Implicit Cognitive Processes in Depression

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Abstract
Implicit Cognitive Processes in Depression
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The terms implicit and automatic processes are used interchangeably in this dissertation and refer to underlying thought processes that are nonvolitional and occur without awareness or attention. Differences in automatic cognitive processes between depressed individuals and nondepressed individuals are discussed in relation to implicit attentional biases, implicit memory, and implicit judgments and associations. The following hypotheses are proposed in this study: (1) There will be differences in task responses on implicit measures between depressed and never depressed individuals, in that depressed individuals will show stronger association between self and negative content words and will exhibit greater implicit memory for negative words compared to never depressed individuals; (2) Grouping depressed individuals based on a depressive personality style will provide greater sensitivity for implicit measures of depression, in that depressed individuals will show greater implicit processing of negative content words that pertain to the individual’s depressive style; and (3) Implicit measures of depression will correlate to a greater degree with each other than with explicit measures. The implicit association test (IAT) and word stem completion task were used to assess implicit cognitive processes, and mixed-model MANOVA’s and correlation analyses were used to test the hypotheses. The results of mixed model MANOVA’s showed significant differences in self-concept associative bias within depressed and never depressed groups, in that both groups demonstrated a positive bias in self-concept. There was a strong tendency for differences between groups based on autonomy on the IAT. Those high on autonomy exhibited a tendency for lower self-concept positive bias than those depressed and low on autonomy and those never depressed. These results indicated that those who were depressed and scored high on autonomy viewed themselves in a less positive light than
the other groups when they implicitly made associations between themselves and negative autonomous stimuli and positive stimuli. Results indicate significant correlations between implicit and explicit measures and between implicit measures and between explicit measures.
1. Introduction

Depression is a widespread and serious mental health problem. The lifetime risk for major depressive disorder varies from 10% to 25% for women and from 5% to 12% for men, and the point prevalence has varied from 5% to 9% for women and from 2% to 3% for men (American Psychiatric Association, 1994). Johnson, Hayes, Field, Schneiderman, and McCabe (2000) report that up to 76% of individuals diagnosed with depression will experience a recurrent episode within 10 years (Piccinell & Wilkinson, 1994), with up to 15% of individuals with recurrent depression committing suicide (Clark & Fawcett, 1992). In addition, they report the World Health Organization ranked depression as the fourth leading source of disease encumbrance in 1990 (Murray & Lopez, 1996), and the costs to the domestic economy exceed $30 billion annually (Rice & Miller, 1995).

Common symptoms of depression include prominent and persistent depressed mood, anhedonia, poor or increased appetite, insomnia or hypsomnia, psychomotor retardation or agitation, fatigue, feelings of worthlessness or guilt, inability to concentrate, feelings of hopelessness and helplessness, and thoughts of death or suicide (American Psychiatric Association, 1994). In addition, there may be dysfunction in cognitive processes including memory impairment and negative biases in perception and interpretation.

Theories of Depression

In the last few decades, depression has been explained by cognitive theorists with reference to vulnerability factors leading to negative biases and dysfunction in information processing. According to Aaron Beck (1963, 1967, 1976), emotional
vulnerability for depression may begin in childhood with experiences of loss, failure, or abandonment. To accommodate these experiences, some individuals may develop schemata in long-term memory that are used to perceive, attend to, and interpret stimuli in the environment that may in part resemble those of earlier experiences. Consequently, this type of information processing may result in distortion of both negative and benign experiences into those of a negative emotional nature such as loss, failure, or abandonment. Schemata act as filters, in that individuals selectively attend to and remember stimuli that are consistent with their schemas and do not attend to and remember information contrary to their schemas. These negative distortions and subsequent interpretations may lead to dysphoric mood especially during stressful times, which further strengthens negative schemas. In addition, Beck acknowledges that not only do schemata and cognitive distortions play a role in the onset and/or maintenance of depression but genetic vulnerability may contribute as well.

Another cognitive model of depression proposed by Seligman (1975) is based on the concept of learned helplessness. Individuals who are vulnerable to depression may develop the belief that they have no or little control over their lives; that is, their responses to life’s events will not change subsequent outcomes. Abramson, Seligman, and Teasdale (1978) revised this theory by postulating that depressed individuals may formulate certain attributions for causes of events such as internal (“I am culpable”), global (“This happens to me in every area of my life”), and stable (“This will happen again to me”) attributions for negative life events or failures and external (“It’s not my doing”), specific (“It only occurred in this one area of my life”), and unstable (“It happened just this one time and won’t occur again”) attributions for positive life events or
successes. Abramson, Metalsky, and Alloy (1989) integrated learned hopelessness into their model to describe the interaction of life stresses with prior cognitive biases that exacerbate depressive attributions about current situations and future events.

Other theorists have explained depression from a network model perspective of emotion. Anderson and Bower (1973) explain long-term memory via a semantic network. Nodes exist within an interconnected network whereby activation of a node leads to activation of those nodes that represent constructs related to it. Bower (1981, 1987) proposed that there exists in humans a network of interconnected emotion nodes that represent distinct emotional states, and when emotion nodes are activated simultaneously, their associations strengthen over time and subsequently can activate one another more efficiently than weakly associated emotion nodes. Mood-congruent information may be easier to retrieve than mood-incongruent information because it does not involve accessing new affect-emotion nodes (Ingram, 1984). The associations between emotionally congruent nodes may be stronger in depressed individuals than in nondepressed individuals (Bower 1981, 1987). These associations may be related to Beck’s (1967) concept of schemata in that a minor failure may automatically prime depression in vulnerable individuals, leading to dysphoric mood. Teasdale (1988) proposed a cyclical relationship between depression vulnerability and mood state, in that when vulnerable individuals experience low mood, they have increased selective attention to and memory of negative events that in turn increase and prolong dysphoria. These theories differ in the degree to which schemata resemble stable traits and information-processing tendencies versus a latent vulnerability that requires activation to bias information processing (Segal, 1988).
Segal (1988) discusses how self-schemata have been explained via theories of availability/accessibility and network theory of associative memory, and he suggests that reconceptualizing self-schema in cognitive-structural terms will enable testing of self-schema hypotheses. According to accessibility theory, as frequency of the activation of a construct is increased, there is a higher probability of its use in the future (Higgins, King, & Mavin, 1982). Negative self-schema accessibility plays a role in depression, in that depressed individuals are more likely than nondepressed individuals to have negative constructs rather than positive constructs accessible in memory based on what is available (existing) in memory (Higgins & King, 1981; Segal). Segal states that there appears to be a mood congruity relationship between affect and accessibility, in that information that matches the individual's mood state is more accessible and thus more easily recalled. Segal concludes that these theories of accessibility and mood congruity associative memory describe correlation of mood and cognitive constructs. However, he argues that these correlations do not fully explain whether these constructs develop from an organized self-schema. Segal argues that although the cognitive-structural view he advocates is similar to the above theories, it differs in that it posits a highly interrelated organization of self-constructs in defining the cognitive structure of self. He states that activating a construct in the system should increase the accessibility of connected constructs that are also self-referent. In conducting research on cognitive processing and the role of self-schema, Segal stresses that one must look not only at content of information but the relation among constructs in memory as well. He advises that due to the strong interrelations among self-constructs, the self-schema may be activated in the absence of depressed mood. This means that negative self-schema may exist in an
individual even when that individual is not currently in a depressive episode. Segal criticizes studies that use direct accessibility measures of assessment to explain cognitive structure, since he argues they cannot detect this level of representation. As an alternative, structure may be studied by indirect assessment measures, such as in automaticity research, where implicit measures of assessment are used.

**Criticism of Self-Report Measures**

Various self-report measures have been used to assess depression, such as the Beck Depression Inventory (BDI: Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; BDI-II: Beck, Steer, & Brown, 1996), Center for Epidemiological Studies Depression Scale (CES-D: Radloff, 1977), Minnesota Multiphasic Personality Inventory Depression Scale (MMPI-D-30: Demsey, 1964), Multiple Affect Adjective Check List-Revised (MAACL-R: Zuckerman & Lubin, 1985), and Zung Self-Rating Depression Scale (SDS: Zung, 1965). Self-report measures are typically used in research to assess for depression and although not intended for use as clinical diagnostic tools, they are often used as screening devices (Boyle, 1985). Many criticisms of self-report measures have been cited, such as their vulnerability to social desirability, self-deception, subjectivity, experimental demand, and insensitivity in measuring cognitive processes. Individuals may be susceptible to experimental demand, especially if a measure is re-administered in the same study (Gemar, Segal, Sagrati, & Kennedy, 2001). Individuals may present themselves in a more favorable light by underreporting depressive symptoms to avoid evaluation by others, either initially or during post-treatment assessment of symptoms (Eysenck, 1991; Rudman, Greenwald, Mellott, & Schwartz, 1999). Researchers have found that several self-report depression and anxiety measures are moderately to highly
associated with social desirability (Tanaka-Matsumi & Kameoka, 1986). For example, Tanaka-Matsumi and Kameoka found correlations ranging from -.49 to -.85 and -.19 to -.32 between nine anxiety and depression scales and the Edwards Social Desirability Scale (ESDS: Edwards, 1957) and Marlowe-Crowne Social Desirability Scale (MCSDS: Crown & Marlowe, 1960), respectively.

According to Shedler, Mayman, and Manis, individuals may also deceive themselves about their psychiatric symptoms, in that they may have an illusion of mental health (1993). They refer to these individuals as defensive deniers. They explain that these individuals use denial of psychological distress as a defense mechanism and may ignore their feelings, desires, and needs. Self-report measures may accurately measure distress in those who are manifestly distressed and in those who are genuinely healthy but may not capture underlying distress in those who have illusory mental health (Shedler et al.). On the contrary, Taylor and Brown (1988) assert that mentally healthy people tend to have illusions of exaggerated positive self-evaluations, perceptions of control, and optimism. They tend to have positive cognitive biases during encoding, interpretation, and retrieval. They suggest that those individuals who have low self-esteem and/or are depressed somehow lack these positive cognitive biases and consequently view their worlds in a more realistic fashion. Taylor and Brown suggest that these illusions may be helpful in overcoming setbacks, maintaining high self-esteem, and maintaining a positive view of the future. On the other hand, Shedler and colleagues argue that defensive deniers who have an illusion of mental health may not fall into the category of mentally healthy. In their study, they used the Eysenck Neuroticism scale for the self-report measure, and clinical judges rated participants as relatively healthy or relatively
distressed based on the Early Memory Test (Mayman & Faris, 1960). Participants who scored below the mean on the self-report measure but were judged by clinicians to be distressed were classified as having illusory mental health. Dependent measures consisted of physiological measures and a verbal defensiveness measure based on responses to phrase associations. Shedler and colleagues found that those having illusory mental health showed higher levels of physiological reactivity under stress and more verbal manifestations of defense than genuinely healthy and manifestly distressed participants. Thus, having an illusion of mental health may not be indicative of genuine mental health but rather may have an effect on physiological arousal and an association with defensiveness.

Gotlib and Krasnoperova (1998) argue that self-report measures are not suitable to assess the existence and operation of schemata or associate networks. Based on theorized definitions of schemata and associate networks, these operations are automatic and nonvolitional. In general, individuals may not accurately report their underlying cognitive processes since they may not be aware of them or may not be accurate in their perception of these processes involved in their judgments, behavior, choices, etc. (Higgins & King, 1981; Nisbett & Wilson, 1977). Nisbett and Wilson explain that individuals may be unaware of a stimulus, a response, or that a stimulus influenced a response. Instead individuals may respond with a causal explanation or judgment based on “a priori implicit causal theories”. For example, they describe their study in which individuals who were out shopping participated in a “consumer survey” where they were asked to indicate which one of four pair of stockings was of the highest quality (in reality all were of the same quality). Shoppers chose the right-most pair of stockings as the
highest quality almost four to one over the left-most pair, and when asked for the reason for their choice, no one mentioned the position of the pair of stockings, and when asked about this as a possible decision factor, all individuals denied it. They suggested that shoppers started evaluating on the left and may have wanted to avoid impulsively choosing the first one they saw. Whatever the actual reason, people implicitly made a decision, that is, they were unaware of the real reason why they made the judgment. In the area of depression, there is the parallel of automatic judgments and explanations of one’s own and others’ behavior that may be inaccurate. Depressed individuals may automatically make negatively biased causal attributions about their own behavior and others’ behavior toward them. As a result, depressed individuals may react in a negative fashion; for example, they may avoid contact with another in the future, or they may experience a worsening of depressed mood, and not be aware of the causes for such behavior. They may provide inaccurate socially learned information about their symptoms or reasons for their symptoms without intention, similar to the basis for judgment investigators provided for participants in the stocking study described above. Therefore, more direct self-report measures of cognitive processes may not accurately assess the underlying cognitive processes of the depressive syndrome. Perhaps implicit measures may come closer to assessing these processes.

