Spring 2021

Depression and Information Processing: The Influence of Affective Cues on College Students' Memory Retrieval

Yutong Zhu
yutong.zhu@trincoll.edu

Depression and Information Processing:

The Influence of Affective Cues on College Students' Memory Retrieval

A thesis submitted in partial fulfillment for the Bachelor of Science degree in Psychology

Yutong Zhu

Trinity College

Fall 2020 - Spring 2021

Acknowledgments

I would like to first thank Professor Laura Holt from the psychology department for supporting me and guiding me during the research process. Her professional knowledge and instructive advice help me push aside distracting information and be clearer about what I was looking at. I appreciate Professors David Reuman and Elizabeth Casserly from the psychology department who helped me analyze and interpret the data. Professor Casserly's insights in statistics also open my understanding of research and data analysis. Finally, I would like to thank the psychology department at Trinity College which inspired my interests in this major. The department's open and communicative atmosphere supported students like me not only learn related knowledge in psychology but also understand the impacts of this knowledge in supporting people around us and contributing to better psychological research for society.

Table of Contents

Abstract……...5

Introduction…….……6

Depressive Symptoms among College Students…….……8

The Cognitive-Vulnerability Model of Depression …….....8

Biased and Impaired Memory Retrieval in People with Depression……...……8

The Reciprocal Interaction between Biased Cognition and Depression……10

Empirical Support for CV Models of Depression…….....…11

Affective Cues and Their Influence on Emotional Responses……. 12

ERP and fMRI Studies…….…….…12

Use of Image Cues in Memory Retrieval……..13

Current Research……...…….14

Aim #1……...……....14

Aim #2……...……....15

Aim #3……...……....15

Hypotheses……...……..16

Method……...17

Measures…….……...17

Depression…….…….17

Cognitive Vulnerability…….17

Affective Word Recognition……..18

Affective Cues……...18

Participants…….19

Procedure……...……19

Results……...…….21

Effects of Word Valence on Recognition Accuracy……..21

Effects of Word Valence and Depression on Recognition Accuracy……22

Discussion…….....23

Mood as an Affective Cue for Word Recognition…….23

The "Stroop Effect" of Negative Mood on Positive Word Retrieval……25

Limitations and Future Directions…….……26

Conclusion……...…..27

References……..29

Table…….…….39

Figures……40

Abstract

Given the reciprocal influence of biased cognition and depression on the development of depressive symptoms, this study used affective facial images to elicit corresponding negative emotions among college students with different depression and cognitive vulnerability levels to investigate the impact of negative emotions on positive, neutral, and negative word recognition. Students (N = 20) from a liberal arts college were asked to complete two self-reports to assess their level of depression and cognitive vulnerability. Participants completed two affective word recognition tasks, between which affective facial images were presented to elicit negative moods. The findings suggest that emotions had an impact on individuals' learning and memory retrieval capacity. Negative mood elicited by affective cues likely functioned as a cognitive cue for participants to encode and recognize negative words, leading to their higher improvement in negative word recognition accuracy after the manipulation (F (2,36) = 7.56, p = .01, η_p^2 = .30). Although participants' word recognition accuracy did not appear to differ based on depression status, it may be influential in determining participants' level of sensitivity to positive stimuli, as it may interfere with the less depressed individuals' performance in positive-word retrieval.

Keywords: cognitive vulnerability of depression, affective cues, affective word recognition, emotion and memory

Depression and Information Processing:

The Influence of Affective Cues on College Students' Memory Retrieval

Depression, more specifically major depressive disorder, is one of the most prevalent psychiatric problems among college students. In 2011, the American College Health Association – National College Health Assessment (ACHA–NCHA) collected nationwide surveys to investigate the mental health situation of college students and found that more than 30 percent of college students reported felt "so depressed that it was difficult to function" within the past 12 months (The American College Health Association, 2012). Recent data reported a rising prevalence of depression diagnoses among college students, accompanied by an increase in related symptomatology and severity (Liu et al., 2019). Moreover, there is an additional 7% of the population experience depressive symptoms but do not meet the diagnostic threshold (Bertha & Balázs, 2013), suggesting a larger number of college students suffer from depression. Nevertheless, many college students with depression do not receive professional help. Some are not aware of mental health services at school or are skeptical about treatment effectiveness. Others do not perceive a need to seek help and think "stress is normal in college/graduate school" (Eisenberg et al., 2007, p. 600). As a result, only 36% of college students who screened positive for major depression received medication or psychotherapy (Eisenberg et al., 2007).

Depression usually first emerges in childhood or adolescence (Kessler et al., 2005) and can be aggravated by various college-life stressors, such as academic performance, pressure to succeed, and post-graduation plans (Beiter et al., 2015). It significantly impacts multiple dimensions of college students' lives. Those diagnosed with clinical depression report missing more classes, assignments, exams, and social activities. They also are more likely to withdraw from courses or have a lower grade point average (GPA) (Hysenbegasi et al., 2005). In addition,

college students with depression are more likely to engage in high-risk behaviors. Excessive drinking (Acuff et al., 2018), substance misuse (Walters et al., 2018), and unprotected sex (Lee et al., 2018) are self-injurious behaviors that college students may use to distract themselves from emotional distress and to achieve temporary relief. Depression also may be comorbid with other psychological disorders including anxiety disorders (Abautret-Daly et al., 2018), personality disorders (Koppers et al., 2019), and substance use disorders (Hunt et al., 2020). Thus, the effects of depression are wide-ranging; it can lead to risky behaviors, co-occur with other mental illnesses, negatively impacting college students' academic and personal development.

Severe depression can also lead to suicide. Suicide was the second leading cause of death in 2013 for teenagers and young adults between 15 and 24 (Jiang et al., 2019) and it is an especially prominent problem among college students. A large sample survey representing 8,155 undergraduate and graduate students from 15 US universities reported that 6.7% of college students had suicidal ideation, 1.6% had a suicide plan, and 0.5% made a suicide attempt in the past year (Downs & Eisenberg, 2012). Moreover, the major risk factors for teenage and young-adult suicide and self-injury are depression, hopelessness, and substance abuse (Pedrelli et al., 2015), and depression can significantly reinforce the feelings of hopelessness and substance abuse (Bagge et al., 2014; Bravo et al., 2016). Considering the large number of college students with depression who do not receive professional help, school mental health services should implement timely screening techniques and effective interventions to identify them and help them engage in treatments regularly and consistently. To sum up, given the adverse psychological and developmental outcomes of depression on college students' lives, it is critical

for scholars to investigate the developmental pathways and mechanisms of depression, so that we can develop better interventions for such disorders in the future.

