



Cognitive vulnerability to depression: A dual process model

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Abstract

Dual process models offer powerful accounts of cognitive phenomena in social and personality psychology but they have not been widely adapted to clinical phenomena. This review presents a dual process model of cognitive vulnerability to unipolar depression. According to dual process theories, humans possess two modes of information processing. An associative mode involves quick, effortless processing that rests on well-learned associations. A reflective mode involves slow, effortful processing that rests on symbolic rule-based inferences. Whereas the associative mode occurs automatically, the reflective mode operates when expectancies are violated and sufficient cognitive resources are available to respond. A cognitive vulnerability to depression is observed when negatively biased associative processing is uncorrected by reflective processing. The circumstances when this is likely to occur are reviewed. New insights and implications for assessment, etiology, and treatment of cognitive vulnerability to depression are discussed.

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Depression is a serious mental health problem, with significant consequences in terms of human suffering, lost productivity, and even loss of life (Wells & Sherbourne, 1999; Wulsin, Vaillant, & Wells, 1999). Current estimates suggest that 16% of the population will experience an episode of depression at some point in their lives (Kessler et al., 2003). Moreover, individuals who experience a major depressive episode are at increased risk for future episodes, with each episode significantly increasing risk for subsequent episodes (Mueller et al., 1999; Solomon et al., 1997). Given this substantial public health

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significance, significant research attention has been devoted to understanding underlying causes of depression.

Cognitive theories of depression vulnerability posit that cognitive factors are causal agents in the disorder (Ingram, Miranda, & Segal, 1998). Several cognitive theories of depression vulnerability have been proposed. Beck, Rush, Shaw, and Emery (1979) proposed a negative self-schema model which suggested that life stress activated underlying dysfunctional attitudes that in turn conferred vulnerability to depression. Building on work by Bower (1981), Ingram (1984) proposed an information processing model. This model suggested that activation of a depression–emotion node increased accessibility to negative cognition, which in turn served to maintain a depressed affective state. Teasdale (1988) has also offered a similar cognitive model of depression vulnerability.

These models were widely adopted in part because they used state-of-the-art cognitive theories to explain vulnerability to depression. For instance, Beck borrowed concepts from cognitive psychology, such as self-schema. Ingram (1984) incorporated spread of activation, emotion nodes, and cognitive capacity to support his information processing model. This article proposes to continue this evolution by incorporating state-of-the-art concepts from current cognitive theory. Specifically, this article proposes a dual process model of cognitive vulnerability to depression.

Dual process models offer powerful accounts for a range of phenomena in social and personality psychology. They have been used to understand why some arguments are more persuasive than others (Chaiken, 1980; Petty & Cacioppo, 1981), how attitudes are retrieved and constructed (Fazio, 1986), what influences person perception and use of stereotypes (Brewer, 1988; Gilbert, 1989), and how people regulate their mood states (Forgas & Ciarrochi, 2002), among others. Despite their widespread use in basic psychological research, such models are rarely used to explain clinical phenomena (for an example of a dual process model applied to a clinical condition, see Brewin, Dalgleish, & Joseph, 1996). This article examines how a dual process model may inform an understanding of cognitive vulnerability to depression.

This article starts by reviewing a generalist dual process model of information processing. This model draws heavily on work by Smith and DeCoster (1999, 2000), Sloman (1996), and Lieberman et al. (Lieberman, 2003; Lieberman, Gaunt, Gilbert, & Trope, 2002). Further, as dysphoric moods are an inherent part of depression, a dual process model of mood regulation articulated by Forgas (2000) is also reviewed. A dual process framework is then applied to cognitive vulnerability to depression. This article examines how such a model may explain findings from past research. In addition, it shows how a dual process model accounts for prior inconsistencies in the literature. Further, new avenues of research suggested by this dual process model are reviewed. Specifically, this model has important implications for how cognitive vulnerabilities develop, how they should be assessed, and how they can be altered. This model thus yields important new insights for understanding cognitive vulnerability to depression and points to several new directions for empirical research.

1. A generalist dual process model

Most dual process models of cognition have three major components. They account for how people process information in a quick, effortless manner, how information is processed when a person is able and motivated to engage in more extensive, effortful thought, and when each mode of processing is likely to be engaged. Each of these components will now be described in greater detail.

1.1. Associative processing mode

Associative processing (also known as automatic, implicit, nonconscious, and intuitive processing) is responsible for quick and effortless information processing. It is essentially a pattern completion mechanism (Smith & DeCoster, 1999). It completes patterns based on associations between the current stimulus and previously encoded stimuli. That is, information that has been previously associated with the salient features of the current stimulus are activated when that stimulus is encountered once again. Past experience thus facilitates processing of the current information. For instance, suppose a person has repeatedly associated owners of large cars with poor driving skills. Such a person may have an urge to quickly change lanes when encountering a Buick Roadmaster on an interstate highway.

Associative processing occurs at a preconscious level. We are generally only aware of its output and not the information used to produce the output. Smith and DeCoster (1999, 2000) suggest that these outputs can be experienced as intuitive and affective responses to stimuli. For instance, a person may see a clock and quickly know what time it is or see a romantic partner and feel love and affection. Similarly, a child that has been bitten by a dog several times may come to automatically fear the sight or sound of a dog, even around well-trained canines.

Smith and DeCoster (2000) suggest that the most general, overall similarity between the current stimulus and previously stored memory representations guides associative processing. It does not produce information based upon reason or underlying structure. As Sloman (1996) suggests, “associative thought uses temporal and similarity relations to draw inferences and make predictions that approximate those of a sophisticated statistician.” This property allows us to quickly fill in details that are missing or not observed. Therefore, our impression of a stimulus is a combination of what we perceive and what our past experiences tell us we should perceive.

Another important feature of associative processing is that it relies on associations in memory that have been formed with repeated experience (Smith & DeCoster, 2000). This is necessary in order for associative processing to be somewhat stable over time. If associations in memory dramatically changed with each new experience, associative processing would become much slower, less focused, and easily overwhelmed. Therefore, we gain stability by building knowledge slowly in a stepped fashion, so that the associative processing mode attends to similarities that have been observed repeatedly over time.

In summary, the associative processing mode is a quick, automatic mode of information processing. Retrieval of knowledge occurs at a preconscious level, so we are only aware of its output. Associative output can take the form of intuition (a thought that seems to “pop” into mind) or an affective response (e.g., a “gut” feeling). The associative mode functions as a pattern completion mechanism and uses the most general similarity with prior associations to guide retrieval. The memory network from which it retrieves information develops over a long period, which helps associative processing to maintain stability.

1.2. Reflective processing

Reflective processing (also known as rule-based, explicit, controlled, conscious, and rational processing) typically involves significantly more intention and awareness than associative processing. Reflective processing uses symbolically represented, rule-based knowledge to direct processing. These rules are typically intentionally accessed to guide processing. For example, a person may see a Buick

Roadmaster, but with effort, decide to obtain additional information, such as the speed the car is moving, if body damage indicates previous accidents, if the car is staying within its lane, before deciding whether to speed up and pass.

Reflective processing is relatively slow (Smith & DeCoster, 2000). It is slow in part because it operates sequentially rather than in parallel. That is, reflective processing follows a series of steps rather than performing multiple actions at once. Whereas associative processing can satisfy multiple constraints simultaneously, reflective processing completes one action at a time. Therefore, only one rule can be implemented to guide processing at a given time. Given these limitations, reflective processing is necessarily more effortful and takes more time than associative processing.

Rules that guide reflective processing may come from language, individuals, media, and other cultural sources. Further, individuals are capable of developing their own symbolic rules that result from conscious thought (Smith & DeCoster, 2000). Based on past experiences, for example, a person could consciously derive a rule to explain a particular phenomenon. That rule could then be unique to that particular individual.

Importantly, reflective processing can use rules gleaned from a single experience. This process of learning, however, is dependent on attention and strategic allocation of resources (Smith & DeCoster, 2000). A person must consciously try to learn the rule in order to use it in the future. This is in contrast to the associative system, where learning is more automatic and less dependent on attention but requires repeated experiences. This feature of reflective processing allows us to respond to our environment in a flexible manner. If one has a positive associative response to seafood but learns that a recent catch has spoiled, reflective processing allows us to choose turf rather than surf.