Implicit Cognitive Processes

In seeking to explain depression via a network model perspective, it is crucial to delineate between effortful (explicit or conscious) processes and automatic (implicit or nonconscious) processes. In this paper the terms implicit cognitive processes and automaticity are used interchangeably. Theories defining these processes are based on
the assumption that humans possess a limited capacity to process information (Ingram, 1984). Hartlage, Alloy, Vazquez, and Dykman (1993) suggest most theorists agree automatic processes occur without: awareness or attention, intention, control, and using energy from a limited cognitive system (thus avoiding interference with effortful processes). In addition, they concluded that automaticity may be a product of multiple experiences with processing specific stimuli in a particular way, but other automatic processes do not benefit from practice per se (see Eysenck, 1984; Hasher & Zacks, 1979; Schneider & Shiffrin, 1977). For example, Hasher and Zacks proposed that automatic processes that are genetically predisposed such as processing of spatial and temporal information do not further develop with time; however, other automatic processes improve with practice, such as behaviors that make up a complex skill. Andersen and Limpert (2001) argue that although these are all components of implicit processes, they need not co-occur. Hartlage and colleagues summarize that explicit processes, on the contrary, require attention and cognitive resources, are serial (controlling only one sequence at a time), and may improve with practice. Bargh (1984) describes another differentiation between the two processes in that implicit processes tend to be difficult to inhibit while explicit processes are relatively easy to disrupt and modify.

It has been suggested that automatic and explicit processes occur along a continuum (Schneider & Schiffrin, 1977) that has been described as a blend of automatic and effortful processes (Shiffrin & Schneider, 1984). What researchers define as “automatic” may not meet all criteria of automaticity as listed above, but rather falls close to the automatic end of the continuum. Hartlage and colleagues suggest that the continuum consists of the following processes: hereditary and automatic (encoding of
frequency and spatial location), learned and automatic (activation of word meaning while reading), veiled and effortful (making conscious judgments without remembering the source of data on which one bases a decision), and accessible and effortful (taking an exam). Greenwald (1997) explains self-deception by describing explicit and implicit processes from a neural network modeling perspective whereby the two processes may occur simultaneously and independently of each other, as if they were occurring in the right and left hemispheres of a split-brain patient. As a consequence, these processes may not be congruent, that is, what people report may not be congruent with their implicit response. An example of this incongruity is the outcome of the “evaluating stockings” study (Nisbett & Wilson, 1977) described earlier. Another example of possible incongruity between implicit and explicit processes is described by Bargh in a study of behavioral consequences of trait concept activation (1997). Participants were primed with words relating to rudeness, politeness, or neither rudeness nor politeness during a “language test”. It was assumed that the priming would trigger the construct of rudeness or politeness in participants, and they would behave in a manner consistent with this activation. Participants were then instructed to find the experimenter when they had completed the “language test” to continue with the second experiment. The experimenter was speaking with another “participant” (a confederate) when the participant approached. The number of minutes (up to 10 minutes) that it took the participant to interrupt was timed. The investigators found that significantly more of the participants who were primed by the rude content words interrupted the experimenter than those who were primed with polite content words. Participants reported they had no awareness of the
effect of the priming task on their behavior, although they agreed unanimously that the experimenter behaved rudely.

There have been numerous methods used to differentiate explicit from implicit processes. Techniques have been created and revised for various dimensions of study, such as variants of the Stroop color-naming task (Stroop, 1935), probe detection tasks (MacLeod & Rutherford, 1998), dual task procedures (Bargh & Chartrand, 2000), free recall memory measures (clustering) (Bargh & Chartrand), sequential priming techniques (Bargh & Chartrand), pronunciation tasks (Bargh & Chartrand), tasks using homophones (Eysenck, 1991), implicit association tests (Greenwald, McGhee, & Schwartz, 1998), word stem completion tasks (Kirsner et al., 1998), backward masking (Turvey, 1973), frequency processing (Hasher & Zacks, 1979), perceptual identification (Kirsner et al.) and lexical decision tasks (Kirsner et al.).

Various methods have been used to assess automatic or implicit cognitive processes in depression research. Gotlib and Neubauer (2000) describe the following tasks that have been adopted and modified for attentional biases studies: emotion Stroop task, dichotic listening task, dot-probe task, and deployment of attention task. In the modified Stroop task and many other tasks, the dependent variable is response time to measure processing efficiency and interference; however Bargh and Tota (1988) warn that raw response latency alone is not a true measure of automaticity, but rather a concurrent memory-load task is required to rule out potential controlled processing biases. More recent studies have employed a cognitive load condition as a secondary task to the primary one, so that attentional capacity is limited and automaticity may be
established (Andersen, Spielman, & Bargh, 1992; MacDonald & Kuiper, 1985; Strayer & Kramer, 1990).

Other investigators have used judgment memory tasks in which participants are instructed to state which type of judgment they were asked to make regarding a pair of words in a prior task (e.g., which word meaning is heavier, larger, more emotional, etc.), and frequency monitoring, in which participants were asked to indicate whether words on a list were read once or twice (Roy-Byrne, Weingartner, Bierer, Thompson, & Post 1986). Recently researchers have employed a homophone task (words that sound the same but have different spellings and meanings) to study perception of ambiguous stimuli (Hertel & Hardin, 1990; Mathews, Richards, & Eysenck, 1989). In addition, the following inferential methods have been used to study schematic processing: the identification of features of social categories, category judgments, incidental recall tasks, organization in free recall, autobiographical memory, and multidimensional scaling (Hollon and Shelton, 1991). The degree to which the above instruments measure automaticity may vary along a continuum.

Horowitz, Nelson, and Person (1997) proposed a test battery of behavioral assessment measures that vary in degree of automaticity to circumvent the pitfalls of self-report measures. Their proposed battery consists of: describe yourself, negative clustering task, subjective conditional probability task, sad music redintegration task, blurring of mild-to-severe experiences of sadness task, ‘like me’ reaction time task, tachistoscopic recognition task, free-recall task, recognition memory task, measure of beta in the recognition task, frequency estimate of positive reinforcements task, ease of recalling negative events task, and the Stroop effect task. This proposed battery is
comprised of an aggregate of the above measures, based on the assumption that the measures are on average correlated. This assumption may need to be investigated. For example, one study of implicit self-esteem examined the reliability and validity of seven implicit self-esteem measures and found that in general the measures did not correlate with one another (Bosson, Swann, & Pennebaker, 2000).

The Implicit Association Test (IAT: Greenwald et al., 1998) was developed to measure individual differences in implicit cognition and has been used to measure self-concept and self-esteem (Greenwald & Farnham, 2000), prejudices (Greenwald et al.; Rudman et al., 1999), and associations in recovered depressed patients (Gemar et al., 2001) and individuals with specific phobias (Teachman, Gregg, & Woody, 2001). The IAT was designed to assess implicit attitudes, that is, attitudes that are automatically activated in an individual without his or her awareness or control (Greenwald & Banaji, 1995). The IAT has been used to assess this automatic activation by measuring the difference between response times in associating different concepts and attributes (Greenwald et al.). The underlying assumption, based on neural network theory, is that strongly associated attribute-concept pairs should be easier to classify together than are weakly associated or incompatible attribute-concept pairs (Farnham, Greenwald, & Banaji, 1999). This is measured by response time differences or errors in making these associations. For example, when strongly associated categories (flower and pleasant) share a response key, response time is faster than when weakly associated categories (insect and pleasant) share a response key (Greenwald et al.).

Several researchers have used a word stem completion task to assess implicit cognitive processes (Banos, Medina, & Pascual, 2001; Denny & Hunt, 1992; Lang &
Craske, 1997). Individuals are given the first few letters of a target word and are asked to complete the word as quickly as possible with the first word that comes to mind (Bradley, Mogg, & Williams, 1994). Implicit memory may be assessed with a word stem completion task in conjunction with priming, in that prior exposure to words may facilitate performance on a task without the individual’s realization of the association (Graf & Schacter, 1985). Implicit memory is indicated when individuals complete more word stems with primed words than unprimed words (Banos et al.). Some researchers studying implicit mood-congruent memory (enhanced recall of information that is congruent with mood) have found no differences between depressed and nondepressed individuals on the word stem completion task (Danion, Kauffmann-Muller, Grange, Zimmerman, & Greth, 1995; Denny & Hunt; Watkins, Martin, & Stern, 2000, Watkins, Mathews, Williamson, & Fuller, 1992). Some theorists claim that this finding is due to the perceptual nature of the word stem completion task versus the conceptual nature of the cognitive processes being studied (Roediger, 1990; Roediger & McDermott, 1992). This is based on transfer-appropriate processing theory, in that memory will be enhanced if the cognitive processes involved in the task are congruent rather than incongruent with the cognitive processes being measured (TAP; Morris, Bransford, & Franks, 1977). In the above studies, conceptual cognitive processes were being studied (meaning of words) with a perceptually driven cognitive task (word stem completion) (Watkins et al., 2000). Roediger explains that in the word stem completion task, incomplete perceptual information is presented, reflecting data-driven or perceptual processing, where “the perceptual features of the word must be ‘driven through’ the perceptual system” (p. 1049). The word stem completion task is directed by the perceptual features of the
stimuli, not the meaning of the stimuli (Watkins, Vache, Verney, Muller, & Mathews, 1996). They give an example that the meaning of los_ is not pertinent in completing the word stem with the first word that comes to the individual. Eysenck (1991) further explains that data-driven processes are guided by external stimuli vis-à-vis conceptually driven processes that rely on expectations and knowledge. Eysenck states that researchers may reduce the use of data-driven processes in tasks by presenting stimuli briefly or by presenting ambiguous stimuli, and they may increase the use of conceptually driven processes by presenting stimuli that are relevant to individuals’ concerns. It may be that the word stem completion task has features of a conceptually driven task in that the word is not simply read, but the individual must access a word from memory that would complete the stem. In addition, primed word stems can be completed with self-relevant words (e.g. depressive content words). Roediger states that it is possible to use implicit memory tests that are conceptually driven, and several researchers have done this (e.g. Watkins et al., 1996).

**Automatic Cognitive Processes in Depression**

Hartlage and colleagues (1993) report that depression seems to interfere with effortful processing. In reviewing numerous studies, they found support for interference in the following effortful domains in individuals suffering from depression: intellectual functioning tasks, problem solving, general learning, certain encoding tasks, reading comprehension, and motor speed. Impairment in some of the above tasks may depend in part on the severity of depression. They review and provide evidence for the following causal mechanisms for interference with effortful processes: reduction of cognitive
capacity, narrowing of attention, and a combination of the two, capacity reduction, and negative focus.