Depressive Symptoms among College Students

There are many types of clinical depression. Besides Major Depressive Disorder (MDD), the most "typical" depression that is marked by depressed moods, common clinical depression also includes Psychotic Depression, Bipolar Disorder, and Seasonal Affective Disorder (NIMH-Depression, 2018). Besides specific symptoms in the DSM-5 diagnostic criteria, individuals with clinical depression experience depressed moods or a loss of interest or pleasure in daily activities for more than two weeks, which significantly impairs their social, occupational, and educational functioning. Although college students need to exhibit at least five of the nine symptoms to receive a diagnosis of MDD, having some of the symptoms can result in noticeable harm to younger adults enrolled in higher education. For example, the diminished ability to think or concentrate can significantly impair academic performance, thus becoming an additional stressor that leads to the persistence of depression (Mahmoud et al., 2012). Insomnia may pair with college students' irregular sleeping patterns and lead to further deterioration (Schlarb et al., 2017). Not to mention the lack of interest or pleasure that hinders college students from participating in campus activities and meaningful social lives (Eisenberg et al., 2009). Thus, it is important to investigate depression on a spectrum to reveal its influence on college students even under the diagnostic threshold. Accordingly, this study used a college-student sample to investigate the cognitive dimensions of depression.

The Cognitive-Vulnerability Model of Depression

Biased and Impaired Memory Retrieval in People with Depression

Depression is characterized by a tendency to attend to and process negative information compared to neutral and positive information (Gotlib & Joormann, 2010). This processing bias is found in various stages of cognitive processing, such as attention, interpretation, and memory. For example, patients with clinical depression are more likely to pay additional attention to negative information, linking ambiguous situations to negative outcomes, and constantly reflecting on negative past experiences or anticipating bad outcomes to present situations (Christopher & MacDonald, 2005; Hankin et al., 2010; Mac Giollabhui et al., 2018; Mathews & MacLeod, 2005; Sanchez et al., 2017). This bias can lead to depressed moods as well as an accumulation of negative thoughts, consequently feeding back and reinforcing this vicious cycle that results in the development of depressive symptoms.

Among various cognitive components of information processing, the most consistent findings of the operational role of depression were revealed in research on negative memory retrieval bias (Gaddy & Ingram, 2014). A negative memory retrieval bias favors material of negative emotional valence. It not only determines specific memory details that are recalled, but also reduces individuals' autobiographical memory specificity (Farina et al., 2019; Gotlib & Joormann, 2010). In other words, patients with depression exhibited difficulties retrieving specific personal experiences; instead, they recalled memories that could be generalized to a larger context. For example, when seeing an emotional word such as "happy," individuals with an overgeneralization tendency would say "whenever I'm with my friends" instead of "going out to see a movie last night" (Vanderveren et al., 2017). Lacking the ability to recall specific personal memories may lead to a discontinuous sense of self and poorer regulation of past negative experiences, both of which are critical factors that influence depression development (Vanderveren et al., 2017). Therefore, depressive mental states interfere with memory retrieval

through recalling negative and over-generalized content. This cognition bias impairs their ability to retrieve positive or neutral affective information, meanwhile increasing their susceptibility to negative affective stimuli and related memories. Altogether, depression impairs individuals' information-processing capacities, as they are likely to encode, process, and recall negative thoughts or stimuli.

The Reciprocal Interaction between Biased Cognition and Depression

Nevertheless, the relationship between biased cognition and depression is not unidirectional. Current cognitive-behavioral therapy of clinical depression is based on Cognitive Vulnerability (CV) models of depression (Platt et al., 2017). These models propose that individuals may hold certain internal cognitive factors that make them more susceptible to negative input and environmental stressors. For instance, self-rumination is one important cognitive factor associated with the development of depression. Self-rumination refers to a chronic and persistent negative self-focus that is triggered by "perceived threats, losses, or injustices to the self" (Trapnell & Campbell, 1999, p. 297). Because its motivation emerges from past unpleasant experiences, self-rumination is often linked to stressful memories (Teasdale & Green, 2004) and can interact with other vulnerability factors such as genetic predisposition and personality traits (e.g., neuroticism) to increase individuals' susceptibility to depression. When an external stressor is presented, individuals with more vulnerability factors are more likely to react negatively to the stressor, consequently holding automatic negative thoughts that lead to depressive symptoms. For instance, adolescents with a dysfunctional self-rumination tendency (e.g., "I am ugly so my parents will not like me") are more likely to be triggered for depressive moods when facing external stressors (e.g., critique from parents). The negative self-images are "assured" by the external stressor (e.g., "My parents do not like me, so they criticized me"), thus

reinforcing the abnormal cognitive styles and resulting in depressive mental states (see Figure 1). As a result, biased cognition is not simply a symptom of depressive disorders, but also a vulnerability factor that interacts with environmental stressors and leads to clinical depression. Thus, CV models of depression demonstrate the reciprocal influence of depression and biased cognition. Studying this dynamic is significant in explaining the development, persistence, and reoccurrence of depressive symptoms.

Empirical Support for CV Models of Depression

CV models of depression are supported by empirical data in different cultural contexts. A higher level of dysfunctional attitudes among Chinese adolescents was correlated with an increase in depressive symptoms and the occurrence of stressful events (Abela et al., 2011). Similar results were also found among depressed and non-depressed Egyptian adults (Beshai et al., 2016), suggesting the cultural consistency of CV models in explaining the mechanisms of depression. In addition, prospective studies found that biased cognition predicted individuals' diagnosis of depressive disorders at a later point in their lives (Burcusa & Iacono, 2007; Mathews & MacLeod, 2005). In the Temple-Wisconsin Cognitive Vulnerability to Depression Project, participants were assessed and separated into high- or low-risk groups using the Dysfunctional Attitudes Scale (DAS) and the Cognitive Style Questionnaire (CSQ). Their mental health conditions were followed up over the next five years. Results showed that the high-risk group had a significantly higher rate of developing MDD than the low-risk group (Alloy et al., 2000). Taken together, studies on individuals from different cultural backgrounds provide empirical support for the cognitive-vulnerability dynamic in the occurrence and development of depression.

Besides this evidence, biological research using brain imaging techniques also

demonstrated the neurological basis of the CV model in explaining depression. Zhong et al. (2011) presented emotional faces and used functional magnetic resonance imaging (fMRI) to document brain activities of participants who (1) had an MDD diagnosis, (2) were higher in cognitive vulnerability but did not develop clinical depression, or (3) were lower cognitive-vulnerability healthy controls. Those with MDD exhibited greater left amygdala responses and lesser left dorsolateral prefrontal cortex (dlPFC) activation compared to the other groups. In parallel, individuals with higher cognitive vulnerability had increased bilateral amygdala responses and decreased dlPFC activation relative to the lower cognitive vulnerability group (Zhong et al., 2011). The dysfunctions in neural networks influence the cognitive processing of emotions, and the extent of this influence varies according to individuals' cognitive vulnerability to depression. Altogether, the aforementioned evidence demonstrates the combined impact of negative cognitive styles and external stressors on individuals' tendency to develop depressive disorders. Biased cognitive styles and depression interact reciprocally to create a cycle that continuously promotes the development of depressive symptoms, leading to the persistence and recurrence of depressive disorders.