In summary, reflective processing is a slow, effortful mode of information processing. Retrieval of knowledge occurs at a conscious level, and we are often aware of the intervening steps necessary to arrive at a particular answer. Reflective processing typically follows symbolic rules that are either socially transmitted or derived by an individual. Rules can be learned after one trial, so repeated exposure to the rule is not necessary.

1.3. Associative and reflective processing: when is each likely to be used?

Given these two modes of processing, an important question to answer is under which conditions each is likely to be used. This is a controversial topic, as there is some disagreement about whether these modes operate simultaneously or in sequence (i.e., associative followed by reflective). Despite these differences, all dual process models suggest that associative processing operates relatively automatically, requiring very little cognitive effort or attention to structure conscious experience. In contrast, reflective processing operates optionally, is more powerful (because of its use of symbolic rules), but requires more attention and cognitive effort.

Most dual process models agree that associative processing is the default mode. A person automatically makes countless automatic judgments and decisions throughout a day. Reflective processing occurs when an individual has ample cognitive resources to engage in this type of processing and is motivated to do so. For instance, when a supervisor calls for an unplanned meeting, associative processing might produce thoughts of being fired and a feeling of dread in the subordinate. If the employee is motivated and has the cognitive resources to further examine his boss' request, he might systematically review his past performance. After doing so, he might come to realize that his past evaluations were positive and he might feel some relief.

Lieberman (2003) and Lieberman et al. (2002) suggest that reflective processing is particularly likely to be engaged when our expectations are violated. That is, associative processing is dominant until an unexpected stimulus is encountered or the results of associative processing are not helpful in a given situation. Lieberman (2003) demonstrates this principle with a straightforward example: when we encounter a doorknob, we have a set of expectations about how it should function and behave. When we turn it, we expect a door to open. When this happens, we focus on other thoughts and do not think about the doorknob itself. However, if the doorknob does not turn, this violates our expectancy for how a doorknob should operate. We then begin a reflective process where we may systematically examine whether the door is locked, if using a key will open the door, who we can call for rescue, and so on. In such a situation, reflective processing is engaged only when our expectation about how the doorknob should function is violated.

Even when expectations are violated, there are times when engaging in reflective processing may not be possible. Reflective processing is an effortful process. If cognitive resources are limited, reflective processing may be disrupted or unable to be initiated. Cognitive resources can be limited by competing demands, distraction, time pressure, and other such impositions. Under such circumstances, output from associative processing will dominate consciousness. For instance, some people believe that they are not prejudiced, even though societal messages may have associated particular ethnic groups with danger. Under conditions where reflective processing is disrupted or not dominant, such a person may appear prejudiced against a member of that group. However, when reflective processing is active or dominant, prejudice may not be observed (e.g., Fazio, Jackson, Dunton, & Williams, 1995).

To summarize, associative processing is the default mode of information processing. It occurs automatically with little or no effort. Output from this mode of processing can be adjusted by reflective processing. Reflective processing typically occurs when expectancies for a given situation are violated. However, reflective processing requires ample cognitive resources and thus cannot be easily engaged in cognitively demanding situations. When output from associative processing is consistent with expectations, reflective processing is typically not engaged. Under such conditions, there is little perceived need to adjust one's thinking.

1.4. Dual processes and mood regulation

The interplay between associative and reflective processing is also thought to be important for the regulation of mood states. Given the importance of mood states for unipolar depression, this article briefly reviews a dual process model of mood regulation. Forgas and colleagues (Forgas, 2000; Forgas, Ciarrochi, & Moylan, 2000) suggest that associative processing (referred to as substantive processing in their work) is used to maintain mood whereas reflective processing (referred to as motivated processing) is used to change mood. They speculate that associative processing maintains current mood states by retrieving mood congruent information. However, when a certain affect intensity or duration is reached, this triggers a shift from associative processing to reflective processing. Reflective processing then retrieves mood incongruent information in order to alter and repair current mood state.

Although this model is somewhat new, there is some empirical evidence to support such reasoning. For instance, Forgas and Ciarrochi (2002) investigated spontaneous changes over time in cognitive strategies people used to regulate transient moods. Across three studies, participants first completed a mood induction procedure (i.e., sad, happy, neutral). Then, they completed a series of serial social tasks where they had to describe others, themselves, or generate trait words given the first letter of a word

(e.g., $t_{\text{_____}}$). Consistent with their dual process model, responses to these tasks were initially mood congruent. However, as time elapsed, responses became mood incongruent. The authors interpreted these findings as evidence that associative processing was initially used, but reflective processing was later engaged in order to return mood to baseline.

Other research is also consistent with this view. For instance, Sedikides (1994) induced individuals into dysphoric, happy, or neutral moods. Participants then wrote self-descriptive essays. As expected by a dual process view, the early portions of the essays were mood congruent. However, the latter portions were mood incongruent. It may be that in an effort to regulate mood, individuals recalled mood incongruent information during the latter parts of the writing period. It thus appears that mood persistence can trigger reflective processing, perhaps by violating expectancies about how long certain moods should last, which is then used to return moods to baseline.

2. A dual process model of cognitive vulnerability to depression

Now that a general dual process model has been described, this article will examine how this model can inform cognitive vulnerability to depression. It will first describe a dual process model of cognitive vulnerability to depression. Existing cognitive vulnerability research will be reviewed and its fit with a dual process perspective will be reviewed. Keep in mind that most of this research was not conducted within a dual process framework. Therefore, much of this review will involve reinterpreting past research and suggesting how a dual process model may explain past findings. This article concludes by reviewing new insights and research directions suggested by a dual process framework.

From a dual process perspective, a cognitive vulnerability to depression involves the interplay between associative and reflective processing. This article proposes that negatively biased self-referent associative processing provides the foundation for a cognitive vulnerability to depression. That is, a person whose pattern completion mechanism is negatively biased when processing information about the self may be particularly susceptible to depression. For instance, when confronted with a new situation, a vulnerable person's first thought might be that he will fail at a newly learned task or he should avoid a new acquaintance. Just as an expert chess player's first instinctual move is strongly associated with skill level (Burns, 2004), a person's first thought may reveal a vulnerability to depression.

Although negatively biased self-referent associative processing provides a foundation for a cognitive vulnerability to depression, corrective reflective processing can overcome this bias. However, there are at least three instances when associative processing is not likely to be corrected: 1) biased associative processing violates expectancies but cognitive resources are not available to engage reflective processing; 2) biased associative processing does not violate expectancies and a need for reflective processing is not realized; and 3) biased associative processing violates expectancies but reflective processing does not adequately adjust negatively biased associative processing. Under each of these conditions, associative processing may not be adequately corrected, thus revealing a cognitive vulnerability to depression. Evidence for each of these instances is reviewed in a later section of this article.

If negatively biased self-referent associative processing goes uncorrected, this can be the starting point of a downward spiral into more severe forms of dysphoria (see Fig. 1). That is, negatively biased

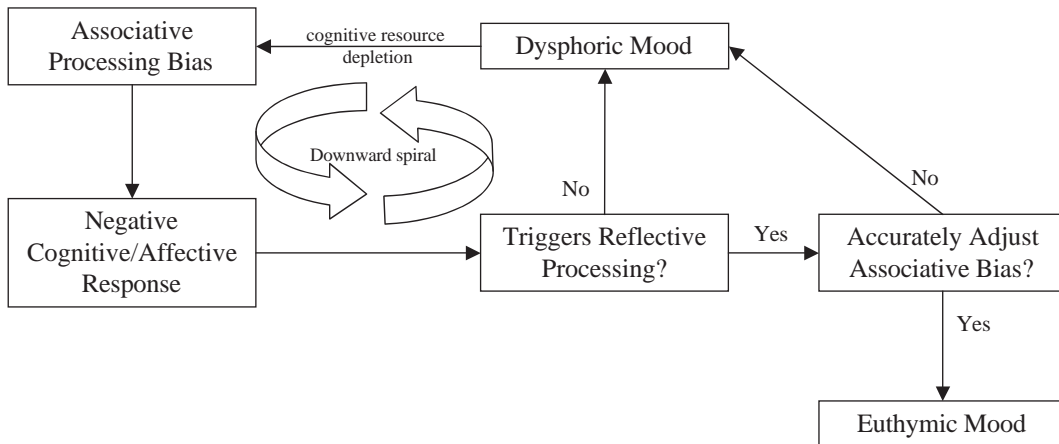


Fig. 1. A dual process model of cognitive vulnerability to depression.

associative processing results in the retrieval of negative cognition, which is likely accompanied by a negative affective response (Smith & DeCoster, 1999). If this output is corrected by reflective processing, a person experiences a fleeting negative thought and a brief moment of dysphoria.