The use of automatic processes may be helpful to maximize efficiency in information processing and allow for concurrent effortful tasks to be executed; however, there are situations where automatic processes may be dysfunctional (Moretti & Shaw, 1989). According to Moretti and Shaw, although individuals may easily interrupt automatic processes during simple cognitive tasks to correct errors, in other more complex tasks, this control may not be so readily apparent. In addition, they suggest there may be individual differences that lead to increased vulnerability to dysfunctional automatic information processing. They propose that dysfunctional automaticity will be amplified when individuals experience the following: ambiguous criteria for detecting dysfunction in processing, a lack of performance feedback, performance of complex stimulus-response sequences, heightened affective arousal and limited attentional resources, and contextual or individual factors that increase the accessibility of specific constructs that interfere with interpretation of facts. Specifically, they conclude that in depression, dysfunctional patterns of attention, interpretation, and memory occur automatically, and these errors in information processing exacerbate or maintain dysphoric mood (Hollon and Shelton, 1991). Other researchers argue that depression is better explained by explicit cognitive processes. For example, some hypothesize that biases favoring negative information occur after reaching consciousness (Mogg, Bradley, Williams, & Mathews, 1993). They claim that elaboration, which is a controlled stage of processing, is required in processing negative stimuli.
Some theorists warn that some seemingly automatic processes may require conscious mediation for meaning (Isen & Diamond, 1989). Isen and Diamond state that an automatic cognitive process may be followed by a shift in attention to the newly noticed stimulus. Once this shift in awareness has occurred, the process changes from automatic to volitional. They explain that negative affect may be processed automatically as a result of the quality of the stimuli but also in the context of situational demands, the individuals’ goals and strategies, and a priori decisions to allow that kind of processing to occur. The differentiation between cognitive products and processes has been explained by several theorists (Ingram & Kendall, 1986; Hollon & Garber, 1988). Cognitive products are defined as outputs of information processing (for example, what people say, think, and do), while cognitive processes transform knowledge structures into cognitive products (Nisbett & Ross, 1980). Through cognitive processes, information is perceived, encoded, altered, combined, and stored (Hollon and Garber). Individuals may be aware of cognitive products, yet the existence and content of knowledge structures can only be surmised (Nisbett & Wilson, 1977).

Although depression may interfere with effortful processing, depression may not interfere with automatic processing (Hartlage et al., 1993). For example, depressed individuals perform as well as nondepressed individuals in frequency encoding and spatial location encoding (Hartlage et al.). There are numerous studies suggesting that depressed individuals automatically process information in a qualitatively different manner than nondepressed individuals. Hartlage and colleagues review studies showing that depressed individuals but not nondepressed individuals show automatic processing of
negative content stimuli over neutral stimuli. Specific studies demonstrating qualitative differences will be discussed later.

**Implicit Memory**

Automaticity is frequently addressed in the study of attention and memory. Graf and Schacter (1985) theorize that explicit memory may be identified when task performance requires conscious recollection of prior experiences, and implicit memory is exposed when task performance is facilitated in the absence of conscious recollection. Implicit memory is remembering without intention. A common occurrence of implicit memory may be the performance of already learned skills, for example driving a car or typing on a keyboard. Individuals don’t consciously recall how to perform these skills, and if they attempt to do so, their performance may decline (Roediger, 1990). Implicit memory is usually studied by researchers via a priming task followed by the memory task. In general, priming refers to how recent experience creates temporary internal readiness for response tendencies without intention (Bargh & Chartrand, 2000). For example, priming may involve the presentation of visual stimuli that facilitates performance on a subsequent task. Hines (1992) describes that when individuals respond to presentation of visual stimuli, they will respond faster if they have viewed that visual stimuli earlier in the experiment. This speeding up effect is called the priming effect. Eysenck (1991) provides examples of explicit memory - free recall, cued recall, and recognition (with instruction to retrieve information that was stored in the past) and implicit memory - word completion tasks. He suggests that the differentiation between the two types of memory is exemplified in amnesia research, since although patients with amnesia traditionally endorse major impairment in long-term memory, they do not
demonstrate impairment in implicit memory (see Schacter, 1987). For example, Roediger describes a study by Warrington and Weiskrantz (1970) where amnesic patients and controls completed two explicit memory tasks (free recall and recognition) and two implicit tasks (word-fragment identification and word stem completion). Non-amnesic participants significantly outperformed the amnesic group on the explicit task; however, there was no significant difference on the implicit tasks between groups.

Many studies have investigated explicit memory in depressed individuals, while fewer have addressed implicit memory processes. For example, Derry and Kuiper (1981) instructed participants to respond “yes” or “no” to one of three questions about target words. The wording of the questions elicited either a semantic, self-referential, or structural type of processing. Afterward, participants were told to recall the trait words from the task just performed. Depressed individuals demonstrated better recall of depressed-content words from a self-referential task (versus structural and semantic tasks), while nondepressed individuals exhibited better recall of self-referential nondepressed-content words. The results of this study and others (see Murray, Whitehouse, & Alloy, 1999; Denny & Hunt, 1992) lend support to the hypothesis that depressed individuals but not nondepressed individuals have negative self-schemas that taint perception and recall of life events; however, automatic biases in the strictest sense could not be established in this type of task, since elaboration of thoughts about the stimuli and explicit memory may have occurred (see also Hertel & Hardin, 1990; Watkins et al., 1992). On the other hand, this task was not purely explicit in that participants were not instructed to remember stimuli that described them prior to nor during the experimental tasks. Jacoby and colleagues (1993) propose the process-
dissociation procedure as an experimental method to separate implicit from explicit processes in memory. This procedure is described later in the methods section.

According to Gotlib and Neubauer (2000), recent studies have focused on conceptual (meaning of the stimuli) rather than perceptual (matching word stems) processing in implicit memory research, whereby participants use conceptual processing at encoding and retrieval. As stated earlier, researchers predicted that according to transfer-appropriate processing theory (Morris et al., 1977), conceptual study of words followed by a conceptual memory test and perceptual study of words followed by a perceptual memory test will result in stronger implicit memory than if conceptual and perceptual encoding and memory test are mixed (Roediger, 1990). These studies using conceptual implicit memory tasks have found support for negative biases in implicit memory in depressed individuals (Bradley, Mogg, & Williams, 1994; Watkins et al., 1996). For example, Watkins and colleagues (2000) used a study design with four implicit memory tests, two conceptual (free association and word retrieval) and two perceptual (word stem completion task and word identification) to study implicit memory in depressed and nondepressed individuals. They describe the tests they used as follows: (1) Free association is the presentation of association cues with the instruction to produce three one-word associations related to the cue as quickly as possible; (2) Word retrieval is the presentation of a definition with the request to produce a word that fits with the definition; (3) Word stem completion task is the completion of a three- or four-letter word stem with the first word that comes to mind; (4) Word identification is the brief presentation of words (33 ms) on a computer monitor followed by masking, and individuals attempt to identify the stimulus word. Depressed and nondepressed
individuals studied negative and positive adjectives via two types of encoding, conceptual (semantic encoding, self-referential) and perceptual (structural encoding). They did not find significant mood congruent memory with perceptually encoded targets. Although all the tests showed reliable priming for conceptually encoded words, they only found mood congruent memory with conceptually encoded words followed by the word retrieval analysis (conceptual memory test). In summary, there was a priming effect on memory for conceptual encoding followed by the four memory tests, and one of the two conceptual tests following the conceptual encoding showed significant mood congruent memory (as predicted by TAP theory of matching conceptual encoding with a conceptual task). However, although priming was significant when perceptual encoding was followed by perceptual tests, perceptual encoding did not show significant priming on conceptual tests. In addition, mood congruent memory was not evident in the two perceptual encoding groups. Watkins and colleagues found evidence of mood congruent implicit memory when conceptual encoding was followed by a conceptual implicit memory test, in that depressed individuals showed greater memory for depressed content stimuli, and nondepressed individuals showed greater memory for nondepressed content stimuli. However, contrary to TAP theory, perceptual encoding followed by perceptual implicit memory tests did not show mood congruent implicit memory.

One study investigated mood-congruent biases in implicit memory in depressed individuals using a primed lexical decision task (Bradley, Mogg, & Williams, 1995). The investigators used supraliminal and subliminal priming conditions. Supraliminal priming is a condition where individuals are presented with stimuli very briefly, yet they are aware of the stimuli. In this study stimuli were presented for 7 seconds (other studies use
much briefer presentation, for example, less than one second). Subliminal priming is
where individuals are presented with stimuli below their conscious awareness threshold.
In this study stimuli were presented for 14 ms followed by a string of letters to avoid
prolonged stimuli exposure either on the computer screen or as a mental image.
Participants were primed with depression-relevant, anxiety-relevant, categorized neutral,
uncategorized neutral, and positive words. In the subliminal priming condition,
participants were shown the target word immediately after the prime, while in the
supraliminal condition, the target word was presented approximately 5 minutes later
(prime word = target word). The depressed group demonstrated greater priming of
depression-relevant words compared to the anxious and control groups, and the group
differences were not significantly influenced by the priming condition (subliminal versus
supraliminal). The investigators report that their findings indicate clinically depressed
individuals demonstrate an automatic memory bias for depression-relevant information.

**Automaticity in Depression Versus Anxiety**

Self-report measures of depression and anxiety tend to exhibit overlap and
consequently high correlation due to common symptoms, social desirability, and presence
of secondary depression in individuals diagnosed with anxiety disorders (Gotlib & Cane,
1989). Theorists have further conceptualized implicit versus explicit measures of these
two syndromes, in an attempt to differentiate the two types of disorders. According to
Beck’s (1976; Beck & Emery, 1986) and Bower’s (1981) theories of emotion, both
depressed individuals and anxious individuals, or individuals vulnerable to these
disorders, will endorse cognitive biases for negatively valenced stimuli. However, more
recently, it has been hypothesized that anxious individuals demonstrate an increase in
integrative processing of negatively valenced information, while depressed individuals demonstrate an increase in elaborative processing of negatively valenced stimuli (Williams, Watts, MacLeod, & Mathews, 1988). Integration refers to automatic cognitive processing that temporarily intensifies a mental representation, while elaboration refers to volitional cognitive processing that strengthens associations between mental representations (Graf & Mandler, 1984). Researchers have investigated implicit and explicit measures of depression and anxiety, and the outcome is mixed. Some studies using probe detection tasks and variants of the Stroop color-naming task support that anxious individuals demonstrate implicit selective encoding and memory bias for threat-related stimuli, especially self-relevant stimuli. In addition, those individuals with a vulnerability to anxiety experiencing induced state anxiety exhibit these encoding and memory biases as well. Yet these groups do not demonstrate differences from non-anxious individuals in explicit memory (see MacLeod & Rutherford, 1998, for review). In contrast to these findings in anxiety, MacLeod and Rutherford cite several studies in which depressed individuals did not demonstrate significant differences in selective encoding and implicit memory from nondepressed individuals. They did however find that depressed individuals but not nondepressed individuals showed an explicit memory recall advantage for negative words. Other studies have compared implicit and explicit information processing in individuals endorsing depressive symptoms and individuals reporting anxious symptoms within the same study, as this method more directly assesses differences in information processing (MacLeod & McLaughlin, 1995). For example, Bradley and colleagues (1995) used a primed lexical decision task and incidental free recall of self-referenced words to investigate implicit and explicit memory in clinical
depression and anxiety. They concluded that depression but not anxiety is associated with mood-congruent biases in explicit and implicit memory. In an earlier study (1994) they found that greater subliminal priming of depression-relevant words than neutral words in a high negative affect group versus a control group was more correlated with depression than anxiety measures. In another study, researchers found no significant implicit and explicit memory biases (assessed using a word stem completion task and free recall task, respectively) among depression and panic groups; however, there were trends for affective congruency in the explicit measure for both groups (Banos et al., 2001).

Overall, there are mixed findings regarding biases in processing implicit negative and positive stimuli in depressed and anxious individuals compared to each other and control groups. Some studies found implicit mood-congruent memory in depressed individuals but not anxious individuals, and some studies found the opposite outcome. Some studies found implicit mood-congruent memory neither in depressed individuals nor anxious individuals. However, most studies have found explicit mood-congruent memory in depressed individuals.