Affective Cues and Their Influence on Emotional Responses

ERP and fMRI Studies

Numerous laboratory studies have examined the association between affective cueing and specific neural activities. Research using either event-related brain potentials (ERPs) or fMRI suggested affective images' ability to elicit similar neurological responses as experiencing real-life emotions. ERP studies indicated that affective cues provoke early posterior negativity (EPN) and late positive potential (LPP) compared to neutral cues, which reflects individuals' early automatic attentional capture and emotional processing of the stimuli (Langeslag et al., 2018;

Michalowski et al., 2009). For instance, Michalowski et al. (2015) presented spider-phobic and non-spider-phobic participants with neutral, unpleasant, or spider pictures. All participants exhibited larger EPN and LPP when seeing an affective image compared to a neutral one. Spider-phobic participants demonstrated an additional increase in EPN and LPP to spider image than non-spider-phobic participants. Therefore, affective cues can elicit similar neurological responses as emotional mental states do, as individuals pay attention to the stimuli and process the emotions accompanying them.

Correspondingly, fMRI research showed that affective cues activated brain regions that are responsible for emotional processing. Not only arousing brain areas like the left amygdala, the prefrontal cortex, and the posterior cingulate cortex for emotional processing (Aryani et al., 2019), affective cues also mediated individuals' emotional regulation by suppressing emotional responses in the brain (Denny et al., 2014). Taken together, ERP and fMRI studies indicate that affective cues can provoke emotional responses and even influence individuals' cognitive regulatory processes, which provides an empirical basis for using affective facial images in the study to elicit corresponding depressed cognitions among college students.

Use of Image Cues in Memory Retrieval

Despite the influence of affective cues on individuals' emotional processing, different cue types suggest nuanced differences in inducing moods while accessing personal affective memories. For example, using emotional faces leads to more consistent findings than affective words when investigating the attentional bias in depression (Hankin et al., 2010). This may because that event-specific knowledge is stored as image representations (Conway, 2005; Williams et al., 2007). Unlike general knowledge such as the Earth is round, or the sky is blue, event-specific knowledge contains many sensory-perceptual details that are unique to the event.

These details are often encoded with visual images rather than abstract and conceptual representations that describe what happened in this incident (Williams et al., 2007). Accordingly, in this research, depressed facial expressions instead of word cues were presented to assist participants to retrieve relevant episodic memories. Episodic memory is the memory of individuals' life events, so it is highly context-relevant and includes many sensory details such as vision, smell, sound, touch, taste, and most importantly, feelings or emotions (Gillund, 2012). Therefore, image cues may be more successful in helping participants revisit a memory that is context- and detail-specific, consequently eliciting depressed moods as expected.

Current Research

Aim #1

Instead of focusing on a clinically depressed sample, this study intends to explore the impact of affective cues on college students without a clinical depression diagnosis. This methodology allows us to capture a larger population of college students and investigate the influence of depression on a more generalizable population. Accordingly, the depression assessment used in this study is the Center for Epidemiological Studies-Depression (CES-D), which provides cutoff scores that identify individuals who are at risk for clinical depression (Lewinsohn, Seeley, Roberts, & Allen, 1997). Studying the influence of depressed mental states on a spectrum can aid in scholars' understanding of depression's continuous impact on individuals' memory processing and cognitive biases. Thus, this study intends to depict the current picture of college-student depression from a more generalizable population, which may lead to the development of better interventions that serve a larger group of young adults suffering from depression or related disorders.

Aim #2

Previous research has provided empirical evidence about the cognitive components underlying the development and maintenance of depression (Williams et al., 1988). The reciprocal impact of depression and biased memory retrieval has generally led to consistent findings. However, few studies have examined the two directions of this dynamic simultaneously. Thus, this study uses negative-valence affective cues to elicit depressive emotional responses in college-student samples. After seeing the same negative affective cues, if participants who are more sensitive to negative affective stimuli scored higher on the depression spectrum, biased cognition may not merely be a symptom of depression, but a vulnerability factor for the development of depressive episodes. Thus, the findings of this study may contribute to scholars' current understanding of the dynamic between memory and depression. By parsing depression at the mechanistic level, the current study may provide more empirical evidence for the application of memory reconstruction on preventing and alleviating depression.

Aim #3

This research also intends to investigate the role of moods in activating affective memories when different types of cues (image vs. words) are presented. Moods, as an important part of context information, influence individuals' long-term memory encoding as well as retrieval processes. They could influence retrieval at both the item (memory associated with a particular affective stimulus) and the task (emotional states when recalling specific memory) level (Buchanan, 2007). When a mood state is encoded with a piece of memory and recapitulates during retrieval, it can act as a cue to increase the probability of successful retrieval. The affective cues used in this study are emotional faces that express negative or neutral emotions, while participants were required to recognize affective words during long-term memory retrieval

tasks. If moods could influence the memory retrieval process on both the item and the task level, they would serve as a cognitive link between the cognitive activation of image and word representations among the participants. As a result, the participants' affective word retrieval performance would be influenced by the emotional faces they saw. They will show higher accuracy in negative affective word retrieval compared to positive or neutral valence words. Thus, by using different affective cues for emotional arousal and memory retrieval, this research examines the impact of emotions on individuals' retrieval process from a highly abstract cognition perspective.

Hypotheses

This study investigated the potential sequential effect of depression and biased information processing in a sample of college students. Three distinct hypotheses were proposed: First, participants' level of depression will correlate with their word recognition task accuracy. Since depression deviates and impairs individuals' memory retrieval capacity, participants who score higher in the pre-manipulation depression assessment will have worse performance in the memory retrieval tasks, especially the one after seeing the affective facial image.

Second, if participants' memory capacity is impaired after the arousal of depressive emotions, their memory retrieval task performance will vary pre- and post-manipulation. Specifically, participants who score higher on the depression spectrum will be more susceptible to negative affective stimuli, thus showing higher variations in their performances. By contrast, participants who score lower on the depression spectrum will have more blunt responses to negative affective stimuli, thus having smaller variations in their task performance. This difference in performance variation is due to their different levels of cognitive vulnerability to depression.

Third, since depressed moods can serve as a cognitive connection between emotional faces and affective words, participants with more depressive symptoms will have higher accuracy in recognizing negative valence words than neutral or positive ones in the post-manipulation word recognition task.

Method

Measures

Depression

The Center for Epidemiological Studies-Depression (CES-D) was used to examine participants' levels of depression. The CES-D is a 20-item 4-point self-report scale that reflects on six major groups of depressive symptoms defined by the DSM-5: sadness, agitation, loss of appetite, loss of sleep, feelings of guilt/worthlessness, and feelings of helplessness/hopelessness (Radloff, 1977). It is an important screen for epidemiologic studies of depression and has shown to be reliable in assessing the number, type, and duration of depressive symptoms across gender, age, and cultural groups (American Psychological Association, 2019). The cutoff score of 16 or greater suggests that the individual is at risk of clinical depression. The CES-D in the current study displayed excellent internal reliability (α = .80). Higher scores suggested a higher risk of clinical depression.