If associative processing goes uncorrected, it will likely influence the pattern completion mechanism of subsequent associative processing. This too will likely be accompanied by dysphoria. As suggested by Forgas et al. (Forgas, 2000; Forgas et al., 2000), reflective processing is needed to mitigate negatively biased associative processing and repair a dysphoric mood. In the absence of such repair, negatively biased associative processing will maintain a dysphoric mood state. Further, reflective processing that unsuccessfully repairs mood (e.g., a person focuses on mood congruent information) can also reinforce a dysphoric mood state.

As dysphoria escalates, it may ironically contribute to the depletion of cognitive resources needed to engage reflective processing. Dysphoric moods automatically bring to mind many task irrelevant and intrusive thoughts. Attending to these thoughts requires cognitive resources that could otherwise be used to engage in reflective processing. Wegner et al. (1993) has speculated that dysphoria can perpetuate a self-loading system, such that as negative mood increases, cognitive resources needed to combat dysphoria are depleted, further contributing to mood escalation. Indeed, there is empirical evidence to suggest that intrusive thoughts stemming from a negative mood deplete cognitive resources and impair performance on cognitively demanding tasks (Ellis, Moore, Varner, & Ottaway, 1997; Ellis, Ottaway, Varner, Becker, & Moore, 1997).

A feedback loop between negative self-referent cognition and dysphoria can then develop, where their mutual entrainment perpetuates a dysphoric mood state. Over time, this feedback loop may make it difficult for a person to disengage from negative thinking. Teasdale (1988) refers to a similar process as “cognitive interlock.” This cognitive interlock, in turn, contributes to more intense and persistent dysphoria. Increases in dysphoria, in turn, further reduce cognitive resources and diminish an ability to engage reflective processing. However, if this negatively biased associative processing can be corrected by reflective processing (e.g., retrieval of mood incongruent information), salutary mood effects may occur and a downward spiral into more severe forms of dysphoria may be averted.

As a concrete example, imagine a person who has experienced multiple failures. With each experience, this person associated failure with his own ineptness. In addition, each time a failure

occurred, it was accompanied by a dysphoric mood state. After repeated experiences, perceptions of failure automatically elicit dysphoria. Similarly, when a dysphoric mood occurs, themes of ineptness and self-deprecation are automatically called to mind. This person readily perceives failure in ambiguous situations, as his pattern completion mechanism is biased towards interpreting events as signs that he has failed. This automatic activation of self-ineptness can be overcome if reflective processing is engaged to appropriately adjust this negative self-referent thinking. However, in the absence of such a process, the mutual entrainment between negative self-referent thinking and dysphoria can further deplete cognitive resources, potentially culminating in a downward spiral into more severe forms of distress.

This dual process model thus emphasizes negatively biased self-referent associative processing and the inability of reflective processing to correct such biases. This article will now review evidence that supports such a model. It will first review empirical support for the idea that depression vulnerability is associated with biased self-referent information processing. Next, it reviews research demonstrating that information processing biases are most likely to be observed under conditions when associative processing is uncorrected. It then examines evidence to suggest that depression vulnerability is associated with difficulty regulating transient negative mood states. Comparisons to previous cognitive models of depression vulnerability are then made, emphasizing similarities and differences. It concludes with new insights suggested by this dual process model and finishes with suggestions for future research in this area.

2.1. Importance of negatively biased self-referent information processing

There is significant theoretical and empirical evidence documenting that how a person thinks about the self confers depression vulnerability. Several theories of depression have emphasized the importance of self-referent cognition. Borrowing concepts from cognitive psychology and social cognition, [Beck et al. \(1979\)](#) was among the first to introduce the idea of self-schema for understanding depression vulnerability. Self-schema is an organized representation of an individual's prior experiences ([Ingram et al., 1998](#)). Beck suggested that depression vulnerability was conferred when self-schemas contained themes of loss and worthlessness.

Other current models of depression vulnerability also emphasize the role of self-referent information for depression vulnerability. The reformulated hopelessness theory ([Abramson, Metalsky, & Alloy, 1989](#)) suggests attributions about the self are an important contributor to a hopelessness subtype of depression. [Ingram et al. \(1998\)](#) propose that strong associations between negatively biased self-schemas and negative affect confer vulnerability to depression. Similarly, [Teasdale \(1988\)](#) also stresses the importance of negative self-referent information in sustaining depressed moods. Further, non-cognitive theories implicate the role of the self in depression vulnerability. For instance, psychodynamic theories emphasize the importance of early life experiences that impair development of an adaptive sense of self ([Blatt, 1995](#)). Thus, negative self-referent information appears to have an important role in conferring depression vulnerability across several influential theories.

Following from this theoretical emphasis on the role of the self in depression, empirical work has also explored the importance of negatively biased self-referent information for conferring depression. In general, there is support for the importance of self-referent information (for a comprehensive review, see [Segal, 1988](#)). For instance, using an innovative psychological distance scaling task, [Dozois and Dobson \(2001a\)](#) found that depressed individuals endorsed stronger associations between negative adjective descriptors and the self than nondepressed and psychiatric controls. Individuals with a recurrent history

of depression had stronger associations between the self and negative adjective descriptors than depressed people with less severe depression histories (Dozois & Dobson, 2003). Further, remitted depressed people maintained these associations beyond symptomatic remission of depression (Dozois & Dobson, 2001b).

Other work has found self-referent information to be associated with depression vulnerability, particularly when transient dysphoric moods are first induced (see below for a dual process perspective on why mood priming might facilitate associative processing). Dysfunctional attitudes about the self, particularly around themes of affiliation and perfectionism, have been linked to depression vulnerability. Segal et al. reported that remitted depressed people who reported higher levels of dysfunctional attitudes when induced into a transient negative mood state were more likely to relapse during follow-up than individuals with lower levels of dysfunctional thinking (Segal, Gemar, & Williams, 1999). Remitted depressed people reported greater incidental recall of negative self-descriptive adjectives than never depressed people, but only when first induced into a negative mood (Teasdale & Dent, 1987). Similarly, remitted depressed individuals are more likely to endorse negative self-beliefs (Miranda, Gross, Persons, & Hahn, 1998; Miranda & Persons, 1988; Miranda, Persons, & Byers, 1990; Roberts & Kassel, 1996) and display information processing biases for negative information (Ingram & Ritter, 2000) in the presence of mild transient moods than never depressed individuals.

This body of work suggests that negative self-referent information may have a particularly important role for conferring vulnerability to depression. People who have associated negative themes such as loss, worthlessness, and defectiveness with the self may be particularly at risk for depression. However, as suggested by a dual process model, such cognitive vulnerabilities may be observed only under certain conditions. This article now reviews conditions when cognitive vulnerabilities to depression are most likely to be revealed.

2.2. Circumstances when associative processing is uncorrected

According to this dual process account, negatively biased associative processing about the self confers vulnerability to depression. However, such biases can be corrected by reflective processing. A cognitive vulnerability is thus likely to be revealed when reflective processing does not correct associative processing. There are at least three situations when this is likely to occur: 1) when cognitive resources are depleted, 2) when negatively biased associative processing does not violate expectancies, and 3) when reflective processing does not adequately adjust biased associative processing. This article now reviews depression-related research that examines these circumstances when negatively biased associative processing goes uncorrected by reflective processing.

2.2.1. Cognitive resources are depleted

From a dual process perspective, negatively biased associative processing is likely to be observed when a cognitive load disrupts reflective processing. For vulnerable people, associative processing may quickly bring to mind negative information about the self when activated by environmental cues. For instance, a potential job loss may automatically activate thoughts of poverty, homelessness, and a negative mood. Reflective processing may override this response when motivation and resources are available; however, when resources are constrained or motivation is reduced, reflective processing is not possible and negative cognition and mood remain dominant. A vulnerable person may thus not appear to

be vulnerable when cognitive resources are available, but may appear vulnerable if cognitive resources are depleted.