Automaticity of Beliefs about Future

According to Beck’s theory of depression, negative beliefs about self, world, and future contribute to the onset of depression (Beck, 1967, 1976). Depressed individuals often endorse hopelessness about the their futures (Abramson et al., 1989; Beck, 1967), in that unpleasant future events are perceived as certain to transpire and desired future events are treated as certain not to occur (Andersen, 1990). It is hypothesized that nondepressed individuals do not show any predictive certainty, while depressive predictive certainty increases as depressed mood worsens (Andersen). Furthermore,
predictive certainty may be schematic in nature, in that through experience and rehearsal, depressed individuals may form a schema for predicting negative future events (Andersen et al., 1992). These schemata may facilitate their making automatic judgments about the future. Andersen and colleagues used a dual-task paradigm to investigate automaticity, predicting that depressed individuals would automatically process predictions about positive and negative future events, while mildly depressed and nondepressed individuals would not automatically process such predictions. They stated that automaticity would be demonstrated if the increase in response latency in the cognitive load condition versus the no cognitive load condition were less for the depressed group than for the other two groups. Participants were asked to make predictions about the future, using either themselves or the average student as the object of the predictions. They pressed either “yes” or “no” as rapidly as possible on a response box in front of a computer screen, indicating whether a positive or negative event would be likely to happen in the future, while experiencing either the presence or absence of cognitive load. Depressed participants responded “Yes” to more negative events and “No” to more positive events than mildly depressed and nondepressed participants. The investigators suggested that depressed individuals demonstrated automatic processing since the cognitive load did not increase their response latencies, yet mildly depressed and nondepressed participants endorsed longer latencies with cognitive load. However, there was a depression by load interaction, which showed a trend for depressed participants to respond “Yes” to fewer events in the load condition than the no load condition. This makes the interpretation of automaticity less clear. Andersen and Limpert (2001) conducted a second study using the same paradigm but with participants with major depressive disorder (versus moderate
depression in the 1992 study), and their results yielded similar findings. The results of these studies suggest that depressed individuals may automatically believe that various negative future events will most likely occur in their lives. Since this happens automatically, depressed individuals may not engage in the intentional act of weighing the evidence for and against such a bleak future.

**Implicit Self-Esteem**

Self-esteem and self-concept have been assessed via implicit measures (Greenwald & Farnham, 2000), based on the assumption that the self is an attitude object and a schema that is automatically processed and affects information processing (Farnham et al., 1999). Gemar et al. (2001) used the IAT (Greenwald et al., 1998) in comparing associative biases among the following groups: never depressed, formerly depressed, and currently depressed. They used two types of judgment tasks, “Self” and “Adjective”. For the “Adjective” judgments, participants judged whether adjectives were positive or negative and pressed the corresponding computer keys designated as “Positive” and “Negative”. The “Self” judgments (“Me”/“Not Me”) consisted of neutral demographic data, such as the participant’s address. Both tasks used the same response keys, and the keys for the “Adjective” (“Negative”/”Positive”) judgment were switched midway through the experiment. It was implied that information about the self had a negative association when participants pressed “Me” responses quicker when “Me” shared the response key with “Negative” than when “Me” shared the response key with “Positive”. The results indicated that formerly depressed participants showed this negative association after undergoing sad-mood induction for material related to self only. Since the depressed group did not undergo mood induction, their scores were not
entered into the main analyses; however, t-tests showed that the “Me” associative bias of the recovered group before mood induction was more positive than that of the currently depressed group. However, after the recovered group underwent the mood induction, their response time differences were equivalent to those of the depressed mood group. The results of this study suggest that formerly depressed individuals may be vulnerable to forming automatic associations congruent with a negative self-concept if they experience a transient depressed mood. These associations may be just as strong as those found in currently depressed individuals.

**Automatic Self-Referential Information Processing**

Several studies have investigated self-referent information processing based on Beck’s model that depressed individuals tend to endorse negative thought patterns pertaining to self (Beck, 1967, 1976). Depressive individuals are prone to negative self-evaluation, especially in achievement and interpersonal performances, and they are apt to expect failure and underestimate the level of their performance, yet they do not view others in the same negative light (Moretti & Shaw, 1989). Depressed individuals develop a negative self-schema through which they filter stimuli, acknowledging confirming evidence of negative self-concept and ignoring data disconfirming negative self-concept (Beck, 1967, 1976). In the same vein, it has been hypothesized that depressed individuals process stimuli that are in accordance with self-schema more efficiently than those stimuli that are incongruent with self-schema (Kuiper & MacDonald, 1982). A modified version of the Stroop color-word test was used to assess information processing in mildly depressed individuals, with the prediction that greater accessibility of negative self-concepts leads to more interference between the meaning of depressed-content words and
the color-naming task (Gotlib & McCann, 1984). They found that depressed individuals (but not nondepressed individuals) demonstrated increased response latencies for color naming of depressed-content words compared to manic-content or neutral words. Some theorize that according to Bower’s (1981) neural network theory, the interconnectedness of the cognitive system would mean that exposing depressed individuals to emotion components of their self-constructs would prime other related emotion nodes relating to their self-concept. Several researchers have added priming conditions to their studies of information processing. Gotlib and Cane (1987) found similar results as Gotlib and McCann in the modified Stroop task, using priming of negative and positive word conditions in clinically depressed patients who were hospitalized; however, after discharge, this difference in color naming response time of depressed content versus nondepressed content words disappeared. They did not find evidence that priming affects negative construct accessibility. However, other investigators found that depressed individuals primed by self-descriptive negative emotional phrases showed increased response time to color naming in the modified Stroop task when negative adjectives were displayed as compared to the other prime-target adjective conditions (Segal, Gemar, Truchon, Guirguis, & Horowitz, 1995). There was no significant effect for any prime-target condition in depressed participants when positive material was used, and nondepressed participants did not show an effect for any prime-target condition regardless of the valence of the material presented. These studies suggest that depressed individuals but not nondepressed individuals may have an attentive bias for negative content stimuli that interferes with information processing of other stimuli. At times, this interference may be increased if individuals are primed by negative content stimuli
pertaining to self. For example, a depressed factory worker receives criticism from a supervisor regarding the accuracy of his inventory, and later, while attempting to concentrate on his work, he overhears co-workers quietly discussing mistakes that were made in purchasing, and he is unable to focus as well on his work.

Barton and Morley (1999) used a sentence completion measure to investigate depressed individual’s reference patterns. To address an interpersonal domain, they extended Beck’s triad to include the influence of other people in agent roles, and they included past events to avoid confirmation bias. They used 48 sentence completion stems with a variety of pronouns and positive, negative, and neutral verbs (e.g., “Five years ago”, “I trust”, “Some people regret”, and “They think”). They found that with self in the agent role, negatively valenced statements regarding self, world, and future were significantly correlated with depression; however, in the other-agent condition, only negative references to the self were significantly correlated with depression. These findings suggest that although depressed individuals may have a negative self-concept, they do not see others in a negative way. However, depressed individuals may perceive that others view them in a negative light.

**Automatic Processing of Self-Relevant Information**

In addition to the significance of self-referential stimuli in depression, Gotlib and Neubauer (2000) emphasize that attentional biases in depression are affected by self-relevance of stimuli (congruency hypothesis), and investigators are more apt to find attentional biases in depressed individuals if they use idiographic stimuli related to the individual’s depressive symptoms. Bargh and Tota (1988) investigated the automaticity of negative thought processes using a forced-choice decision paradigm with and without
cognitive load. Depressed and non-depressed participants were asked whether depressed-content or nondepressed-content adjectives were similar to either self-descriptive or “average” person descriptive adjectives. Depressed participants endorsed equal response latencies for self-referent type judgments of depressed-content adjectives in both cognitive load conditions (presence and absence), and self-referential type judgment latencies of nondepressed-content adjectives were increased in the presence versus the absence of cognitive load. Nondepressed participants endorsed the opposite outcome; when self-referential judgments were made under cognitive load, they endorsed increased response latencies for depressed-content adjectives. Both groups of participants exhibited longer response latencies for judgments of other-referent negative adjectives in the presence versus the absence of cognitive load. These results suggest that depressed individuals automatically process negative self-referential material, yet they do not automatically process negative other-referential information.

Investigators have studied information processing of self-relevant stimuli in depressed individuals in the area of personality, specifically, autonomy and sociotropy. According to Beck (1983), sociotropy and autonomy are personality dimensions that play a role in the onset of depression. Sociotropy is described as a set of beliefs, attitudes, and behaviors that pertain to an individual’s dependence on others for personal fulfillment (Beck). Sociotropic individuals tend to excessively focus on seeking approval and avoiding disapproval from others (Beck). They seek interpersonal gratification such as intimacy, protection, sharing, and help (Sato & McCann, 1997). They depend on attention, approval, and love from others to sustain their self-esteem, and are at risk for depression if receipt of such interpersonal support is threatened (e.g., receipt of criticism.
Autonomy is described as a set of beliefs, attitudes, and behaviors that contribute to an individual’s sense of independence and goal achievement (Beck). These individuals strive to attain self-reliance, reach personal achievement-oriented goals, and exert control over their own activities and rights (Beck). They may be at risk for depression when one of these areas of focus is threatened (e.g., failing an exam) (Beck). These vulnerability dimensions are hypothesized to develop from childhood experiences and further develop in cognitive distortions in later life, representing significant factors in the diathesis-stress model of depression (Beck). That is, an individual’s appraisal of a stressor combined with the stressor itself plays a role in the onset of depression.

One study investigated the congruency hypothesis in sociotropy, the relationship between sociotropy and negative interpersonal experiences and depression (Dozois & Backs-Dermott, 2000). They attempted to assess schema activation and cognitive processing via a modified interpersonal Stroop task, primed with an interpersonal rejection situation. They hypothesized that the processing of positive and negative interpersonally relevant stimuli would vary based on the congruency between an individual’s personality vulnerability and type of priming (failure v. rejection imagery). Participants listened to a monologue and were asked to imagine that they themselves were experiencing the situation. Participants were asked to indicate whether or not positive and negative interpersonally relevant words described them. These same words were used in an interpersonal Stroop task. As is typical in this task, response times were used as the dependent variable. The results indicated that sociotropic individuals showed greater attentional biases toward negative self-referential stimuli when primed with a
congruent imaginal situation than individuals who did not experience a congruent prime. The differences were only significant when response times for self-relevant words were included in the analyses. These findings are consistent with earlier discussion of the congruency hypothesis for self-relevant information processing.

**Implicit Cognitive Processes in State Versus Trait Depression**

One of the objectives of research encompassing cognitive processes in depression is to differentiate between dysfunctional cognitive processes that form part of a vulnerability factor and those that are a result of current mood state (Eysenck, 1991). Eysenck theorizes that dysfunctional automatic processes are most likely a function of a vulnerability factor, and dysfunctional controlled processes are more apt to be explained by current mood state. This hypothesis is in part congruent with Beck’s theory, in that negative schemata may be associated with cognitive vulnerability for depression (1967, 1976). The findings of some studies suggest that depressive automatic attributions were more closely linked to depression vulnerability than to current depression (see Hartlage et al., 1993 for a review). In one study, 42 female participants completed the BDI-SF as part of a larger battery 12 months prior to the experiment (Williams & Nulty, 1986). The participants completed another BDI-SF at the time of the experiment, and were grouped into the following four categories: depressed at both times, depressed at neither time, depressed at time 1 but not time 2, depressed at time 2 but not time 1. They found the strongest results in the two groups who were depressed or nondepressed at both times, in that depressed individuals showed the greatest interference on a modified Stroop Task when negative emotion words were displayed, and nondepressed individuals showed the least interference. In addition, they found that individuals who had changed groups from
depressed at time 1 to nondepressed at time 2 showed a significant correlation of -.79, indicating that as BDI score decreased, interference on the emotion Stroop task increased. These results suggest that the emotion Stroop interference effect cannot be explained simply by transient mood, but rather vulnerability to depression plays a role in selective attention to negative emotion stimuli. In the same vein, investigators hypothesized that individuals who are cognitively vulnerable to depression endorse comparable negative self-referent processing as those who are depressed (Alloy, Abramson, Murray, Whitehouse, & Hogan, 1997), suggesting that those who are vulnerable to depression may be at risk for experiencing a depressive episode given that they may process information about the self in a negatively biased fashion similar to those who endorse current symptoms of depression. Alloy and colleagues found that high cognitive risk participants (based on level of risk assessed from dysfunctional attitudes and inferential styles measures) demonstrated greater processing of negative self-referent information and less processing of positive self-referent information than low risk participants. On the contrary, it has been argued that individuals vulnerable to depression will process implicit information similarly to never depressed individuals unless they experience current depressed mood (Miranda & Persons, 1988). One study found that negative construct accessibility assessed through a modified Stroop task significantly differed between nondepressed controls and hospitalized depressed individuals. However, when the depressed patients were discharged and endorsed decreased symptomatology, there were no longer significant differences in negative construct accessibility between patients and never depressed controls (Gotlib & Cane, 1987). There are mixed findings to explain implicit cognitive processing of negative stimuli in individuals vulnerable to depression.
There is some support indicating vulnerability alone is sufficient for such dysfunction in implicit cognitive processing, while other findings support that in addition to vulnerability to depression, current depressed mood is necessary to trigger implicit cognitive processing of negative stimuli.

