognition, 13(3), 501-518.

Schacter, D. L., Kihlstrom, J. F., Kihlstrom, L. C. & Berren, M. B. (1989). Autobiographical memory in a case of multiple personality disorder. Journal of Abnormal Psychology, 98(4), 508-514.

Schacter, D. L., Kaszniak, A. W., & Kihlstrom, J. K. (1990). Models of memory and the understanding of memory disorders. In T. Yanagihara & R. C. Peterson (Eds.), Memory disorders in clinical practice. New York: Marcel Dekker.

Schacter, D. L. & Tulving, E. (1994). What are the memory systems of 1994? In Schacter, D.L. & Tulving, E. (Eds.), Memory Systems 1994 (pp. 1-38). Cambridge, MA: MIT Press.

Schacter, D. L., Alpert, N.M., Savage, C.R., Rauch, S. L., Albert, M.S. (1996). Conscious recollection and the human hippocampal formation: Evidence from PET. Proceedings of the National Academy of Sciences, 93, 321-325.

Scheier, M. F., & Carver, C. S. (1980). Individual differences in self-concept and self-process. In D. M. Wegner & R. R. Vallacher (Eds.), The self in social psychology. New York: Oxford University Press.

Schmitter-Edgecombe, M. (1999). Evidence of divided attention and time course on automatic and controlled components of memory in older adults. Psychology and Aging, 14(2), 331-345.

Shriffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory. Psychological Review, 84, 127-190.

Singer, J. A., & Salovey, P. (1988). Mood and memory: Evaluating the network theory of affect. Clinical Psychology Review, 8(2), 211-251.

Spreen, O., & Strauss, E. (1991). A conpendium of neuropsychological tests: Administration, norms, and commentary. (pp. 219-227). New York: Oxford University Press.

Stuss, D. T. (1991). Disturbance of self-awareness after frontal system damage. In G. P. Prigatano & D. L. Schacter (Eds.), Awareness of deficit after brain injury: Clinical and theoretical issues (pp. 66-83). New York: Oxford University Press.

Stuss, D. T., & Benson, D. F. (1986). The frontal lobes. New York: Raven Press.

Symons, C. S. & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. Psychological Bulletin, 121(3), 371-394.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), Organization of memory (pp. 381–403). New York: Academic Press.

Tulving, E. (1973). Encoding specificity and retrieval processes in episodic memory. Psychological Review, 80(5), 352-373.

Tulving, E. (1984). Précis of elements of episodic memory. The Behavioral and Brain Sciences, 7, 223-268.

Tulving, E. & Schacter, D.L. (1990). Priming and human memory systems. Science, 247(19), 301-305.

Tulving, E. (1993). Self-knowledge of an amnesic individual is represented abstractly. In T. K. Srull & R. S. Wyer (Eds.), Advances in social cognition (Vol. 5, pp. 147-156). Hillsdale, NJ: Erlbaum.

Wechsler, D. (1981). Wechsler Adult Intelligence Scale-Revised. San Antonio, TX: The Psychological Corporation.

Wechsler, D. (1987). Wechsler Memory Scale-Revised. San Antonio, TX: The Psychological Corporation.

Wells, G. L., Hoffman, C., & Enzle, M. E. (1984). Self-versus other referent processing at encoding and retrieval. Personality and Social Psychology Bulletin, 10, 574-584.

Wheeler, M. A., Stuss, D.T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. Psychological Bulletin, 121(3), 331-354.

Wicklund, R. A. (1972). A theory of objective self awareness. New York: Academic Press.

Wicklund, R. A., & Frey, D. (1980). Self-awareness theory: When the self makes a difference. In D. M. Wegner & R. R. Vallader (Eds.), The self in social psychology. New York: Oxford University Press.

Wine, J. (1971). Test anxiety and direction of attention. Psychological Bulletin, 76, 92-104.

Ybarra, O., & Trafimow, D. (1998). How priming the private self or collective self affects the relative weights of attitudes and subjective norms. Personality and Social Psychology Bulletin, 24(4), 362-370.