Several studies have been completed that support this view. For instance, [Wenzlaff and Bates \(1998\)](#) reported that in the absence of a cognitive load, people recently remitted from depression did not differ from never depressed individuals in the number of negative sentences formed when presented with a scrambled sentence that had either a negative or positive solution. However, when participants were also required to remember a six-digit number, remitted depressed people unscrambled significantly more negative sentences than never depressed people. In fact, this bias among remitted depressed people equaled the bias observed among currently depressed individuals. Further, the tendency to unscramble negative sentences was associated with the dispositional tendency to suppress negative thoughts (for similar results with a different task, see [Wenzlaff, Rude, Taylor, Stults, & Sweatt, 2001](#)).

[Wenzlaff and Eisenberg \(2001\)](#) found that a similar negative bias was revealed under conditions of time pressure. Specifically, remitted dysphoric, chronically dysphoric, and nondysphoric individuals listened to a series of homophones. Some of the homophones had a negative interpretation (e.g., weak vs. week). After each word was presented, participants wrote down each word. Participants wrote the words either immediately or after ten seconds. Interestingly, in the ten-second condition, remitted dysphoric and nondysphoric individuals did not differ in the number of negatively biased homophones. However, in the immediate condition, remitted dysphoric individuals identified significantly more negative words than never dysphoric. Indeed, number of negative words was similar to that of the dysphoric individuals.

Prospective tests among depression vulnerable college students have also been completed. [Rude et al. \(Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002\)](#) administered the previously described scrambled sentence task in the presence or absence of a cognitive load. Symptoms of depression were then reassessed 4–6 weeks later. Interestingly, responses on the scrambled sentence task assessed when a cognitive load was imposed significantly predicted subsequent increases in depression. Thus, depleting cognitive resources revealed a cognitive vulnerability to depression that predicted future symptoms.

Stressful life events can also deplete cognitive resources. This may occur because life stress increases the number of task irrelevant thoughts that a person experiences. A person must then draw upon a limited supply of cognitive resources to manage intrusive thoughts about stressful life events, thus reducing resources available for the effortful task of correcting an associative bias. Across a series of studies, [Klein and Boals \(2001\)](#) documented that participants with greater life stress performed more poorly on a working memory task. Further, intrusive thoughts about stressful events and the recency of the life stress both predicted a diminished working memory capacity. Interestingly, life stress does not appear to disrupt associative processing. In a different study, although life stress disrupted an effortful sentence completion task, implicit memory was not affected by life stress ([Yee, Edmondson, Santoro, Begg, & Hunter, 1996](#)). Thus, life stress appears to deplete cognitive resources necessary for correcting biased associative processing, but it does not appear to disrupt associative processing.

This suggests that depression vulnerability may be observed when life stress disrupts attempts to correct associative biases. There is some evidence to support this hypothesis. [Beevers and Meyer \(2004\)](#) measured depressive symptoms and dispositional use of thought suppression. The effortful intention to suppress negative thoughts, which may guide reflective processing, should work effectively as long as cognitive resources are available to engage in thought suppression. As cognitive resources become depleted by life stress, attempts to suppress negative thoughts should become less effective and a negative bias may be revealed. This, in turn, should then lead to increases in depressive symptoms. This

position was consistent with the pattern of observed results. Thought suppression in the absence of life stress actually led to a slight decrease in depressive symptoms. High levels of thought suppression in the presence of life stress, however, were associated with increased depressive symptoms. Unfortunately, the putative mediator, negatively biased self-referent processing, was not assessed in that study.

Wenzlaff and Luxton (2003) used a similar design to examine the effects of life stress on depression. Individuals high and low in dispositional thought suppression who also had low levels of depression were identified. Approximately 10 weeks later, intervening life stress, depressive symptoms, and rumination tendencies were assessed. Consistent with Beevers and Meyer (2004), individuals with high levels of thought suppression were particularly likely to report higher levels of depression if they also experienced life stress. Further, these individuals were also likely to report higher levels of rumination. It appears that when reflective processing is impaired by life stress, individuals trying to suppress a cognitive bias are unable to do so. This results in increased negative thinking (i.e. rumination) and a concurrent increase in depressed mood.

These findings are consistent with the proposed dual process model. To summarize, in the absence of a cognitive load, depression vulnerable individuals are able to use reflective processing to adjust their initially biased interpretation of ambiguous stimuli. However, when cognitive resources are depleted by time pressure, a competing task (such as remembering a six-digit number), or life stress, reflective processing cannot be invoked. As a result, depression vulnerable individuals are unable to adjust their negatively biased associative processing and a cognitive vulnerability is revealed.

2.3. *Expectancies are not violated*

The second way in which biased associative processing may not be corrected occurs when expectancies are not violated. Reflective processing is most likely to occur when results of associative processing are incongruent with a person's expectancy (e.g., recall the broken doorknob example). However, if expectancies are not violated, negatively biased associative processing remains uncorrected. Such uncorrected associative bias could then become a starting point for a downward spiral into more severe forms of distress.

This idea has not yet explicitly been tested among individuals vulnerable to depression. However, there is some evidence suggesting that negatively biased information is less likely to engage reflective processing in depressed and mildly depressed people compared to nondepressed people. Sheppard and Teasdale (2000) presented a series of statements, taken from the Dysfunctional Attitudes Scale (DAS), to nondepressed and depressed individuals. Participants' task was to either agree or disagree with each statement. Latency to a decision was recorded for functional and dysfunctional statements. Response times for nondepressed individuals were significantly slower for incongruent responses (e.g., agreeing with a dysfunctional statement) than for congruent responses (e.g., disagreeing with a dysfunctional statement). Depressed individuals, in contrast, showed no relative slowing for incongruent or congruent responses. That is, for depressed individuals, a mismatch (e.g., an agreement to a dysfunctional statement) failed to violate expectancies. Thus, reflective processing was not engaged to "double-check" their response and slowing of response times was not observed.

Similarly, Teasdale et al. (2002) suggested that depression vulnerability is associated with poor metacognitive awareness. The authors defined metacognitive awareness as the ability to relate more functionally to their depressive symptoms. For instance, depressed individuals may learn that self-referent negative thoughts are events that occur in the mind and therefore are not necessarily a true

reflection of reality. In dual process terms, metacognitive awareness occurs when negative self-referent thoughts violate expectancies and engage reflective processing that reminds the individual that such thoughts are not necessarily statements of truth.

Across a series of studies, [Teasdale et al. \(2002\)](#) found that people with residual symptoms of depression had less metacognitive awareness than nondepressed people. Among residually depressed individuals, lower levels of metacognitive awareness at the end of a preventative cognitive behavioral treatment was associated with faster time to depressive relapse. Further, among residually depressed individuals who did not relapse, treatment increased metacognitive awareness. Similarly, among residually depressed individuals, mindfulness-based cognitive therapy reduced depressive relapse to the extent that it increased metacognitive awareness.

Dichotomous thinking, the tendency to endorse absolutistic forms of thinking, may also result from uncorrected associative processing. [Teasdale et al. \(2001\)](#) write that “extreme responses (‘totally agree’ or ‘totally disagree’) to depression-related items are the ‘tip of the iceberg’ reflecting underlying activity of mood-dependent, developmentally early, depressogenic schematic processing, uncorrected by subsequent reappraisal” (p. 354). Therefore, dichotomous thinking reflects uncorrected dysfunctional thinking, whereas less extreme thinking (e.g., agree very much) may be corrected by secondary reappraisal. In dual process terms, among less vulnerable individuals, extreme thinking may trigger reflective processing designed to moderate the results of associative processing. Among vulnerable individuals, reflective processing may not be invoked.

There is some evidence to suggest that depression vulnerability is associated with higher levels of extreme thinking (or less reflective processing). [Beevers, Keitner, Ryan, and Miller \(2003\)](#) tested whether poor change in dichotomous thinking during treatment for major depression predicted the return of symptoms among people who had significantly improved at the end of treatment. As expected, the authors found that people with poor change in dichotomous thinking during treatment experienced the return of significant symptoms more quickly during a yearlong follow-up period. This finding remained intact even after controlling for severity of depression at the end of treatment and previous number of depressive episodes. These findings are consistent with those reported by [Teasdale et al. \(2001\)](#) for residually depressed individuals.