**Implications of Implicit Cognitive Processes Research in Depression**

Increasing understanding of implicit cognitive processes in depression has implications for improving assessment and treatment of depression. Studying depression from an explicit/implicit view may provide answers in the following areas: (1) how stress precipitates a depressive episode, (2) how people become vulnerable to depression, and (3) why depression persists (Hartlage et al., 1993). Hartlage and colleagues hypothesize that stress leads to narrowing of cognitive capacity, resulting in greater dependence on automatic processing. Furthermore, depression-prone individuals may automatically process negative features of a stressful situation, consequently recalling more negative experiences, and they may not be able to lessen their negative thoughts through effortful strategies (e.g. problem solving). This style becomes more practiced and more automatic. Although individuals may become aware of automatic thoughts (as defined by Beck), underlying schemata may be more difficult to access and change. Implicit measures may provide a means of access to underlying schemata, and change or progress in altering schemata or at least the degree of accessibility to these dysfunctional schemata may be monitored via implicit measures. Clinicians may be able to assess and treat underlying dysfunctional automatic cognitive processes (e.g. minor depression) before depressive symptoms become more serious (e.g. major depressive disorder). Clinicians may also use implicit assessment as a tool in relapse prevention. Thus
individualized implicit assessment measures of depression may be used in addition to self-report measures, since implicit measures may capture a different dimension of cognitive processing. In addition, assessing implicit processes may provide data to support cognitive and emotion network models of depression.

**Future Directions of Automaticity Research in Depression**

Employing information-processing models to investigate biases in attention and memory in depression may provide additional information to what is generated from self-report methods (Gotlib & Neubauer, 2000). However, Gotlib and Neubauer report that findings regarding biases in depressed individuals are mixed. They explain that inconsistencies across studies may be due to several factors: (1) Attentional biases in depression may be in part a result of comorbid anxiety; (2) Different studies use varying degrees of stimuli relevance to depressed individuals’ concerns; (3) Studies use tasks with varying number of stimuli for individuals to process simultaneously; and (4) Some studies encourage guessing, and responses may result from different ways of making judgments as opposed to attentional processing. Researchers should consider these criticisms in designing future research of implicit cognitive processes.

Very few studies have investigated implicit evaluative biases in depressed individuals using an association task. In this study, automatic associations involving self-concept were investigated in depressed individuals; however, it could not be determined that purely implicit processes were measured. Anxiety was controlled for statistically in secondary analyses, since many researchers proposed that there is a difference in implicit cognitive processing between depressed and anxious individuals. Many studies have shown that there is a greater effect of implicit cognitive processing when stimuli are
related to the concerns of depressed individuals. Some studies have used word stimuli that participants chose as self-descriptive; however, in this study, a depressive personality measure was used to find some degree of relevance of stimuli. If this study included a true idiographic assessment, a comprehensive psychological assessment would have been required, including extensive interviewing and psychological testing. However, it can be argued that assessment involving self-report may not accurately describe a person’s concerns. In this study, participants were assessed for degree of sociotropy and autonomy, and participants were presented with stimuli pertaining to these constructs.

Further research is necessary in comparing implicit measures that purport to measure similar constructs. For example, Bosson and colleagues investigated the correlation among seven implicit measures of self-esteem and found primarily weak positive correlations and weak negative correlations (2000). However, in their study, they used measures of varying implicitness. If one considers the continuum of automaticity, an individual’s response on one “completely implicit” measure of self-esteem may not correlate strongly with another measure of implicit self-esteem that is less indirect. One goal for researchers of implicit processes in depression may be to design a battery of implicit measures that complement one another, using different methods but assessing a similar construct. Investigators may use implicit measures that include idiographic assessment of individuals to capture their relevant concerns and use stimuli that are self-referent. In addition, they may consider using measures that are similar in the degree of implicitness so that they may capture the same level of processing. There have been few studies that have attempted this. In this study, a test to assess automatic associations in self-concept as well as an implicit memory measure were
used. It was expected that self-concept schemata would be activated in both making associations of negative self-relevant stimuli with self-concept and in accessing memory for these negative self-relevant stimuli. In this study, individuals’ responses on implicit measures of depression were compared to their responses on explicit measures of depression. It was hypothesized that implicit and explicit measures would be weakly correlated, since they may measure two different types of processing, one that the individual has awareness of and the other that may be operating in parallel but for which the individual is unaware. However, it was beyond the scope of this study to further examine why these differences may occur.

Hypotheses

The following hypotheses were tested in this study:

1. There will be differences in task responses on implicit measures between and within depressed and never depressed individuals. Depressed individuals will show stronger associations of self-concept with negative stimuli than positive stimuli, while never depressed individuals will show the opposite pattern. There will be significant differences in self-concept associations between depressed and never depressed individuals, in that the depressed group will demonstrate a greater association than the never depressed group between self and negative stimuli. In addition, depressed individuals will have greater implicit memory for depressed content words than positive words, while never depressed individuals will show the opposite pattern. The depressed group will demonstrate greater implicit memory than the never depressed group for depressed content stimuli.
2. Depressed individuals who score high on sociotropy will show a greater self-concept negative sociotropic bias than a general negative bias. In addition, their response times in making associations between self-concept and negative sociotropic content stimuli will be faster than those low on sociotropy and those never depressed. High autonomy depressed individuals will exhibit a greater self-concept negative autonomous bias than a general negative bias. In addition, their response times in making associations between self-concept and negative autonomous content stimuli will be faster than those low on autonomy and those never depressed. High sociotropic depressed individuals will demonstrate greatest implicit memory of sociotropic words, while high autonomous depressed individuals will demonstrate greatest implicit memory for autonomous content words. In addition, depressed sociotropic individuals will exhibit greater implicit memory for sociotropic content stimuli than those low on sociotropy and those never depressed, and depressed autonomous individuals will show greater implicit memory for autonomous content stimuli than those low on autonomy and those never depressed.

3. Implicit measures will correlate more highly with each other than they will correlate with explicit measures, since implicit measures, even if varying in degree of indirectness, will more likely measure the same processes than clearly explicit measures.
2. Method

Design

The study design included one between-groups factor (groups: depressed high autonomy (n = 8), depressed not high autonomy (n = 7), depressed high sociotropy (n = 8), depressed not high sociotropy (n = 7), and never depressed (n = 15) and one within-groups factor (task response for negative sociotropic, negative autonomous, depressive content, and positive affective stimuli). Some participants fell into more than one group. For example, a participant could score high on both sociotropy and autonomy or score low on both sociotropy and autonomy. Depressed participants were split into high and low autonomy and sociotropy groups based on a median split. Participants were recruited from clinics in Salt Lake City, and the control group was approximately matched with the depressed group for education level and gender. Participants completed self-report measures of depression, anxiety, and autonomy/sociotropy within three days preceding the implicit association test and word stem completion task.

Participants

Fifteen participants at least 18 years of age with a diagnosis of major depressive disorder, dysthymic disorder, or depressive disorder NOS were recruited from Valley Mental Health in Salt Lake City. The investigator obtained confirmation of the participant’s diagnosis of major depressive disorder, dysthymic disorder, or depressive disorder NOS from the patient’s therapist at the time of enrollment. Master- or Doctoral-level licensed therapists from the outpatient clinics determined a psychiatric diagnosis based on an unstructured clinical interview and review by a treatment team or intake team that included psychologists, psychiatrists, social workers, and psychiatric nurses.
Depressed participants were included if they scored 15 or higher on the BDI-II (Beck, Steer, & Brown, 1996), as other studies have used similar BDI cut-off scores (Andersen et al., 1992; Watkins et al., 2000; Watkins et al., 1996). Participants were excluded if they had a diagnosis of major depressive disorder with psychotic features or a psychotic disorder. Fifteen never depressed participants who were employed at Valley Mental Health sites in Salt Lake City were recruited. Never depressed participants were excluded if they ever experienced a depressive episode in the past or were experiencing depressed mood at the time of the experiment, as indicated by an unstructured clinical interview based on DSM-IV (American Psychiatric Association, 1994) criteria for major depressive disorder and dysthymic disorder. In addition, never depressed participants were excluded if they scored high on the Personal Style Inventory (PSI); that is, above 94 on the autonomy scale or above 107 on the sociotropy scale, based on the 75th quartiles of a study conducted by Robins and colleagues with a sample size of 411 participants (1994). Never depressed participants were included if they scored 12 or below on the BDI-II (Beck, Steer, & Brown, 1996), as other studies have used similar BDI cut-off scores (Andersen et al., 1992; Watkins et al., 2000; Watkins et al., 1996). The researcher approximately matched never depressed participants for education level and gender with depressed participants. Thus, depressed participants were recruited based on current diagnoses and their scores on the BDI-II (Beck, Steer, & Brown, 1996), while never depressed participants were recruited based on unstructured clinical interviews, BDI-II scores, and PSI (Robins et al.) scores. All participants were required to be fluent and literate in English. Three participants in the depressed group were excluded because they were no longer experiencing clinically significant depressive symptoms and scored below
15 on the BDI-II. Five participants in the never depressed group were excluded because they met criteria for a history of a depressive diagnosis. No participants were excluded based on PSI scores.

**Measures**

**Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996)**

The BDI-II is a 21-item self-report measure that has been widely used to assess the presence and severity of depressive symptoms. The BDI-II manual (Beck, Steer, & Brown) reports a correlation of .93 between the BDI-II and the BDI (Beck et al., 1961) in a sample of 191 outpatients. The manual also reports that the BDI-II correlates .68 with the Revised Hamilton Psychiatric Rating Scale for Depression (Hamilton, 1960) and correlates .71 with the Beck Hopelessness Scale (Beck & Steer, 1988). The BDI-II manual reported alpha coefficients of .91 and higher as evidence for the instrument's internal consistency.

**State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)**

The STAI is a widely used self-report measure assessing anxiety as an emotional state and as a personality trait (Murphy, Conoley, & Impara, 1994). The psychometric data that follows is from the Eighth Mental Measurements Yearbook (Buros, 1978). The STAI consists of 40 items, 20 items assessing state anxiety or how the individual feels currently, and 20 items assessing trait anxiety or how the individual feels generally. The reviewers summarize that the STAI is a relatively efficient, reliable, and valid measure of state and trait anxiety. Test-retest reliabilities for state and trait scores for a one-hour interval are .33 (males) and .16 (females) and .84 (males) and .76 (females) respectively.
Alpha reliability coefficients for the normative samples range from .83 to .92 for state scores and .86 to .92 for trait scores. Convergent validity of the STAI with the IPAT Anxiety Scale, Manifest Anxiety Scale, and Affect Adjective Checklist were .75, .80, and .52 respectively. The reviewers state that the STAI shows good internal consistency.