Cognitive Vulnerability

The Cognitive Style Questionnaire-Short Form (CSQ-SF) is a 72-item 5-point self-report that measures individuals' vulnerabilities for anxiety and depression. It examines five dimensions of cognitive vulnerability for depression, including internality, globality, stability, negative consequences, and self-worth implications. The CSQ-SF has demonstrated high internal and test-retest reliability. It also displayed predicted correlations with other depression and

anxiety measurements, suggesting its construct validity. The CSQ-SF is a reliable tool to measure individuals' cognitive vulnerability to depression (Meins et al., 2012). In the current study, the CSQ-SF showed excellent internal reliability (α = .93). Higher scores suggested a higher level of cognitive vulnerability.

Affective Word Recognition

The Affective Norms for English Words (ANEW) was developed to construct a standardized emotional rating for English words (Bradley & Lang, 2017). The ANEW includes 1,034 terms and their analysis on valence (ranging from pleasant to unpleasant), arousal (ranging from calm to excited), and dominance (the prevalence of using this word in past emotion-related research) scores. Previous research suggests that ANEW can elicit corresponding emotional responses (positive vs. neutral vs. negative) among individuals from various cultural backgrounds (Soares et al., 2012). Thus, ANEW was used in this study for word recognition tasks to investigate the potential emotional connections that support participants' memory encoding and retrieval. Specifically, words in the ANEW were ranked from highest to lowest on their valence scores. The positive words were selected from words with the highest valence scores whereas the negative words were selected from words with the lowest scores. The neutral words were selected from the words whose scores beside the median valence. If two words appear to be similar semantically, such as "happy" and "happiness," one of them would be replaced by the next word on the valence score scale to avoid potential intervention between words.

Affective Cues

One neutral and one sad face image were chosen from the FACES database as the affective cues used in this study. FACES is a set of images of naturalistic faces of 171 Caucasian

people of different ages and genders. Facial expressions of these images involve neutrality, sadness, disgust, fear, anger, and happiness (Ebner, Riediger, & Lindenberger, 2010). Images of this database contain a grey background that is consistent with the word recognition task. I chose images from a young man and a young woman who matched the participants' age group to help them better relate to the emotions associated with these facial expressions.

Participants

Demographic information of the participants is presented in Table 1. Nine male and eleven female students participated in the study (M_{age} = 19, *SD* = .973). Most (75%; *n* = 15) of the participants were White/Caucasian, 15% (*n* = 3) were Black or African American, 10% (*n* = 2) were Asian or Asian American, and 5% (*n* = 1) was Middle Eastern.

Of note, six of the participants reported a previous diagnosis of clinical depression and one was “unsure” about this question. Four of them were currently taking antidepressants (Sertraline or Lexapro) and two were taking other types of psychiatric medication (methylphenidate). Seven participants were currently undergoing psychotherapy (CBT, talk therapy, or “unsure”). Four participants reported a history of serious head injury (e.g., concussion) and none of them had a neurological disorder (e.g., seizure/epilepsy). Moreover, 40% of the participants (*n* = 8) scored above the CES-D cutoff score of clinical depression with current medication and psychotherapy, indicating an elevated level of depression than my intended sample.

Procedure

An invitation letter was sent to the course instructors to advertise to PSYC-101 classes. The participants were required to schedule a consecutive forty-minute remote meeting with the researcher before the study and complete the study under the guidance of the researcher during

that time slot. This approach was deliberately used to make sure that affective word recognition tasks were completed immediately after the assessments of depression and cognitive styles, which eliminates the possible time-varying effects on the participants' mood. It can also help the participants concentrate on the study and receive timely feedback from the researcher under the remote experimental condition. By completing the research, participants could receive research course credit for PSYC-101 or a $10 incentive.

The study consists of two sections and informed consent was signed before the study (Figure 2). In the first section, participants completed an online survey containing demographic questions, a depression assessment, and a cognitive style assessment. In the second section, participants accessed an online experimental site to complete two affective word recognition tasks. Each affective word recognition task consists of a studying and a recognizing phase. During the studying phase, 10 positive, 10 negative, and 10 neutral words selected from the ANEW were presented on the center of the screen randomly. Each word lasted for 1 second and participants were asked to memorize as many words as they could. In the recognizing phrase, the old list and a new list of affective words that consists of 10 positive, 10 negative, and 10 neutral words were presented randomly as the first phase. Participants needed to press "Y" or yes if they had seen the word in the studying phase, and to press "N" or no if they did not encounter the word in the studying phase. Participants' answers to affective words were recorded according to the valence of the word, and their recognition accuracy was analyzed separately based on word valence.

Between these two affective word recognition tasks, one neutral face and one sad face were presented during the affective valence cues section. The neutral face appeared first to help participants to be familiar with the questions and then the depressive face appears to elicit

corresponding negative emotions among the participants. In order to elicit corresponding emotions among the participants, the participants were asked to look at the affective faces and answer a series of questions about the memory-related sensory details to help them "recall a memory of [their] own." Participants needed to press corresponding keys for each question to proceed.

Results

Due to the elevated level of depression among the participants, I decided not to exclude the participants with a history of clinical depression. A Pearson product-moment correlation coefficient was conducted to assess the relation between participants' level of depression and CV. A correlational analysis found no significant relationship between the participants' depression and CV level, $p = .051$, $r = .44$. Therefore, the assumption that depression and CV reciprocally influence each other to determine the participants' recognition accuracy of affective words is not supported in this study. As a result, instead of analyzing participants' level of depression on a spectrum, I decided to revise the data analysis approach by separating participants into two groups based on the depression level. Participants who scored equal to or higher than the cutoff score of CES-D (CES-D score >= 16) were considered as the depressed group whereas those who scored lower than the cutoff score were viewed as the non-depressed group (CES-D score < 16). The corresponding hypotheses were also revised as (1) The non-depressed group would exhibit better performance in *overall* word recognition accuracy; (2) The depressed group would show higher variations in negative word recognition performance.

Effects of Word Valence on Recognition Accuracy

A 2 (depression status) x 3 (word valence) mixed-model ANOVA with an alpha level of .05 was conducted to explore the effects of depression status on participants' pre-cue and post-

cue variation in affective word recognition performance. Mauchly's test indicated that the assumption of sphericity had been violated, $W = .48$, $\chi^2(2) = 12.60$, $p = .002$. Thus, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .66$). The results revealed a significant main effect for word valence on participants' variation in recognition accuracy, F (2,36) = 7.56, $p = .01$, $\eta_p^2 = .30$. Participants showed a significant improvement in negative-word recognition accuracy ($M = .55$) compared to positive words ($M = -1.95$) and neutral words ($M = -1.10$). Therefore, word valence had a significant impact on participants' change in word recognition accuracy, and participants' recognition accuracy in negative words was significantly improved compared to positive and neutral words after seeing the affective cue (Figure 4). Moreover, participants displayed the highest mean for post-cure negative word recognition accuracy ($M = 16.85$) compared to positive ($M = 14.85$) and neutral words ($M = 16.45$), which supports my third hypothesis that participants would have higher accuracy in recognizing negative valence words than neutral or positive ones in the post-manipulation word recognition task.