To summarize, there is support for the idea that biased associative processing does not trigger reflective processing among depressed individuals. Depressed people respond to functional and dysfunctional statements similarly, whereas nondepressed individuals appear to take a more reflective stance when expectancies are violated (e.g., agreeing with a dysfunctional statement). Mildly depressed individuals who do not correct extreme forms of thinking, which presumably requires reflective processing, are at greater risk to experience future depression. Similarly, people who are less likely to engage in reflective processing (indicated by low metacognitive awareness) are at greater risk for an episode of major depression. These findings are consistent with a dual process model.

2.3.1. Reflective processing does not adequately adjust biased associative processing

The third situation in which a cognitive vulnerability is revealed occurs when biased associative processing appropriately triggers reflective processing, but rules used to guide reflective processing do not adequately adjust output from associative processing. This is an instance where rules used to guide reflective processing may help to maintain a cognitive vulnerability rather than correct for one. As noted above, few research studies have used a dual process model to examine cognitive vulnerabilities to depression, so this question has not been directly examined. However, several studies suggest that

depression vulnerable individuals use rules to guide reflective processing that may be ineffective for correcting biased associative processing.

Rumination is arguably the most well researched reflective processing strategy associated with depression vulnerability. Rumination is often defined as turning one's attention towards symptoms of depression and the causes and consequences of those symptoms (Nolen-Hoeksema, 1991). Although not explicitly stated within the rumination model, it is possible that negatively biased associative processing triggers ruminative processing. In the case of rumination, a potential rule guiding reflective processing is to complete a thorough search for the causes and consequences of those symptoms. Unfortunately, this rule may only maintain or amplify an associative bias rather than correct it.

Although ruminative thinking may be engaged with the goal of increasing an understanding of why these negative thoughts and symptoms occur (Watkins & Baracaia, 2001), it can increase the likelihood that transient negative mood states become full blown depressive episodes. Several studies support the idea that rumination increases depression severity and prolongs a depressive episode (Nolen Hoeksema, McBride, & Larson, 1997; Nolen Hoeksema & Morrow, 1991, 1993; Nolen Hoeksema, Parker, & Larson, 1994). Further, several other studies suggest that a ruminative response style predicts new onsets of depressive episodes among nondepressed people, even after controlling for baseline symptoms (Just & Alloy, 1997; Nolen-Hoeksema, 2000; Spasojevic & Alloy, 2001).

Consistent with a dual process model, it appears that depressed and dysphoric individuals often endorse positive beliefs about their rumination (Papageorgiou & Wells, 2003). For instance, depressed people often endorsed the belief that "I need to ruminate about my problems to find answers to my depression" compared to nondepressed adults (Papageorgiou & Wells, 2001). This is an example of how a rule used to guide reflective processing (e.g., rumination will be helpful) may not adequately correct biased associative processing. In such a case, a depression vulnerable person who believes rumination will have positive effects may not recognize a need to adjust his or her negative ruminative thinking.

Watkins and Mason (2002) have examined the impact of manipulating conscious rules used to guide ruminative thinking. Participants were asked to provide reasons for current or past dysphoric moods. People were randomly assigned to give as many reasons as they can, to give reasons as long as they felt like continuing, or were given no stopping rule instructions. Interestingly, among those high in dispositional rumination, people in the give as many explanations as possible condition gave an equal amount of reasons as people with no stopping instructions. High ruminators in the feel like continuing condition and all three conditions for the low ruminators reported significantly fewer reasons for their dysphoric moods. It appears that ruminators ruminate in part because they use an explicit rule that encourages searching for as many reasons as possible to explain their current state. This research also suggests that altering the rules by which reflective processing operates can mitigate rumination.

Other cognitive styles, which likely involve reflective processing, have also been associated with depression vulnerability. For instance, hopelessness theory (Abramson et al., 1989) suggests that people who characteristically attribute negative life events to stable and global causes, expect negative consequences to follow from a current negative event, and believe that negative events indicate they are deficient or unworthy, are thought to be at risk for depression. Although this attributional style could result from an associative bias, this cognitive style is typically assessed with a self-report, which likely measures reflective processing. People with this attributional style have been shown to be at greater risk for depression onset than those without such a style (Alloy & Abramson, 1999; Alloy et al., 2000). Further, one study suggests that people with a negative attributional style are more likely to ruminate,

which in turn mediates the relationship between attributional style and depression vulnerability (Spasojevic & Alloy, 2001).

In summary, research supports the idea that certain rules used to guide reflective processing may not adequately adjust negatively biased associative processing. This article briefly reviewed two different examples. The tendency to ruminate and a negative attributional style may both not adequately adjust associative processing. As a result, associative processing may be maintained or amplified, potentially increasing a person's risk for depression.

2.4. Mood consequences of uncorrected associative processing

Consistent with Forgas et al. (Forgas, 2000; Forgas et al., 2000), once biased associative processing is not adequately corrected by reflective processing, this could initiate a feedback loop between negative cognition and dysphoria that leads to increasingly severe and persistent forms of dysphoria (see Fig. 1). As a result of this feedback loop, people at risk for depression may experience more prolonged periods of dysphoria following stressful events.

Surprisingly few studies have examined whether people at risk for depression experience more persistent mood states. One of the first studies to examine this idea was completed by Gilboa and Gotlib (1997). In their study, remitted depressed and never depressed participants reported their mood, completed an autobiographical recall task designed to induce a negative mood, and then completed a five-minute filler task. Peak negative mood was recorded immediately following the mood induction and delayed mood was reported after the filler task. Remitted depressed and never depressed people did not differ in their peak moods, but delayed mood was more negative among remitted depressed people than never depressed people, even after controlling for baseline mood ratings, peak mood ratings, BDI scores, and intensity of experiences recalled during the mood induction.

Beevers and Carver (2003) provide further support for the idea that depression vulnerability is associated with difficulty managing mood states. In their study, nondepressed college students were induced into a dysphoric mood. Self-reported mood was then measured repeatedly over the course of the laboratory session. The rate at which mood returned to baseline was assessed. Individuals were then brought back to the laboratory 7 weeks later and intervening life stress and current depression were assessed. Interestingly, mood persistence following the dysphoric mood induction predicted higher levels of depression at follow-up for those individuals who also experienced intervening life stress. Individuals who experienced greater difficulty regulating their moods in the laboratory were subsequently at higher risk for increased depression following stressful life events.

This evidence, although sparse, supports the idea that depression vulnerability is associated with difficulty regulating negative mood states. This difficulty may represent the starting point for an increased vulnerability to more persistent forms of distress. Additional research is needed to determine why moods are more persistent for people who are vulnerable to depression. A dual process model may be particularly helpful in elucidating the answer to this question. More specifically, biased associative processing uncorrected by reflective processing may contribute to the persistence of dysphoric moods.

2.5. Similarities and differences with other cognitive vulnerability models

This dual process perspective is consistent with other models of cognitive vulnerability. In fact, several cognitive models of depression vulnerability are implicitly dual process models. For instance,

negatively biased associative processing is consistent with what Beck refers to as a negatively biased self-schema (Beck et al., 1979). According to Beck, a negative self-schema is thought to produce negatively biased, automatic thoughts that are triggered by internal and external stimuli. This is consistent with the pattern completion mechanism attributed to associative processing in a dual process model. Further, Beck suggests that responding to these automatic thoughts in a logical, rationale, and contemplative manner, may be a particularly effective method for coping with such thoughts. Indeed, rational responding to automatic thoughts is an integral part of cognitive therapy. This too is consistent with the use of reflective processing to adjust thoughts automatically produced by associative processing.

This dual process model is also consistent with information processing models of depression vulnerability (Ingram, 1984; Teasdale & Barnard, 1993). In general, these models focus on cognitive processes that guide the selection, transformation, encoding, storage, retrieval, and generation of information. These models suggest that negative cognitive biases are essential elements of depression. Cognitive symptoms of depression reflect a spread of activation among associative pathways within depressive cognitive networks, and can result in unwanted and distressing thoughts about personal inadequacy or themes of loss.