**Personal Style Inventory, Version II (PSI: Robins et al., 1994)**

The PSI is a 6-point self-rating measure assessing sociotropy and autonomy, consisting of two scales of 24-items each. Using a college student sample, Robins and colleagues found good internal consistency for both scales, Sociotropy (alpha=.88) and Autonomy (alpha=.86) and the correlation between the two scales was low, r(411)=.18. In terms of construct validity, they found positive modest correlation with the BDI for Sociotropy (r=.20) and Autonomy (r=.27), and the Sociotropy scale was very highly correlated with the Revised Depressive Experience Questionnaire Dependency scale (RDEQ: Welkowitz, Lish, & Bond, 1985), r=.84. Autonomy correlated moderately highly with the Self-Criticism scale of the RDEQ, r=.50. Test-retest reliability was high for a 5- to 13-week period (n=74) for Sociotropy (r=.80) and Autonomy (r=.70).

**Implicit Association Test (IAT: Greenwald et al., 1998)**

The IAT was developed to measure individual differences in implicit cognition and has been used to measure self-concept and self-esteem (Greenwald & Farnham, 2000) and associations in recovered depressed patients (Gemar et al., 2001). The IAT is designed to assess implicit attitudes, that is, attitudes that are automatically activated in an individual without his or her awareness or control (Greenwald & Banaji, 1995). The IAT is used to assess this automatic activation by measuring the difference between response times in associating different concepts and attributes (Greenwald et al.). The
underlying assumption, based on neural network theory, is that strongly associated attribute-concept pairs should be easier to classify together than are weakly associated or incompatible attribute-concept pairs (Farnham et al., 1999). This is measured by response time differences or errors in making these associations. Greenwald and Farnham (2000) discuss the validity of the IAT in general. For example, they refer to Greenwald and colleagues’ study in which IAT measures demonstrated stability across various procedural alterations (such as key assignment), time interval between onset of stimuli, and number of stimuli presented in one trial. However, it is more difficult to establish psychometric properties of implicit attitude measures since there is a high degree of intrinsic measurement error in latency-based measures (Cunningham, Preacher, & Banaji, 2001). Cunningham and colleagues were able to correct for measurement error by using a latent variable approach to estimate stability and convergent validity of the IAT. They used a sample of 93 participants and administered three implicit attitude measures of race (IAT, response-window associative priming, and response-window IAT) and one explicit attitude measure (Modern Racism Scale) four times. They found that the interitem consistency for the IAT was acceptable, Cronbach’s alpha = .78. After separating out measurement error from estimates of stability using a latent variable method, they found a stability index of .68 for the IAT. In investigating convergent validity, Cunningham and colleagues found that all of the latent variable correlations were statistically significant, r=.63, although the simple bivariate correlations were only r=.19. Thus, they reported greater convergent validity using a latent variable method of analysis than a traditional bivariate correlation. Also, each of the three implicit measures was significantly correlated with the explicit measure, the Modern Racism Scale, mean
r=.35; however, they state that the implicit tests are measuring something distinct from the explicit measure. Although the implicit measures found that participants made racist associations, participants scored significantly below the midpoint of the self-report racism scale.

**Word Stem Completion Task (WSCT)**

The WSCT was used as a second implicit measure of depression for comparison of two implicit measures of depression. It was expected that the WSCT would be positively correlated with the IAT (Greenwald et al., 1998) since both are based on self-concept using the same stimuli. They were not expected to be highly correlated since one assesses automatic associations (IAT) and the other implicit memory (WSCT). The WSCT has been widely used in the assessment of implicit memory (Banos et al., 2001; Denny & Hunt, 1992; Lang & Craske, 1997). Implicit memory is assessed with a WSCT in conjunction with priming, in that prior exposure to words may facilitate performance on a task without the individual’s realization of the association (Graf & Schacter, 1985). Individuals are given the first few letters of a target word and are asked to complete the word as quickly as possible with the first word that comes to mind (Bradley et al., 1994). Implicit memory is indicated when individuals complete more word stems with primed words than unprimed words (Banos et al.). Neuroimaging experiments have demonstrated that there is decreased cortical activity in several areas during priming (Schacter & Buckner, 1998), and numerous studies have found dissociations between explicit and implicit memory using the word stem completion task (Cloitre, Shear, Cancienne, & Zeitlin, 1994). Jacoby (1991) recommends using his process-dissociation procedure as a more stringent method of separating implicit from explicit influences in
completing a task, since participants may purposefully use memory for word stimuli presented during a prior task to complete word stems, even though they are not instructed to do so. Jacoby, Toth, and Yonelinas (1993) explain that this method combines outcomes of an exclusion task (do not use words from the prior task) and inclusion task (use words from the prior task) by measuring the difference between performance when trying versus trying not to complete word stems as instructed. They state that if the participant is as likely to complete word stems with words from a prior task when trying not to as when trying to do so, then the participant has no control. Jacoby and colleagues’ model is based on the assumption that unconscious and conscious memory systems are independent; however, others have argued that alternative models may be used that assume some degree of redundancy (Cowan & Stadler, 1996; Joordens & Merikle, 1993). Although the estimate of the unconscious processes involved in the task may vary according to the model adopted, the advantage in using this procedure is that there is an experimental method to separate to some degree implicit from explicit processes.

**Materials and Apparatus**

Both implicit tasks described below were executed on IBM-compatible laptops. FIAT for Windows software program (Farnham, 1998) was used to control presentation of stimuli and record response times for the IAT (Greenwald et al., 1998). Software for presentation of stimuli and recording of responses for the WSCT was designed by a computer programmer consultant. A keyboard was connected to the laptop for participants to respond to stimuli. There were 120 different stimulus words and 180 different 2- or 3- or 4-letter word stems presented to each participant.
Procedure

Recruitment

Approvals from the Internal Review Boards at Drexel University College of Medicine and the Utah Department of Human Services were obtained. Written consent was obtained from those participants who qualified for the study and verbally agreed to participate. Participants who completed the study requirements as outlined in the consent form received $10 compensation, and those who completed part of the study requirements received $2.

Experiment

Participants completed the BDI-II (Beck, Steer, & Brown, 1996), STAI (Spielberger et al., 1983), and PSI (Robins et al., 1994) within three days of completing the experiment. Participants first completed the IAT (Greenwald et al., 1998) that served as a priming task for the second implicit measure, the WSCT. Thus, words in the IAT were presented without instruction that these words would be used later in the WSCT, and exposure to word stimuli in the IAT was hypothesized to facilitate completion of word stems with words that were presented in the IAT. All participants completed the experiment individually. Participants were debriefed after the experiment.

IAT (Greenwald et al., 1998). The procedure that follows was based largely on Gemar and colleagues’ (2001) method. Participants provided 15 specific personal demographic and other data to be used as ostensibly affectively neutral “Me” stimuli for “Self” category judgments (first name, middle name, last name, birth date, birth year, city, state, zip code, country, zodiac sign, age, ethnicity, gender, handedness, and phone number) prior to the experimental tasks. In addition, participants chose 15 corresponding
“Not Me” ostensibly affectively neutral stimuli approximately matched for length with “Me” stimuli. Before the experiment and during transitions in tasks, participants were told that response times would be measured, as this and accuracy together determined their level of performance. During the experiment, the participant judged whether the stimulus was “Me” or “Not Me” and responded by pressing the right or left key assigned to “Me” or “Not Me” on the keyboard. Half of the participants were assigned “Me” to the right response key, and assignment remained the same for all participants for the duration of the experiment. The second type of stimuli consisted of negative content words pertaining to sociotropy, autonomy, and general depressive words and positive affective content words. Participants were presented with 45 negative content words and 45 positive affective words. Words were selected from various sources (other researchers’ lists, PSI, SAS); however, later the researcher required additional words to meet word stem uniqueness, word frequency and word length requirements, thus the researcher added word stimuli to the word lists. These added words were judged by 10 individuals, and the word stimuli with the highest average ratings were selected for use in the program. Words in different categories were approximately matched for length and frequency (Carroll, Davies, & Richman, 1971) by using a computer program designed by a computer programmer consultant. All words had a unique word stem. Participants judged whether the word was positive or negative and responded by pressing the right or left response key. Half of the participants were assigned “Positive” to the right response key, and all participants reversed the response key assignment “Positive” and “Negative” half way through the experiment. This judgment task was referred to as the valence judgment. At the start of the data collection, participants were given 30 practice trials, 10
each for the following: self judgments, valence judgments, and the two judgments mixed. After completion of the practice trials, participants completed 50 trials of mixed type judgments (self judgments interspersed with valence judgments) based on the practiced side of the response assignment. Next, participants repeated the practice trial procedure with the new key assignment (“Positive” and “Negative” reverse sides). After completion of the 30 practice trials, participants completed 50 additional trials using the reversed side assignment. Scores on the IAT were calculated for both the “Me” and “Not Me” self judgments separately by subtracting the response times for the two response-matching conditions, that is when self was matched with the same side of the screen as “Positive” versus “Negative”. If there was a significant difference in response time depending on matching response sides, there was an associative bias. It was hypothesized that depressed individuals would respond quicker when “Me” was matched with “Negative” than when “Me” was matched with “Positive”, and would respond quickest when “Me” was matched with self-relevant negative words. It was hypothesized that never depressed individuals would not show this bias but would in fact show the opposite bias, faster reaction times when “Me” was matched with “Positive”.

WSCT. The following procedure was based on the process dissociation procedure used by Jacoby, Toth, and Yonelinas (1993). After completion of the IAT, participants were given 10 practice trials for word stem completion, 5 of which are unrelated to the actual task stimuli. For the inclusion task, participants were instructed to complete each word stem with a word they saw during the first task, and if they were not able to do so, then they should complete the word stem with the first word to come to mind as quickly as possible. For the exclusion task, participants were instructed to
complete each word stem as quickly as possible using a word that was not viewed during the first task. Next, participants were given a total of 180 2-, 3-, or 4-letter word stems in semi-random order (no more than three word stems from the same category presented contiguously), 15 each previously presented words and 15 each new words from the following categories: negative sociotropy, negative autonomy, depressive content, and positive affective. For the inclusion part of the task, participants were instructed to complete each word stem with a word they saw during the first task, and if they were not able to do so, then they should complete the word stem with the first word to come to mind as quickly as possible. During the exclusion part of the task, participants were instructed to complete each word stem as quickly as possible with a word that was not presented in the first task. Color-coding was used to indicate whether the task required exclusion or inclusion of previously viewed words, in that green word stems were used for inclusion, and red word stems were used for exclusion (Jacoby et al.). For each 2-, 3-, or 4-letter stem there was at least one word that could be formed that was higher in word frequency than the target word (Watkins et al., 1992). If participants completed word stems with words that were in a different form from the target words presented in the IAT but were semantically similar or were simply misspelled, the words were scored as correct responses as long as there was at least one word that could be formed that was higher in frequency (Watkins et al.). Half of the word stems were presented in the inclusion task and half in the exclusion task, and these two sets were counterbalanced, so that approximately half of the participants in each group received set A word stems in the inclusion task and set B word stems in the exclusion task.
3. Results

Analyses

A mixed-model MANOVA was run to investigate within- and between-groups differences on the IAT based on the two groups depressed and never depressed. The two dependent variables consisted of the association response times when “Me” was mapped with positive word stimuli and when “Me” was mapped with general depressive stimuli on the IAT. The FIAT software program generated IAT mean latency scores for each critical block, automatically excluding the first two trials of each block and any latency over 3000 ms or under 300 ms. These data were used in the analyses rather than individual trial scores, since outliers were already excluded and the database was more manageable.

A mixed-model MANOVA was run to investigate within- and between-groups differences on the WSCT based on the two groups depressed and never depressed. The two dependent variables consisted of the automaticity estimate for positive stimuli and the automaticity estimate for general depressive stimuli.

A mixed-model MANOVA was run to investigate within- and between-groups differences on the IAT based on depressive personality style. The independent variables were autonomy and sociotropy. There were three levels for each factor: low and depressed, high and depressed, and never depressed. The three dependent variables consisted of the response time differences between the following: positive stimuli mapped with “Me” and negative autonomous stimuli mapped with “Me”, positive stimuli mapped with “Me” and negative sociotropic stimuli mapped with “Me”, and positive stimuli mapped with “Me” and general depressive stimuli mapped with “Me”. As
discussed above, mean latency scores for critical blocks generated by the FIAT software program were used in the analyses.