Effects of Word Valence and Depression on Recognition Accuracy

Nevertheless, the mixed model ANOVA suggests that the between-subjects effect was nonsignificant, indicating that there was no overall difference by the level of depression on *overall* word recognition task accuracy, F (1) = 1.30, $p = .27$, $\eta_p^2 = .07$. Therefore, my first hypothesis, the non-depressed group would exhibit better performance in *overall* word recognition accuracy, was not supported.

Moreover, there was not a significant impact of the interaction between word valence and depression status on participants' change in word recognition accuracy, F (2,36) = 3.40, $p = .07$,

η_p^2 = .16 (*Figure 5*). Thus, the second hypothesis, the depressed group would show higher variations in negative word recognition performance, was also not supported.

Nevertheless, there is a visible difference between the depressed and non-depressed groups on their variations in positive word recognition accuracy in Figure 5. The depressed group was more impacted by the affective cues on their positive word recognition compared to the depressed group, which may suggest a potential inference effect of the depressive facial image on the non-depressed group's positive word recognition.

Discussion

Mood as an Affective Cue for Word Recognition

The results suggest a main effect of word valence on participants' word recognition accuracy, despite their depression status. After seeing the affective cues, participants showed improved performance in negative-word recognition compared to positive and neutral words. Therefore, the depressive facial image successfully elicited a corresponding negative mood among the participants, and this negative mood serves as a cue that helped participants to encode and retrieve negative affective words in the post-manipulation word recognition task. This finding was consistent with previous literature showing that mood states function as important components for both memory encoding and retrieval (Buchanan, 2007). Moreover, my findings confirmed previous theories that mood could influence retrieval at both the item (memory associated with a particular affective stimulus) and the task (emotional states when recalling specific memory) level (Buchanan, 2007). The use of affective images led to better retrieval of affective words, suggesting the generalizable impact of moods on individuals' memory retrieval across tasks.

This effect of moods on learning and memory is supported by neurological findings. Recent neuroimaging studies suggest that the amygdala, the prefrontal cortex, and the medial temporal lobe cooperate to consolidate and retention information (Tyng et al., 2017). The amygdalae play a primary role in forming and consolidating emotional memories. They are responsible for processing emotional states (e.g., fear, joy, distress, etc.) as well as mediating associative learning and memory (Anderson & Phelps, 2001). The amygdalae are activated under positive and negative valence for both pictures- and words-cues, supporting the generalizable impact of moods on individuals' emotional learning and memory retrieval across different types of information (Kensinger & Schacter, 2006).

I did not find a significant impact of depression status on participants' *overall* word recognition accuracy. The correlation analysis suggests no significant relationship between the participants' depression and CV level, although the *p-value* is very close to the alpha level. In other words, the assumption that depression and CV reciprocally influence each other to determine the participants' recognition accuracy of affective words is not supported in this study. This unexpected result might be due to the impact of salient environmental factors, such as the pandemic, on the relationship between depression and CV. For instance, the CES-D consists of questions like "I talked less than usual" and "I felt lonely." Participants might score very high in these questions and displayed more depressive symptoms because of the pandemic and quarantine policies. As a result, individuals with a relatively low level of cognitive vulnerability can also score very high in depression assessment. Given the impact of COVID-19 on the validity of depression assessments, future research is needed to further examine the current relationship between depression and CV level and to adjust depression assessment if it is necessary.

The "Stroop Effect" of Negative Mood on Positive Word Retrieval

Unexpectedly, instead of showing a larger variation in recognizing negative words, participants from the depressed group exhibited a relatively lower level of variation in their positive word recognition accuracy. This finding does not support previous research about negative information processing bias among people with clinical depression, as they are more likely to pay attention to and process negative stimuli (Gotlib & Joormann, 2010). Nevertheless, this result might suggest a "Stroop effect" of negative-valence face cues on participants' positive word recognition accuracy. "Stroop effect" refers to the delay in reaction time when individuals are processing incongruent stimuli compared to congruent stimuli (Stroop, 1935). Thus, conflicting information can interfere with each other and lead to a longer reaction time. Similarly, the negative-valence facial image might also interfere with positive word recognition among non-depressed participants. By contrast, the depressed group's performance in positive-word recognition was less susceptible to the impact of the negative-valence face because they have relatively "blunt" responses to emotions, especially to positive emotions.

Lack of sensitivity to positive emotions and related experiences is one major category of symptoms of depression (Dunn, 2012). Research has shown that individuals with treatment-resistant depression exhibited blunted amygdala activity when trying to pair an emotional word to a facial expression image (Ferri et al., 2017). Therefore, when recognizing positive words, it was possible that participants with moderate and severe depressive symptomatology did not perceive the positive affect underlying these words, and they were encoding and retrieving positive words with fewer emotional components. As a result, the depressed group was less influenced by the negative moods in positive word recognition as the positive moods pairing with these words were not salient enough to conflict with their negative emotional states.

Nevertheless, since the between-subject comparison does not necessarily suggest a significant impact of the depression status on word recognition accuracy in this sample, future research is needed to reevaluate this finding before drawing any conclusion.

Limitations and Future Directions

The limitations of this study must be acknowledged. First, this study consists of a relatively small sample size, and the participants were from a similar educational background. In total, only 20 participants were involved in the research, and they are all students from an introductory psychology course. The limited number and diversity of the participants may also be one reason that depression and cognitive vulnerability levels did not correlate with each other in this research. Therefore, future research with a larger and more diverse sample can be conducted to reevaluate the hypotheses of the current study to understand the reciprocal influence of depression and biased cognition in determining the development of depressive symptoms.

Second, the remote design of this research due to the pandemic made it difficult to control the experimental setting of the participants. Although I required the participants to stay in the Zoom room throughout the study, most participants stayed muted and kept their cameras off during the research. As a result, it is hard to tell whether the participants concentrated during the CV and depression assessments as well as the affective word recognition tasks. Thus, further similar research needs to be conducted in an experimental setting to reduce the potential environmental impact of participants' self-report responses and word recognition task performance.

Third, the moods provoked by emotional faces may have had nuanced differences that impacted the participants' memory encoding and retrieval. For instance, for the sad facial image,

some participants reported disgusted emotions after seeing the image and recalling corresponding autobiographical memories whereas some participants reported fearful emotions. Although fearful and disgusted emotions both are associated with core symptoms of depression, the effects of these two emotions on affective word recognition can be distinct. Some affective words are more connected to fearful emotions whereas some words are better at provoking disgusted moods. Also, individuals with depression showed greater activation in the left insula and right middle/inferior temporal when seeing faces with strong disgust, whereas they displayed reduced activation in the left inferior parietal lobe responding to fearful faces (Surguladze et al., 2010). Therefore, the neurological mechanisms of disgusted and fearful emotions, although both contribute to depression, are distinct and can support individuals' retrieval of related memories differently. Future researchers can conduct studies with more detailed classifications of the participants' emotional responses to parse the relationship between moods and memory on a mechanistic level.