Information processing models also suggest a role for more effortful cognitive processing. For instance, Ingram, Fidaleo, Friedberg, Shenk, and Bernet (1995) suggest that nondepressed individuals, with great cognitive effort, may attempt to avoid processing depression-relevant information whereas currently depressed individuals may consciously focus on this same information. As reviewed in earlier sections, these differences in effortful information processing may increase vulnerability to depression. Indeed, in an account that incorporates a dual process model, Teasdale et al. (2001) suggest that failing to use effortful processing to adjust quick, automatic, and developmentally premature processing may be closely associated with depression vulnerability.

Although there are similarities between prior cognitive models and this dual process model, this model has several unique aspects as well. Specifically, a dual process model emphasizes the interplay between two cognitive processes: associative and reflective processing. Emphasizing two cognitive processes may provide a more parsimonious explanation of cognitive vulnerability to depression than other more complex models (Teasdale & Barnard, 1993). Such parsimony may facilitate empirical tests of this dual process model.

This dual process model also highlights three specific and testable instances when a cognitive vulnerability is most likely to be observed (i.e., when cognitive resources are depleted, when negatively biased associative processing does not violate expectancies, and when reflective processing does not adequately adjust biased associative processing). Further, this dual process model suggests that in the absence of these conditions, a cognitive vulnerability is unlikely to be seen. This conceptualization has important implications for the measurement of cognitive vulnerability, which is discussed in greater detail below.

This model also incorporates the reciprocal associations between associative processing, reflective processing, and dysphoric moods. This has implications for how to disrupt these vicious self-perpetuating cycles (e.g., correcting associative bias with reflective processing). This model thus integrates several cognitive phenomena (e.g., self-referent information processing, rumination, mood regulation) into one model.

Further, a significant strength of this model is its explicit link with basic dual process research in social and personality psychology, thus providing a sizeable foundation on which to rest this

cognitive model. This foundation in basic research is important, as understanding how cognitive processes operate in normal mood states can foster a better understanding of how they can go awry in clinical depression.

In addition to these benefits, a dual process model suggests several new and important insights about the nature of cognitive vulnerability to depression. Specifically, a dual process model may account for previous discrepancies in the cognitive vulnerability literature, suggest mechanisms for the development of associative biases, and identify how cognitive vulnerabilities may be altered. This article now reviews these important issues.

2.6. New insights derived from a dual process perspective

2.6.1. Different modes of processing can account for discrepancies in the literature

A dual process model may account for previous failures to find cognitive predictors of depression vulnerability. Previous work did not take into account that information processing may involve both associative and reflective processing. As a result, these studies did not deplete, via a cognitive load or other such procedures, cognitive resources required for reflective processing. This is unfortunate, as associative processing may be closely associated with a cognitive vulnerability to depression. Unless reflective processing is disrupted, such a cognitive vulnerability may not be revealed.

The majority of early work on cognitive vulnerability to depression examined whether formerly depressed and nondepressed individuals differed on self-reported measures of negative cognition. In general, this early work found that negative cognition (e.g., dysfunctional attitudes) endorsed by remitted depressed people no longer differed from (e.g., Dobson & Shaw, 1987; Dohr, Rush, & Bernstein, 1989; e.g., Hamilton & Abramson, 1983; Lewinsohn, Steinmetz, Larson, & Franklin, 1981) or were slightly higher than nondepressed controls (e.g., Peselow, Robins, Block, Barouche, & Fieve 1990).

It is possible that remitted depressed individuals reported low levels of negative cognition because they were able to engage reflective processing and could correct for an initially biased response. Indeed, work by Wenzlaff and Bates (1998) suggests that cognitive vulnerabilities to depression can be observed when a cognitive load is imposed, thereby impairing reflective processing. Given the manner in which negative cognition was assessed in these earlier studies, they were not able to test such a hypothesis. Future research would benefit from assessing results of both associative and reflective processing. A dual process model would be supported if a cognitive vulnerability to depression was observed when cognitive resources were depleted.

2.6.2. Development of cognitive vulnerability

A dual process model also has implications for understanding how cognitive vulnerabilities to depression develop. Associative processing rests upon similarities that have been associated with repeated experience over a long period of time. However, some experiences may be particularly important for shaping this associative memory network. Rudman (2004) reviews several sources of associative bias, including early experiences, affective experiences, and cultural biases.

The experiences an individual has early on in development appear to have a particularly important role for shaping associative processing, whereas more recent experiences may influence reflective processing. In support of this idea, Rudman and Heppen (2001) reported that smokers' earliest experiences were associated with their current implicit associations with smoking. If early experiences

were unpleasant, implicit attitudes were also negative. In contrast, recent experiences with smoking were more closely associated with their self-reported attitudes on smoking.

It follows that a cognitive vulnerability to depression could develop among people who at an early age have experiences that encourage associations between the self and negative themes such as low worth or defectiveness. For instance, an associative bias may develop within a child who, at a young age, experienced a great deal of failure or criticism. Interestingly, [Steinberg, Gibb, Alloy, and Abramson \(2003\)](#) reported that high levels of childhood maltreatment were associated with greater negative bias for self-referent information processing. [Ingram and Ritter \(2000\)](#) reported that maternal caring was associated with information processing biases observed in a dysphoric mood among depression vulnerable individuals. Similarly, peer and parental victimization during childhood was associated with greater cognitive vulnerability to depression ([Gibb, Abramson, & Alloy, 2004](#)). Emotional maltreatment appears to be particularly relevant compared to physical and sexual maltreatment for the development of a cognitive vulnerability ([Gibb, Alloy, & Abramson, 2003](#); [Gibb, Alloy, Abramson, & Marx, 2003](#)). Further, epidemiological studies have also found that early parental mistreatment is associated with depression vulnerability ([Shaw, Krause, Chatters, Connell, & Ingersoll Dayton, 2004](#)). This evidence supports the idea that early developmental experiences confer vulnerability to depression. More specific research is needed to determine whether biased associative processing mediates the effect of such early experiences for depression onset.

Affective experiences may also have an important role in shaping associative processing. There is some evidence that associative processing is correlated with brain centers that regulate emotional experiences. For instance, [Phelps et al. \(2000\)](#) reported that implicit prejudice covaried with amygdala activation in Caucasians when shown pictures of African-Americans. [Rudman, Ashmore, and Gary \(2001\)](#) suggested that emotional reconditioning may be necessary to change associative processing, whereas changes in reflective processing may depend more on cognitive and motivational factors (e.g., a willingness to change). This evidence suggests that a negative affective experience is particularly likely to influence associative processing.

It follows that repeated or chronic episodes of depression are likely to reinforce negatively biased associative processing. Associations made when depressed may be particularly influential. Therefore, a person who has spent significant time thinking how inferior and worthless he is when depressed may readily perceive himself negatively. As a result, potential job loss may automatically bring to mind thoughts of failure, leading to an increasingly dysphoric mood. This is consistent with work known as the kindling hypothesis ([Post et al., 1996](#)), which predicts that depression onset is more easily triggered by increasingly less severe negative events.

Cultural beliefs are a third potential source of associative bias. These might be a particularly important source of bias because these are transmitted with great frequency. For instance, it has been shown that African Americans and Caucasians both share an implicit prejudice against African Americans ([Nosek, Banji, & Greenwald, 2002](#)). It has been suggested that African Americans have an associative bias against their own race because they have internalized a society's negative view of minorities ([Jost & Banaji, 1994](#)). Similar effects have also been demonstrated for groups that differ in social status (e.g., slim, rich vs. poor, overweight).

Societal messages may also influence the development of a depression-relevant associative bias. For instance, young girls appear more likely than young boys to explicitly or implicitly receive messages from society that lead them to question their self-worth ([Eccles, Jacobs, & Harold, 1990](#)). This may translate into greater negatively biased self-referent associative processing among women than men. This

difference may contribute to gender differences in depression onset, where women are twice as likely to become depressed as men (Nolen-Hoeksema, 2002). Additional research is needed to determine whether negatively biased associative processing accounts in part for the gender differences in the rate of depression.

In summary, the pattern completion mechanism of associative processing is based on similarities detected during repeated experiences. Early experiences, experiences that involve affect, and societal messages may be particularly important factors that influence the pattern completion mechanism of associative processing. Future research should examine whether these types of experiences, particularly negative experiences involving the self, are associated with biased associative processing among depression vulnerable individuals.