A mixed-model MANCOVA was run to investigate within- and between-groups differences on the WSCT based on a depressive personality style. The independent variables were autonomy and sociotropy. There were three levels for each factor: low and depressed, high and depressed, and never depressed. The four dependent variables consisted of automaticity estimates for positive, general depressive, negative autonomous, and negative sociotropic word stimuli.

Correlation analyses were used to investigate relationships between the two implicit measures and between the implicit measures and the explicit measures of depression and sociotropy/autonomy. Data from both depressed and never depressed participants were included in the correlation analyses.

Statistical Findings

The sample consisted of 22 female participants and 8 male participants with an average age of 44.5 years. The mean education level was 13.5 years. Twenty-eight Caucasians, one Hispanic, and one Asian participated in the study. See Table 1 for sociodemographic statistics for the depressed and never depressed groups.

<table>
<thead>
<tr>
<th>Table 1 Sociodemographic Descriptive Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never depressed (n=15)</td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Education</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
</tbody>
</table>
The mean BDI-II score was 32 for the depressed group and 4 for the never depressed group. The mean STAI-State score was 57 for the depressed group and 31 for the never depressed group. The mean STAI-Trait score was 60 for the depressed group and 31 for the never depressed group. The mean PSI-Autonomy scale score was 94 for the depressed group and 65 for the never depressed group. The mean PSI-Sociotropy scale score was 102 for the depressed group and 77 for the never depressed group. See Table 2 for means and standard deviations for the self-report explicit measures.

<table>
<thead>
<tr>
<th></th>
<th>Never depressed (n=15)</th>
<th>Depressed (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>BDI-II</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>STAI-State</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>STAI-Trait</td>
<td>31</td>
<td>5</td>
</tr>
<tr>
<td>PSI-Autonomy</td>
<td>65</td>
<td>16</td>
</tr>
<tr>
<td>PSI-Sociotropy</td>
<td>77</td>
<td>19</td>
</tr>
</tbody>
</table>

It was expected that there would be significant differences in self-concept associative biases within and between groups as suggested by differences in response times between when “Me” is mapped with positive stimuli and when “Me” is mapped with general depressive stimuli based on depression. A mixed-model MANOVA showed significant results within groups on the IAT, in that participants demonstrated a significant positive bias, $F(1,28) = 90.59$, $p = .001$, eta squared $= .76$. Participants scored in a positive direction, in that participants demonstrated faster associations between self and positive descriptive stimuli than between self and negative descriptive stimuli (see
Table 3). There were no significant differences between groups on the IAT, $F(1,28) = .12$, $p=.73$, eta squared = .004.

<table>
<thead>
<tr>
<th></th>
<th>Never Depressed ($n=15$)</th>
<th>Depressed ($n=15$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IAT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^a$Negative</td>
<td>476</td>
<td>402</td>
</tr>
<tr>
<td>$^b$Negative-Me</td>
<td>1706</td>
<td>1623</td>
</tr>
<tr>
<td>$^b$Positive-Me</td>
<td>1230</td>
<td>1221</td>
</tr>
<tr>
<td>$^a$Autonomy</td>
<td>453</td>
<td>400</td>
</tr>
<tr>
<td>$^b$Negative-Me</td>
<td>1735</td>
<td>1637</td>
</tr>
<tr>
<td>$^b$Positive-Me</td>
<td>1282</td>
<td>1237</td>
</tr>
<tr>
<td>$^a$Sociotropy</td>
<td>547</td>
<td>324</td>
</tr>
<tr>
<td>$^b$Negative-Me</td>
<td>1716</td>
<td>1562</td>
</tr>
<tr>
<td>$^b$Positive-Me</td>
<td>1170</td>
<td>1238</td>
</tr>
</tbody>
</table>

$a$Response time difference in milliseconds between when “me” is mapped with positive words and when “me” is mapped with negative words. $^b$Response time in milliseconds when “Me” is matched with word stimuli.

According to a mixed-model MANOVA, there were no significant differences in implicit memory as measured by positive and negative automaticity estimates between groups, $F(1,28) = .88$, $p=.36$, eta squared = .03 and within groups $F(1,28) = 1.35$, $p=.26$, eta squared = .03 on the WSCT (see Table 4).

<table>
<thead>
<tr>
<th></th>
<th>Never Depressed ($n=15$)</th>
<th>Depressed ($n=15$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WSCT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^a$Response time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^b$Response time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4 (continued)

WSCT

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
<th>Autonomy</th>
<th>Sociotropy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.06</td>
<td>.17</td>
<td>.11</td>
<td>.17</td>
</tr>
<tr>
<td></td>
<td>.02</td>
<td>.17</td>
<td>.09</td>
<td>.13</td>
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<td></td>
<td>.16</td>
<td>.21</td>
<td>.13</td>
<td>.19</td>
</tr>
<tr>
<td></td>
<td>.29</td>
<td>.21</td>
<td>.26</td>
<td>.28</td>
</tr>
</tbody>
</table>

Note. Unit of measure is probability of automatic influences of memory.

It was expected that depressed individuals who scored high on sociotropy would demonstrate a greater negative sociotropic bias than a general negative associative bias. In addition, their response times in making associations between self-concept and negative sociotropic content stimuli would be faster (thus a stronger association) than those low on sociotropy and those never depressed. It was also predicted that high autonomy depressed individuals would exhibit a greater self-concept negative autonomous associative bias than a general depressive bias. In addition, their response times in making associations between self-concept and negative autonomous content stimuli would be faster than those low on autonomy and those never depressed. The results of the mixed-model MANOVA showed no significant differences in the overall model based on autonomy and sociotropy on the IAT, $F(2,24) = .2, p = .82$, eta squared = .02 (see Table 5 for groups’ $M$ and $SD$). The differences within groups were not significant for autonomy, $F(2,25) = .11, p = .9$, eta squared = .004, and sociotropy, $F(2,25) = 1.52, p = .23$, eta squared = .06. However, the differences between groups based on autonomy approached significance, $F(1,25) = 3.94, p = .058$, eta squared = .14. The three groups scored in a positive direction; however, the never depressed group had
the greatest positive bias, second highest was the low autonomy depressed group, and the high autonomy depressed group exhibited the least positive bias. The differences between groups based on sociotropy were not significant, $F(1,25) = 2.6$, $p = .12$, eta squared = .09.

Table 5 Descriptive Statistics for the IAT – Autonomy and Sociotropy Factors

<table>
<thead>
<tr>
<th></th>
<th>Low Sociotropy (n=7)</th>
<th>High Sociotropy (n=8)</th>
<th>Low Autonomy (n=7)</th>
<th>High Autonomy (n=8)</th>
<th>Never Depressed (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>IAT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>468</td>
<td>213</td>
<td>343</td>
<td>136</td>
<td>534</td>
</tr>
<tr>
<td>Autonomy</td>
<td>334</td>
<td>251</td>
<td>457</td>
<td>237</td>
<td>455</td>
</tr>
<tr>
<td>Sociotropy</td>
<td>211</td>
<td>177</td>
<td>423</td>
<td>170</td>
<td>337</td>
</tr>
</tbody>
</table>

Note. Unit of measurement is response time difference in milliseconds between when “me” is mapped with negative words and when “me” is mapped with positive words.

It was expected that high sociotropic depressed individuals would demonstrate greatest implicit memory of sociotropic words, while high autonomous depressed individuals would demonstrate greatest implicit memory of autonomous content words. In addition, depressed high sociotropic individuals would exhibit greater implicit memory of sociotropic content stimuli than those depressed and low on sociotropy and those never depressed, and depressed high autonomous individuals would show greater implicit memory for autonomous content stimuli than those depressed and low on autonomy and those never depressed. The results of a mixed-model MANOVA were significant overall, $F(2,24) = 6.44$, $p = .006$, eta squared = .35. There were significant differences within depressive personality style groups in implicit memory, $F(2,50) = 7.32$, $p = .002$, eta squared = .23. All groups showed highest implicit memory of negative sociotropic words.
(see Table 6 for groups’ M and SD). There were no significant differences between
groups in implicit memory based on autonomy, F(1,25) = .19, p = .66, eta squared = .008
and sociotropy, F(1,25) = 1.25, p = .28, eta squared = .05.

Table 6 Descriptive Statistics for the WSCT – Autonomy and Sociotropy Factors

<table>
<thead>
<tr>
<th></th>
<th>Low Sociotropy (n=7)</th>
<th>High Sociotropy (n=8)</th>
<th>Low Autonomy (n=7)</th>
<th>High Autonomy (n=8)</th>
<th>Never Depressed (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSCT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>.09</td>
<td>.10</td>
<td>.12</td>
<td>.21</td>
<td>.07</td>
</tr>
<tr>
<td>Negative</td>
<td>.04</td>
<td>.15</td>
<td>.13</td>
<td>.10</td>
<td>.12</td>
</tr>
<tr>
<td>Autonomy</td>
<td>.12</td>
<td>.15</td>
<td>.14</td>
<td>.24</td>
<td>.09</td>
</tr>
<tr>
<td>Sociotropy</td>
<td>.22</td>
<td>.27</td>
<td>.29</td>
<td>.30</td>
<td>.27</td>
</tr>
</tbody>
</table>

Note. Unit of measure is probability of automatic influences of memory.

It was expected that the implicit measures would be more highly correlated with
each other than with an explicit measure. Correlation analyses were run among all of the
explicit and implicit measures. There were mixed findings, in that results indicated six
significant correlations between explicit measures, two significant correlations between
implicit measures, and three significant correlations between implicit and explicit
measures (see Table 7). Not surprisingly the BDI-II was significantly positively
correlated with the PSI Autonomy (r = .8, p < .001) and Sociotropy (r = .61, p < .001)
scales, and the two PSI scales were significantly positively correlated with each other (r =
.79, p < .001). The WSCT recollection measures were all significantly positively
correlated with each other (positive, autonomous, and sociotropic words; see Table 7).
The IAT negative difference score was significantly positively correlated with the IAT
autonomy difference score ($r = .48$, $p = .007$). Thus, as individuals showed a greater positive self-concept bias when “me” was mapped with positive versus negative words, they also showed a greater positive bias when “me” was mapped with positive words versus negative autonomy words. The WSCT automaticity estimates for positive and negative stimuli were significantly positively correlated, ($r = .5$, $p = .005$), indicating that as implicit memory for positive words increased so did implicit memory for negative words. There was a significant negative correlation between the PSI Autonomy scale and the IAT sociotropy difference score ($r = -.48$, $p = .007$); thus, as individuals scored higher on an explicit autonomy measure, they demonstrated a lower positive self-concept bias on an implicit measure of sociotropy. In addition, there was a significant negative correlation between the IAT sociotropy difference score and the BDI-II ($r = -.41$, $p = .03$), indicating that as individuals scored higher on an explicit depression measure, they demonstrated a lower positive self-concept bias on an implicit measure of sociotropy. Lastly, there was a significant negative correlation between the WSCT recollection of autonomous words and the WSCT automaticity estimate for autonomous words ($r = -.64$, $p < .001$); thus, as explicit memory of autonomous words increased, implicit memory of autonomous words decreased. If these results were corrected with a Bonferroni adjustment (calculated by dividing the probability .05 by the number of correlations 80) to the probabilities, there would be fewer significant correlations. The following correlations were significant after the Bonferroni adjustment: (1) The BDI-II was significantly correlated with the PSI Autonomy and Sociotropy scales; (2) The PSI scales were correlated with each other; and (3) The implicit and explicit measures of autonomy on the WSCT were correlated.
Table 7 Correlations among Implicit and Explicit Measures

<table>
<thead>
<tr>
<th></th>
<th>1. BDI-II&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2. PSI-A&lt;sup&gt;a&lt;/sup&gt;</th>
<th>3. PSI-S&lt;sup&gt;a&lt;/sup&gt;</th>
<th>4. IAT-negative&lt;sup&gt;b&lt;/sup&gt;</th>
<th>5. IAT-autonomy&lt;sup&gt;b&lt;/sup&gt;</th>
<th>6. IAT-sociotropy&lt;sup&gt;b&lt;/sup&gt;</th>
<th>7. WSCT-recollection-P&lt;sup&gt;a&lt;/sup&gt;</th>
<th>8. WSCT-recollection-N&lt;sup&gt;a&lt;/sup&gt;</th>
<th>9. WSCT-recollection-A&lt;sup&gt;a&lt;/sup&gt;</th>
<th>10. WSCT-recollection-S&lt;sup&gt;a&lt;/sup&gt;</th>
<th>11. WSCT-automaticity-P&lt;sup&gt;b&lt;/sup&gt;</th>
<th>12. WSCT-automaticity-N&lt;sup&gt;b&lt;/sup&gt;</th>
<th>13. WSCT-automaticity-A&lt;sup&gt;b&lt;/sup&gt;</th>
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Note. A=autonomy; S=sociotropy; P=positive; N=negative.