Conclusion

Given the reciprocal influence of biased cognition and depression on the development of depressive symptoms, this study intended to use affective facial images to elicit corresponding negative emotions among college students with different depression and cognitive vulnerability levels to investigate negative emotions' impact of positive, neutral, and negative word recognition. The findings suggest the impact of emotions on individuals' learning and memory retrieval capacity. Negative mood elicited by affective cues could function as a cognitive cue for participants to encode and recognize negative words, leading to their higher improvement in negative word recognition accuracy after the manipulation. Although depression status did not suggest a significant impact on participants' word recognition accuracy, it may be influential in

determining participants' level of sensitivity to positive stimuli, as it may interfere with the less depressed individuals' performance in positive-word retrieval. This "Stroop effect" could be due to the depressed group's blunt responses to positive emotions during positive word recognition. Limitations of the current research are acknowledged, suggesting the importance of testing a larger and more diverse sample in a designed experimental setting. The impact of the pandemic on the relationship between cognitive vulnerability and depression is also highlighted to warn of the potential risks of directly applying past depression assessments to the population. Negative moods, depression, and their impact on people's memory and information processing are an increasingly important topic in the field of psychology, especially considering the negative social and psychological consequences of COVID-19 recently. It is important for scholars to test empirical data with theories like the cognitive vulnerability models of depression to develop a concrete and comprehensive theoretical structure that could explain the etiology and mechanisms of depression, consequently developing better interventions and treatments for individuals who are suffering from such abnormal mental states.

References

Abautret-Daly, Á., Dempsey, E., Parra-Blanco, A., Medina, C., & Harkin, A. (2018). Gut–brain actions underlying comorbid anxiety and depression associated with inflammatory bowel disease. *Acta Neuropsychiatrica*, *30*(5), 275–296. https://doi.org/10.1017/neu.2017.3

Abela, J. R. Z., Stolow, D., Mineka, S., Yao, S., Zhu, X. Z., & Hankin, B. L. (2011). Cognitive vulnerability to depressive symptoms in adolescents in urban and rural Hunan, China: A multiwave longitudinal study. *Journal of Abnormal Psychology*, *120*(4), 765–778. https://doi.org/10.1037/a0025295

Acuff, S. F., Soltis, K. E., Luciano, M. T., Meshesha, L. Z., Pedrelli, P., Dennhardt, A. A., & Murphy, J. G. (2018). Depressive symptoms as predictors of alcohol problem domains and reinforcement among heavy drinking college students. *Psychology of Addictive Behaviors*, *32*(7), 792–799. https://doi.org/10.1037/adb0000397

Alloy, L. B., Abramson, L. Y., Hogan, M. E., Whitehouse, W. G., Rose, D. T., Robinson, M. S., Kim, R. S., & Lapkin, J. B. (2000). The Temple-Wisconsin Cognitive Vulnerability to Depression Project: Lifetime history of Axis I psychopathology in individuals at high and low cognitive risk for depression. *Journal of Abnormal Psychology*, *109*(3), 403–418. https://doi.org/10.1037/0021-843X.109.3.403

American Psychological Association. (2019, August). *Depression Assessment Instruments*. https://www.apa.org/depression-guideline/assessment

Anderson, A. K., & Phelps, E. A. (2001). Lesions of the human amygdala impair enhanced perception of emotionally salient events. *Nature*, *411*(6835), 305–309. https://doi.org/10.1038/35077083

Aryani, A., Hsu, C., & Jacobs, A. M. (2019). Affective iconic words benefit from additional sound–meaning integration in the left amygdala. *Human Brain Mapping*, *40*(18), 5289–5300. https://doi.org/10.1002/hbm.24772

Bagge, C. L., Lamis, D. A., Nadorff, M., & Osman, A. (2014). Relations Between Hopelessness, Depressive Symptoms and Suicidality: Mediation by Reasons for Living: Reasons for Living as a Mediator. *Journal of Clinical Psychology*, *70*(1), 18–31. https://doi.org/10.1002/jclp.22005

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *Journal of Affective Disorders*, *173*, 90–96. https://doi.org/10.1016/j.jad.2014.10.054

Bertha, E. A., & Balázs, J. (2013). Subthreshold depression in adolescence: A systematic review. *European Child & Adolescent Psychiatry*, *22*(10), 589–603. https://doi.org/10.1007/s00787-013-0411-0

Beshai, S., Dobson, K. S., Adel, A., & Hanna, N. (2016). A Cross-Cultural Study of the Cognitive Model of Depression: Cognitive Experiences Converge between Egypt and Canada. *PLOS ONE*, *11*(3), e0150699. https://doi.org/10.1371/journal.pone.0150699

Bradley, M.M. & Lang, P.J. (2017). Affective Norms for English Words (ANEW): Instruction manual and affective ratings. Technical Report C-3. Gainesville, FL:UF Center for the Study of Emotion and Attention.

Bravo, A. J., Pearson, M. R., Stevens, L. E., & Henson, J. M. (2016). Depressive Symptoms and Alcohol-Related Problems Among College Students: A Moderated-Mediated Model of

Mindfulness and Drinking to Cope. *Journal of Studies on Alcohol and Drugs*, *77*(4), 661–666. https://doi.org/10.15288/jsad.2016.77.661

Buchanan, T. W. (2007). Retrieval of emotional memories. *Psychological Bulletin*, *133*(5), 761–779. https://doi.org/10.1037/0033-2909.133.5.761

Burcusa, S. L., & Iacono, W. G. (2007). Risk for recurrence in depression. *Clinical Psychology Review*, *27*(8), 959–985. https://doi.org/10.1016/j.cpr.2007.02.005

Christopher, G., & MacDonald, J. (2005). The impact of clinical depression on working memory. *Cognitive Neuropsychiatry*, *10*(5), 379–399. https://doi.org/10.1080/13546800444000128

Conway, M. A. (2005). Memory and the self. *Journal of Memory and Language*, *53*(4), 594–628. https://doi.org/10.1016/j.jml.2005.08.005

Denny, B. T., Ochsner, K. N., Weber, J., & Wager, T. D. (2014). Anticipatory brain activity predicts the success or failure of subsequent emotion regulation. *Social Cognitive and Affective Neuroscience*, *9*(4), 403–411. https://doi.org/10.1093/scan/nss148

Downs, M. F., & Eisenberg, D. (2012). Help Seeking and Treatment Use Among Suicidal College Students. *Journal of American College Health*, *60*(2), 104–114. https://doi.org/10.1080/07448481.2011.619611

Dunn, B. D. (2012). Helping Depressed Clients Reconnect to Positive Emotion Experience: Current Insights and Future Directions. *Clinical Psychology & Psychotherapy*, *19*(4), 326–340. https://doi.org/10.1002/cpp.1799

Ebner, N., Riediger, M., & Lindenberger, U. (2010). FACES—A database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behavior research Methods, 42*, 351-362. doi:10.3758/BRM.42.1.351.