2.6.3. *Altering cognitive vulnerability*

A dual process model suggests several ways in which to correct a cognitive vulnerability to depression. The first is to alter expectancies so that negatively biased associative processing triggers reflective processing designed to adjust or override output from associative processing. This, of course, assumes that cognitive resources are available to adjust associative processing. For instance, if a person automatically thinks he will be unable to attain an important goal, he can employ a reflective strategy of considering past achievements and the conditions under which a particular goal was or was not achieved (Beck et al., 1979). Similarly, another approach could be to adopt a reflective stance recognizing that this product of associative processing is simply one perspective, not a truth, and that other possibilities may exist (Teasdale et al., 2002). Engaging in such reflective processing may help the individual readjust his current thoughts.

Although adjusting the product of associative processing with reflective effort may be a useful, short-term strategy, an ideal strategy would be to influence associative processing so that it no longer produces negatively biased output. This requires altering the pattern completion mechanism, which, as reviewed earlier, relies upon well-established associations that were developed, over time, with repeated experiences. Given this cognitive architecture, it follows that changing the associative network may be possible, but it may take time.

A significant amount of research has examined whether repeatedly engaging in reflective processing can alter associative processing. McClelland and colleagues (McClelland, McNaughton, & O'Really, 1995) refer to this process as consolidation. Consolidation occurs when a person accumulates enough experience with a particular association that it becomes integrated within the associative system. However, consolidation can take weeks to years to accomplish. McClelland et al. (1995) suggests that this process is necessarily slow, in order to allow new information to be integrated without disrupting previous knowledge.

This suggests that repetitive exposure to new associations is needed to consolidate results of reflective processing to associative processing. A cognitive vulnerability may thus be reduced by repeatedly engaging in reflective processing to correct biased associative processing. As a more concrete example, a depression vulnerable person could be taught to effortfully challenge their negative thinking when negative instances occur. That is, they could be taught to have “second thoughts” about thoughts that result from associative processing (Barber & DeRubeis, 1989; Teasdale et al., 2001). Over time and with repeated practice, changes in associative processing may occur as associations become relearned. However, this will take repeated practice and a significant amount of time.

A third and related way to alter results of associative processing may be to encourage repeated experiences that will help to form new associations. For instance, a depression vulnerable person may automatically associate themselves with failure. Repeated exposure to experiences in which he succeeds may begin to alter this associative network. Such experiences may help an individual begin to associate success with the self rather than failure. Of course, repeated experiences are also critical for the success of this approach. This is consistent with cognitive-behavioral approaches to depression treatment that encourage patients to engage in activities that are likely to succeed (Hoberman, Lewinsohn, & Tilson, 1988; Lewinsohn & Clarke, 1984). Further, this is an example of how a behavioral intervention (e.g., increasing mastery experiences) could be used to alter cognitive structure.

Finally, it may be possible to undo a cognitive vulnerability by helping an individual relearn associations underlying an associative processing bias. Relearning may be particularly effective when “emotional reconditioning” occurs. Rudman et al. (2001) found that implicit prejudice towards African-Americans changed for individuals who were affectively engaged in a diversity training intervention. No change in implicit prejudice occurred for people not affectively engaged with the intervention. Further, increased awareness of one’s own bias to be non-prejudiced was related to less explicit prejudice. This increased awareness, however, was not related to reductions in implicit prejudice. The authors concluded that conscious cognitive change may alter reflective processing whereas emotional reconditioning may reduce associative biases. Effective interventions may thus use affective and cognitive approaches to target associative and reflective processing, respectively (cf. Samoilov & Goldfried, 2000).

There is preliminary evidence that such an approach may be helpful for the treatment of depression. Hayes, Beevers, Feldman, Laurenceau, and Perlman (in press) reported that a treatment designed to promote cognitive change and affective engagement significantly reduced depression. Specifically, 83% of participants reported a 50% or greater reduction in symptom severity and no longer met SCID criteria for depression at the end of treatment. Process analyses indicated that higher levels of cognitive processing (i.e., exploring and questioning issues and material related to depression with some insight or perspective shift) during the second phase of therapy, when patients were taught to approach their sense of hopelessness, defectiveness, and failure, was predictive of treatment response. Cognitive processing during the first phase of treatment, which is designed to restore depleted energy, coping resources, and social support, was not associated with improvements in depression. Further, depression scores significantly decreased from before to after the peak level of processing during this second phase of treatment. It appears that the most therapeutic cognitive processing occurred during a period where there was high affective engagement. Whether this treatment reduces vulnerability to depression by changing associative biases remains to be tested; however, these preliminary findings are particularly encouraging.

2.7. Implications for future cognitive vulnerability research

Although this article has already reviewed several implications for future research on cognitive vulnerability to depression, several additional recommendations for future research are offered. Specifically, future research should: a) minimize use of self-report questionnaires to measure cognitive vulnerability, b) use mood priming to facilitate the assessment of associative processing, c) examine whether biased associative processing relates to mood persistence, d) examine how this dual process model relates to other models of depression vulnerability, particularly interpersonal and biological models, and e) examine the effect of treatment on associative and reflective processing. Each area is reviewed in turn.

2.7.1. *Reliance on self-report*

As discussed earlier, associative and reflective processing, and their interplay, may underlie a cognitive vulnerability to depression. It follows that both processes should be considered when assessing cognitive vulnerability. Traditionally, most studies of cognitive vulnerability to depression have typically relied on self-report questionnaires, which may only measure cognitive products that result from reflective processing. For instance, people may indicate their level of agreement to a series of beliefs on a self-report inventory. Such responses may be the product of thoughtful, reflective processing. This may not be a particularly potent predictor of depression vulnerability if biased associative processing corresponds with an individual's depression vulnerability.

Assessment of associative and reflective processing may not necessarily be a complex task. For instance, suppose we are interested in assessing the importance of dysfunctional attitudes about the self for depression vulnerability. It is possible to assess such attitudes using both associative and reflective processing modes. For instance, results of associative processing could be measured by asking individuals to agree or disagree with dysfunctional attitudes statements as quickly as possible, in order to limit reflective processing. Other ways to limit reflective processing include imposing a cognitive load or requiring participants to complete a secondary task while identifying their dysfunctional attitudes. In contrast, asking people to carefully consider each question or encouraging them to be as accurate as possible with their responses could be used to assess reflective processing.

In addition to modifying existing research paradigms to assess associative and reflective processing, innovative methods have been developed to assess associative processing. The Implicit Associations Task (Greenwald, McGhee, & Schwartz, 1998) has been widely adopted within social cognition research. This task has been modified to assess implicit associations between the self and negative trait adjectives among depression vulnerable individuals (Gemar, Segal, Sagrati, & Kennedy, 2001). Importantly, this task is thought to reflect implicit associations that are not influenced by reflective, consciously controlled, cognitive processes. Additional research utilizing this and similar methodologies to examine cognitive vulnerability to depression is clearly warranted (De Houwer, 2002).

2.7.2. *Associative priming*

A dual process model can also identify conditions when cognitive vulnerabilities are especially likely to be observed. Conditions that enhance the pattern completion mechanism of associative processing may be particularly conducive to identifying an associative bias. Priming associations thought to underlie a cognitive vulnerability prior to assessing cognitive vulnerability may enhance associative processing. Such priming could be accomplished with a dysphoric mood induction or by presenting cognitive primes (e.g., idiographically derived negative trait words).

There is growing recognition that cognitive vulnerabilities may require activation prior to assessment (Segal & Ingram, 1994). Although negative cognition appeared to remit along with symptoms of depression, people with a history of depression were more likely to exhibit dysfunctional thinking in the presence of negative mood states than people with no such history (Miranda et al., 1998; Miranda & Persons, 1988; Miranda et al., 1990; Roberts & Kassel, 1996; Solomon, Haaga, Brody, Kirk, & Friedman, 1998). Perhaps most importantly, greater cognitive reactivity to dysphoria was associated with an increased risk of future depression among nondepressed individuals (Beevers & Carver, 2003; Segal et al., 1999).