<sup>a</sup>Explicit measure. <sup>b</sup>Implicit measure.

*p < .05. **p < .01.
4. Discussion

Study Overview

This study was designed to measure implicit cognitive processes in depressed individuals. There are theories that postulate the existence of underlying negative cognitive processes in depression; however, there are not many studies to support implicit self-concept and implicit memory in depression. This study examined automatic self-concept and implicit memory in depressed individuals. Participants’ response times were recorded during a task (IAT) where they implicitly associated themselves with negative and positive words. The second implicit task (WSCT) involved completing a word stem not using a word they viewed during the first implicit task.

Covariates

After MANOVA’s were run, anxiety measures were entered as covariates in order to control for anxiety while looking at differences in implicit measures based on depression. However, it was likely that depression was removed from the analyses since the BDI-II was significantly positively correlated with the STAI-State ($r = .79, p < .001$) and STAI-Trait ($r = .91, p < .001$), and many of the items on these measures are similar. There were significant differences on anxiety measures between depressed and never depressed groups, $F(2,27) = 80.90, p = .001$. It is difficult to separate anxiety from depression, as they are often comorbid, especially in a severely and persistently mentally ill population like the depressed group recruited in this study. The results of the MANCOVA’s are only reported in the discussion section and are not considered primary analyses.
Depressed Versus Never Depressed Groups

**IAT**

A mixed-model MANOVA showed significant results within groups on the IAT, in that participants demonstrated a significant positive bias, making faster associations between self and positive descriptive stimuli than negative descriptive stimuli, indicating a stronger positive self-concept bias than a negative self-concept bias according to neural network theory. This finding was somewhat congruent with Gemar and colleagues’ (2001) study, in that their formerly and currently clinically depressed patients groups also showed a positive bias, albeit a smaller positive bias than the control group. There were no significant differences within groups after the anxiety covariates were entered $F(1,26) = 1.23$, $p = .28$, eta squared = .05. There were no significant differences in implicit self-concept between depressed and never depressed groups when comparing association of self with negative and positive descriptive stimuli. The mean differences between the depressed and never depressed groups were in the expected direction; however, the variance within groups on each dependent variable was high (see Table 2). There were no significant differences between groups after the anxiety covariates were entered, $F(1,26) = 1.26$, $p = .27$, eta squared = .05. It may be that depressed people do not have as strong a positive self-concept as never depressed people, but perhaps they have a tendency to defend against a negative self-concept.

**WSCT**

Contrary to expectations, there were no significant differences in implicit memory within and between depressed and never depressed groups. There were also no significant differences in implicit memory after the anxiety covariates were entered.
within groups, $F(1,26) = .22$, $p = .65$, eta squared = .008 and between groups, $F(1,26) = .22$, $p = .65$, eta squared = .05.

**Autonomy and Sociotropy Groups**

**IAT**

There were no significant differences in implicit self-concept within depressive personality groups on the IAT. In addition, there were no significant differences within groups after the covariates were entered, $F(2,46) = .81$, $p = .45$, eta squared = .05. There was a strong tendency for differences in implicit self-concept biases between groups based on depressive personality style. After the covariates were entered, significant differences were found between groups, $F(1,23) = 8.25$, $p = .009$, eta squared = .26. Those who were high on autonomy tended to have a smaller positive self-concept bias (but not a negative autonomy bias) than those depressed and low on autonomy and those never depressed. Depressed individuals who scored high on the personality trait autonomy on the PSI had a greater tendency to associate themselves with negative descriptive words that were associated with lack of independence and failure in goal achievement than individuals depressed and low on autonomy and those never depressed. These individuals may see themselves in a negative light, especially in attempts to maintain independence and succeed in accomplishing tasks. These results suggest a negative self-concept in depressed high autonomy individuals that was assessed without interference from social desirability, self-deception, subjectivity, and experimental demand that may occur when participants are aware of what is being assessed and respond either intentionally or unintentionally in a particular direction. These individuals may be prone to have the core belief revolving around “I am a failure” and may benefit
from cognitive therapy to change dysfunctional negative beliefs to more adaptive ones. It may be useful to use an implicit measure to assess changes in self-concept to circumvent the pitfalls of explicit self-report measures.

**WSCT**

There were significant differences in implicit memory within depressive personality groups. These within-group differences were not significant after the anxiety covariates were entered, \( F(2,46) = 2.36, p = .11 \), eta squared = .09. The means within groups were not in an expected direction. All groups demonstrated highest implicit memory of negative sociotropic words. Also, all groups except those in the depressed and low on autonomy group exhibited the second greatest implicit memory for negative autonomous words. The reasons for this are unclear. This may have resulted from participants failing to complete many of the baseline word stems (word stems that could not be completed by words previously viewed) with new word stimuli (stimuli that the participants did not see in the IAT) pertaining to autonomy and sociotropy; thus, the probability of completing a baseline word stem with new word stimuli was small.

Baseline was subtracted from the automaticity estimate to calculate automatic processes in the experiment. Although word stimuli were matched for frequency of use, it may have been easier for participants to think of general positive and negative words than words pertaining to autonomy and sociotropy. The differences in implicit memory between positive and general depressive words seemed minimal within all groups. There were no significant differences in implicit memory between groups based on level of autonomy and sociotropy. In addition, there were no significant differences between
groups after the anxiety covariates were entered based on autonomy, $F(1,23) = .38$, $p = .55$, eta squared = .02 and sociotropy, $F(1,23) = 1.3$, $p = .27$, eta squared = .05.

**Correlation Analyses**

There were several significant correlations between explicit measures and implicit measures within and between types of measures; however, given the number of correlations that were calculated (80), these p-values are “pseudo probabilities” because the results do not take into account the number of correlations tested. If these results were corrected with a Bonferroni adjustment (calculated by dividing the probability .05 by the number of correlations 80) to the probabilities, there would be fewer significant correlations. The following correlations were significant after the Bonferroni adjustment: (1) The BDI-II was significantly correlated with the PSI Autonomy and Sociotropy scales; (2) The PSI scales were correlated with each other; and (3) The implicit and explicit measures of autonomy on the WSCT were correlated. The other “significant” correlations in Table 6 should be interpreted with caution, as the Bonferroni corrections were not reported in the table. These correlations would have to be replicated before any conclusions could be drawn.

**Summary of Results and Implications**

This study contributes to the understanding of how implicit cognitive processes in depression compare and contrast with explicit cognitive processes. It is notable that all participants exhibited a self-concept positive bias, and there was not a significant difference in self-concept bias between depressed and never depressed participants. The depressed participants were receiving treatment at Valley Mental Health at the time of recruitment. It may be that receiving treatment for depression has ameliorated these
participants’ negative self-concepts. Future studies may investigate differences in implicit self-concept among depressed individuals who are on a wait-list for treatment and depressed individuals who have been receiving treatment for a specified amount of time. On the other hand, it may be that depressed individuals are in a constant volitional state of convincing themselves and others how “bad” they are while implicitly they have more positive beliefs about themselves. Perhaps instead of focusing on changing underlying negative beliefs about self, depressed individuals may benefit from focusing on strengthening the underlying positive beliefs about self that already exist. This could be facilitated by identification of underlying positive beliefs about self and focusing on individual strengths and accomplishments that may be explicitly denied or ignored. Perhaps depressed individuals need to calibrate their filters to ignore or allow minimal attention to explicit negative stimuli and attend to positive thoughts, behaviors, and feedback from others rather than focus on challenging negative beliefs. Future studies may explore this hypothesis, although it is not congruent with most theories of depression.

There was some degree of support in this study for greater implicit cognitive processing of self-relevant stimuli in depressed individuals (based on autonomy) even though the finding just approached significance. It is interesting that nearly significant differences were found among the autonomy groups but not among the sociotropy groups. The reason for this is unclear. The nature of the task may have contributed to these differences. The two tasks were goal-oriented and were completed alone (the researcher sat in the room but did not interact with the participant). This goal-oriented non-interpersonal experiment may have triggered implicit autonomy beliefs in those high
on autonomy. According Blatt and Shichman (1983), depressed individuals who are highly introjective (autonomous) will use unconscious strategies to maintain a sense of the self as separate, autonomous, and positively valued. It may be that the participant’s sense of introjection was challenged during these tasks. These results lend support for use of: 1) implicit assessment to facilitate case conceptualization; 2) identification of clinical targets based on implicit self-concept; and 3) monitoring progress of changing dysfunctional cognitive beliefs into more adaptive ones, without experiencing the “pitfalls” of explicit measures.

Depressed individuals were grouped based on one personality measure of sociotropy/autonomy. Some participants were high on both sociotropy and autonomy; therefore, it would be unlikely to find within-group differences in these participants based on this personality measure, since these two constructs were not independent of each other. An idiographic assessment involving a full battery of psychological testing would be a more precise and powerful method of separating depressed individuals into groups rather than defining them based on a single explicit measure of personality. Based on assessment results, the investigator would then be able to generate self-relevant stimuli. In addition to self-relevant stimuli, investigators may study implicit processes in depression that include beliefs about others and future.

The analyses that were not significant in this study tended to have small effect sizes. One way to increase power would be to increase sample size. According to Cohen (1988), a sample size of 88 would be required for the MANOVA with two groups and a sample of 130 would be required for the 3 x 3 MANOVA based on a small effect size of .1.
Study Challenges

The investigator encountered several challenges during the study that may have weakened construct validity. The investigator intended to select only those words that judges rated 4 or greater on a scale of 1 to 6 for each category of words; however, the investigator was not able to find enough word stimuli that would meet these requirements in addition to the selection criteria word length and frequency and original word stem. The greatest challenge was finding autonomy- and sociotropy-related word stimuli. This investigator recruited 10 judges who were mental health clinicians to rate each word stimulus on a Likert scale 1 – 6, with 1 being the word stimulus fits into the category (e.g. sociotropic) “not at all” and 6 “very well”. The average rating for each word stimulus was used as a selection criterion. Future studies investigating implicit cognitive processes may benefit from employing at least 50 – 100 judges to rate word stimuli and select only those stimuli that meet a minimum rating by all judges. It was proposed that never depressed participants were to be recruited from a general medical clinic. The investigator attempted to recruit participants at a general family medicine clinic; however, no patients agreed to participate, and after two months with no response, the investigator recruited never depressed employees from various Valley Mental Health sites to participate in the study. Therefore, one unintentional difference between the depressed and never depressed groups was that the depressed participants were seeking health treatment, while the never depressed participants may not have been seeking health treatment at the time of the study.
List of References


Vita

Jillian Garlipp was born on August 13, 1969 in Rochester, NY. She received her Bachelor of Arts degree in Spanish and International Trade at Clemson University in Clemson, SC in 1991. She received her Master of Arts degree in Clinical Psychology from MCP Hahnemann University in Philadelphia, PA in 2000. She completed her internship at Valley Mental Health in Salt Lake City, UT in 2003. She will receive her Doctor of Philosophy degree in Clinical Psychology from Drexel University in Philadelphia, PA in June 2004.