Eisenberg, D., Golberstein, E., & Gollust, S. E. (2007). Help-Seeking and Access to Mental Health Care in a University Student Population: *Medical Care*, *45*(7), 594–601. https://doi.org/10.1097/MLR.0b013e31803bb4c1

Eisenberg, D., Golberstein, E., & Hunt, J. B. (2009). Mental Health and Academic Success in College. *The B.E. Journal of Economic Analysis & Policy*, *9*(1). https://doi.org/10.2202/1935-1682.2191

Farina, F. R., Barry, T. J., Damme, I., Hie, T., & Raes, F. (2019). Depression diagnoses, but not individual differences in depression symptoms, are associated with reduced autobiographical memory specificity. *British Journal of Clinical Psychology*, *58*(2), 173–186. https://doi.org/10.1111/bjc.12207

Ferri, J., Eisendrath, S. J., Fryer, S. L., Gillung, E., Roach, B. J., & Mathalon, D. H. (2017). Blunted Amygdala Activity is Associated with Depression Severity in Treatment-Resistant Depression. *Cognitive, Affective & Behavioral Neuroscience*, *17*(6), 1221–1231. https://doi.org/10.3758/s13415-017-0544-6

Gaddy, M. A., & Ingram, R. E. (2014). A meta-analytic review of mood-congruent implicit memory in depressed mood. *Clinical Psychology Review*, *34*(5), 402–416. https://doi.org/10.1016/j.cpr.2014.06.001

Gillund, G. (2012). Episodic Memory. In V. S. Ramachandran (Ed.), *Encyclopedia of Human Behavior (Second Edition)* (pp. 68–72). Academic Press. https://doi.org/10.1016/B978-0-12-375000-6.00152-X

Gotlib, I. H., & Joormann, J. (2010). Cognition and Depression: Current Status and Future Directions. *Annual Review of Clinical Psychology*, *6*(1), 285–312. https://doi.org/10.1146/annurev.clinpsy.121208.131305

Hankin, B. L., Gibb, B. E., Abela, J. R. Z., & Flory, K. (2010). Selective attention to affective stimuli and clinical depression among youth: Role of anxiety and specificity of emotion. *Journal of Abnormal Psychology*, *119*(3), 491–501. https://doi.org/10.1037/a0019609

Hunt, G. E., Malhi, G. S., Lai, H. M. X., & Cleary, M. (2020). Prevalence of comorbid substance use in major depressive disorder in community and clinical settings, 1990–2019: Systematic review and meta-analysis. *Journal of Affective Disorders*, *266*, 288–304. https://doi.org/10.1016/j.jad.2020.01.141

Hysenbegasi, A., Hass, S. L., & Rowland, C. R. (2005). The Impact of Depression on the Academic Productivity of University Students. *J Ment Health Policy Econ*, 7.

Jiang, C., Mitran, A., Miniño, A., & Ni, H. (2019, June 1). *Products - Health E Stats - Racial and Gender Disparities in Suicide Among Young Adults Aged 18–24: United States, 2009–2013*. https://www.cdc.gov/nchs/data/hestat/suicide/racial_and_gender_2009_2013.htm

Kensinger, E. A., & Schacter, D. L. (2006). Processing emotional pictures and words: Effects of valence and arousal. *Cognitive, Affective, & Behavioral Neuroscience*, *6*(2), 110–126. https://doi.org/10.3758/CABN.6.2.110

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime Prevalence and Age-of-Onset Distributions of DSM-IV Disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 593. https://doi.org/10.1001/archpsyc.62.6.593

Kisch, J., Leino, E. V., & Silverman, M. M. (2005). Aspects of Suicidal Behavior, Depression, and Treatment in College Students: Results from the Spring 2000 National College Health Assessment Survey. *Suicide and Life-Threatening Behavior*, *35*(1), 3–13. https://doi.org/10.1521/suli.35.1.3.59263

Koppers, D., Kool, M., Van, H., Driessen, E., Peen, J., & Dekker, J. (2019). The effect of comorbid personality disorder on depression outcome after short-term psychotherapy in a randomised clinical trial. *BJPsych Open*, *5*(4), e61. https://doi.org/10.1192/bjo.2019.47

Langeslag, S. J. E., Gootjes, L., & van Strien, J. W. (2018). The effect of mouth opening in emotional faces on subjective experience and the early posterior negativity amplitude. *Brain and Cognition*, *127*, 51–59. https://doi.org/10.1016/j.bandc.2018.10.003

Lee, K., Hutton, H. E., Lesko, C. R., Monroe, A. K., Alvanzo, A., McCaul, M. E., & Chander, G. (2018). Associations of Drug Use, Violence, and Depressive Symptoms with Sexual Risk Behaviors Among Women with Alcohol Misuse. *Women's Health Issues*, *28*(4), 367–374. https://doi.org/10.1016/j.whi.2018.04.004

Lewinsohn, P. M., Seeley, J. R., Roberts, R. E., & Allen, N. B. (1997). Center for Epidemiologic Studies Depression Scale (CES-D) as a screening instrument for depression among community-residing older adults. *Psychology and Aging*, *12*(2), 277–287. https://doi.org/10.1037/0882-7974.12.2.277

Liu, C. H., Stevens, C., Wong, S. H. M., Yasui, M., & Chen, J. A. (2019). The prevalence and predictors of mental health diagnoses and suicide among U.S. college students: Implications for addressing disparities in service use. *Depression and Anxiety*, *36*(1), 8–17. https://doi.org/10.1002/da.22830

Mac Giollabhui, N., Hamilton, J. L., Nielsen, J., Connolly, S. L., Stange, J. P., Varga, S., Burdette, E., Olino, T. M., Abramson, L. Y., & Alloy, L. B. (2018). Negative cognitive style interacts with negative life events to predict first onset of a major depressive episode in adolescence via hopelessness. *Journal of Abnormal Psychology*, *127*(1), 1–11. https://doi.org/10.1037/abn0000301

Mahmoud, J. S. R., Staten, R. "Topsy," Hall, L. A., & Lennie, T. A. (2012). The Relationship among Young Adult College Students' Depression, Anxiety, Stress, Demographics, Life Satisfaction, and Coping Styles. *Issues in Mental Health Nursing*, *33*(3), 149–156. https://doi.org/10.3109/01612840.2011.632708

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology*, *1*(1), 167–195. https://doi.org/10.1146/annurev.clinpsy.1.102803.143916

Meins, E., McCarthy-Jones, S., Fernyhough, C., Lewis, G., Bentall, R. P., & Alloy, L. B. (2012). Assessing negative cognitive style: Development and validation of a Short-Form version of the Cognitive Style Questionnaire. *Personality and Individual Differences*, *52*(5), 581–585. https://doi.org/10.1016/j.paid.2011.11.026