One interpretation of these findings is that a negative mood prime facilitates negatively biased associative processing. That is, a negative mood state increases the probability that cognitive

material associated with dysphoric moods will be used in the pattern completion mechanism of associative processing. Of course, a negative mood prime would be more likely to negatively bias pattern completion among individuals with significant associative networks containing negative themes. Further, mood priming may also reduce cognitive resources by increasing the number of intrusive thoughts (Ellis, Moore et al., 1997; Ellis, Ottaway et al., 1997), thus interfering with reflective processing. If so, mood priming could be a particularly effective way to identify a cognitive vulnerability. It can facilitate negatively biased pattern completion mechanism of associative processing and simultaneously deplete cognitive resources needed to engage reflective processing.

2.7.3. *Dual processes and mood persistence*

Given that a persistent dysphoric mood is a hallmark feature of a depressive episode (Scott, Winters, & Beevers, 2000), additional research is needed that examines the interplay between dual processes and mood persistence. A dual process model can account for mood persistence in a number of ways.

First, mood persistence may stem from delayed engagement of reflective processing. That is, persistent negative moods may not violate expectancies as easily among depression prone individuals, thus resulting in delayed reflective processing to regulate a dysphoric mood. As a person becomes more and more experienced with negative mood states, such mood states may become less and less alarming. A longer period of dysphoria may be required before reflective processing is triggered to repair mood.

Second, dysphoric moods may enhance associative processing among depression vulnerable people by facilitating negatively biased pattern completion. If this associative processing bias is particularly strong, this automatic bias may be particularly difficult to override. Third, depression vulnerable individuals may be using ineffective reflective strategies to regulate their dysphoric moods. Doing so may unwittingly enhance mood persistence. Additional research is needed to explore these and other explanations for mood persistence among depression vulnerable people.

2.7.4. *Links with other models of depression vulnerability*

A major need for future research will be to examine how a dual process model relates to other models of depression vulnerability. Such an endeavor has the potential to develop an integrative model of depression vulnerability; one that explains the phenomenon of depression vulnerability across levels of analysis. Interpersonal and biological models of depression vulnerability may be especially good starting points for integration with a dual process model.

It may be particularly useful to identify the interpersonal consequences of negatively biased associative processing. For some time, theorists have suggested that the integration of social and cognitive models of depression could be particularly fruitful (cf. Gotlib & Hammen, 1992). Biased associative or reflective processing may contribute to interpersonal behavior that confers vulnerability to depression (e.g., Wenzlaff & Beevers, 1998). For instance, does negatively biased associative processing increase problematic social behaviors and possibly increase life stress by eroding social support (cf. Joiner, 2000)?

Although no work has addressed this issue directly, there is evidence from social-cognition research to suggest that associative processing can be a potent predictor of behavior. For instance, Fazio and Williams (1986) reported that the latency to responding to attitude statements about the

suitability of various presidents enhanced the prediction of actual voting behavior beyond the reporting of the attitude itself. Further, implicit measures of prejudice have been associated with behaviors that a person does not closely monitor, such as being friendly and other non-verbal behavior. Reflective processing is more closely associated with behaviors that are closely monitored, such as their speech content (Dovidio, Kawakami, & Gaertner, 2002; Fazio et al., 1995; McConnell & Leibold, 2001; Sekaquaptewa, Espinoza, Thompson, Vargas, & von Hippel, 2003). Similarly, implicit associations between the self and shyness predict shy behavior in spontaneous situations, whereas explicit associations predict shy behavior in controlled situations (Asendorpf, Banse, & Muecke, 2002). Analogous research conducted with depression vulnerable individuals could be particularly helpful for understanding of how cognitive vulnerabilities relate to interpersonal factors that also contribute vulnerability to depression.

A dual process model of cognitive vulnerability might also be particularly amenable to integration with a biological level of analysis. As pointed out by Kosslyn et al. (2002), such integration is critical for fully understanding a particular phenomenon. Lieberman (2003) has begun to do this important work with social cognitive phenomena. Specifically, he has developed a social cognitive neuroscience approach to understanding a dual process model of judgment. For instance, Liberman argues that the amygdala, basal ganglia, and lateral temporal cortex are neural structures involved with associative processing. The anterior cingulate cortex, lateral prefrontal cortex, and the medial temporal lobe (including the hippocampus) are neural structures involved with reflective processing. Based on cognitive neuroscience research, he then articulates how these neurobiological systems interact to help an individual make decisions on a moment-to-moment basis. Similar research with depression vulnerable individuals may help to understand the neural processes that underlie a cognitive vulnerability to depression (for related work, see Siegle, Konecky, Thase, & Carter, 2003; Siegle, Steinhauer, Thase, Stenger, & Carter, 2002).

2.7.5. Treatment and dual processes

If a dual process model can reliably explain vulnerability to depression, it will be important to determine whether current depression treatments alter associative and reflective processing. There is preliminary evidence to suggest that cognitive behavioral treatments can influence associative processing among people with spider phobias. Specifically, Teachman and Woody (2003) measured implicit associations between spiders and semantic categories such as good vs. bad, afraid vs. unafraid, danger vs. safety, and disgusting vs. appealing. This assessment was referred to as implicit fear. At the beginning of treatment, spider phobic people had greater implicit fear of spiders compared to non-psychiatric controls. However, at the end of an exposure-based treatment, implicit fear of spiders (on 2 of the 4 tasks) did not differ for phobics and controls. Future work should examine whether depression treatments similarly influence associative processing, and whether poor change in associative processing during symptomatically successful treatment is a harbinger for the return of symptoms.

Research by Teasdale and colleagues suggests that cognitive therapy (CT) and mindfulness based cognitive therapy (MBCT) can improve metacognitive awareness among residually depressed people (Teasdale et al., 2002). From a dual process perspective, this evidence suggests that CT and MBCT may have altered reflective processing. That is, after treatment, biased associative processing may trigger reflective processing that more accurately corrects associative processing. MBCT may have helped individuals recognize that negative self-referent thoughts are simply “mental events that occur

in the mind.” Similarly, CT may help individuals recognize that negative self-referent thoughts may be distorted versions of reality and that the veracity of such thoughts should be examined. It would be particularly interesting to examine whether these treatments influence post-treatment associative processing, and, if not, whether altering reflective processing in such a manner changes associative processing over time. Further, it may be important to develop depression treatments that specifically target biased associative processing, if, as a dual process model predicts, such processing underlies depression vulnerability.

3. Conclusion

In this article, a dual process model of cognitive vulnerability to depression is proposed. This model emphasizes the interplay between two modes of information processing, associative and reflective processing. Associative processing involves quick, automatic information processing, whereas reflective processing involves relatively slow, effortful processing of information. Negatively biased associative processing, particularly about the self, is thought to confer cognitive vulnerability to depression. This bias, however, can be corrected by reflective processing if cognitive resources and motivation are available to do so. Therefore, a cognitive vulnerability to depression is most likely observed when reflective processing is disabled in some manner, often by a competing task, time pressure, or life stress.

Uncorrected negatively biased associative processing can then lead to a transient dysphoric mood. This occurs because negative cognitive content and dysphoric moods are closely intertwined (Blaney, 1986). As suggested by Forgas and Ciarrochi (2002), reflective processing is critical for regulating dysphoric moods. In the absence of such processing, a transient dysphoric mood can become more persistent and deplete cognitive resources, and in turn, reinforce negatively biased associative processing. Over time, a feedback loop can form between associative processing and dysphoric mood. The mutual entrainment between dysphoria and negatively biased associative processing can then lead to greater forms of distress, eventually culminating in a depressive episode.

Although there is evidence to support aspects of this proposed dual process model of cognitive vulnerability to depression, more research is needed. The vast majority of evidence supporting a dual process model of cognitive vulnerability to depression has involved clinical analog samples of college students. Research with vulnerable individuals, perhaps those who have recently recovered from a major depressive episode, will help to determine whether this prior research is clinically meaningful. Similarly, future research in this area should study clinically significant outcomes, such as depressive onset and relapse. Doing so will be critical for advancing the clinical significance of this dual process model.

In conclusion, a dual process model of cognitive vulnerability offers several new insights into the assessment, etiology, and treatment of depression vulnerability. This model suggests how cognitive vulnerabilities to depression develop, under which conditions they are most likely to be observed, and how treatments might alter cognitive vulnerability. More research is now needed to determine whether this model of depression vulnerability can live up to this considerable promise. If so, such a model could provide important insight into why some people are particularly susceptible to depression, and, more importantly, help to avert the substantial distress that often accompanies an episode of major depression.

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