Michalowski, J. M., Melzig, C. A., Weike, A. I., Stockburger, J., Schupp, H. T., & Hamm, A. O. (2009). Brain dynamics in spider-phobic individuals exposed to phobia-relevant and other emotional stimuli. *Emotion*, *9*(3), 306–315. https://doi.org/10.1037/a0015550

Michalowski, J. M., Pané-Farré, C. A., Löw, A., & Hamm, A. O. (2015). Brain dynamics of visual attention during anticipation and encoding of threat- and safe-cues in spider-phobic individuals. *Social Cognitive and Affective Neuroscience*, *10*(9), 1177–1186. https://doi.org/10.1093/scan/nsv002

Pedrelli, P., Nyer, M., Yeung, A., Zulauf, C., & Wilens, T. (2015). College Students: Mental Health Problems and Treatment Considerations. *Academic Psychiatry*, *39*(5), 503–511. https://doi.org/10.1007/s40596-014-0205-9

Platt, B., Waters, A. M., Schulte-Koerne, G., Engelmann, L., & Salemink, E. (2017). A review of cognitive biases in youth depression: Attention, interpretation and memory. *Cognition and Emotion*, *31*(3), 462–483. https://doi.org/10.1080/02699931.2015.1127215

Sanchez, A., Romero, N., & De Raedt, R. (2017). Depression-related difficulties disengaging from negative faces are associated with sustained attention to negative feedback during social evaluation and predict stress recovery. *PLoS ONE*, *12*(3). https://doi.org/10.1371/journal.pone.0175040

Schlarb, A., Friedrich, A., & Claßen, M. (2017). Sleep problems in university students—An intervention. *Neuropsychiatric Disease and Treatment*, *Volume 13*, 1989–2001. https://doi.org/10.2147/NDT.S142067

Soares, A. P., Comesaña, M., Pinheiro, A. P., Simões, A., & Frade, C. S. (2012). The adaptation of the Affective Norms for English Words (ANEW) for European Portuguese. *Behavior Research Methods*, *44*(1), 256–269. https://doi.org/10.3758/s13428-011-0131-7

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*(6), 643–662. https://doi.org/10.1037/h0054651

Surguladze, S. A., El-Hage, W., Dalgleish, T., Radua, J., Gohier, B., & Phillips, M. L. (2010). Depression is associated with increased sensitivity to signals of disgust: A functional magnetic resonance imaging study. *Journal of Psychiatric Research*, *44*(14), 894–902. https://doi.org/10.1016/j.jpsychires.2010.02.010

Teasdale, J. D., & Green, H. A. C. (2004). Ruminative self-focus and autobiographical memory. *Personality and Individual Differences*, *36*(8), 1933–1943. https://doi.org/10.1016/j.paid.2003.08.022

The American College Health Association. (2012). American College Health Association-National College Health Assessment II: Reference Group Executive Summary Fall 2011. Hanover, MD: American College Health Association.

The National Institute of Mental Health. (2018). *NIMH-Depression*. Retrieved December 27, 2020, https://www.nimh.nih.gov/health/topics/depression/index.shtml

Trapnell, P. D., & Campbell, J. D. (1999). Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. *Journal of Personality and Social Psychology*, *76*(2), 284–304. https://doi.org/10.1037/0022-3514.76.2.284

Tyng, C. M., Amin, H. U., Saad, M. N. M., & Malik, A. S. (2017). The Influences of Emotion on Learning and Memory. *Frontiers in Psychology*, *8*, 1454. https://doi.org/10.3389/fpsyg.2017.01454

Vanderveren, E., Bijttebier, P., & Hermans, D. (2017). The Importance of Memory Specificity and Memory Coherence for the Self: Linking Two Characteristics of Autobiographical Memory. *Frontiers in Psychology*, *8*, 2250. https://doi.org/10.3389/fpsyg.2017.02250

Walters, K. S., Bulmer, S. M., Troiano, P. F., Obiaka, U., & Bonhomme, R. (2018). Substance Use, Anxiety, and Depressive Symptoms Among College Students. *Journal of Child & Adolescent Substance Abuse*, *27*(2), 103–111. https://doi.org/10.1080/1067828X.2017.1420507

Williams, J. M. G., Barnhofer, T., Crane, C., Herman, D., Raes, F., Watkins, E., & Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder. *Psychological Bulletin*, *133*(1), 122–148. https://doi.org/10.1037/0033-2909.133.1.122

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1988). *Cognitive psychology and emotional disorders.* (pp. ix, 226). John Wiley & Sons.

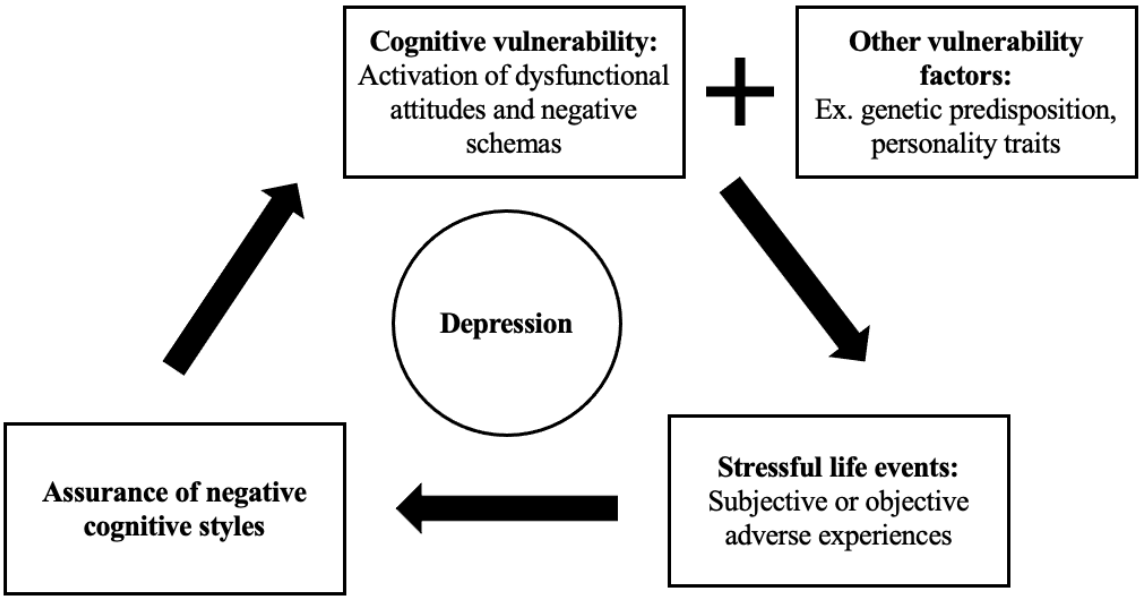
Zhong, M., Wang, X., Xiao, J., Yi, J., Zhu, X., Liao, J., Wang, W., & Yao, S. (2011). Amygdala hyperactivation and prefrontal hypoactivation in subjects with cognitive vulnerability to depression. *Biological Psychology*, *88*(2–3), 233–242. https://doi.org/10.1016/j.biopsycho.2011.08.007

Table 1

Demographic Characteristics of Participants

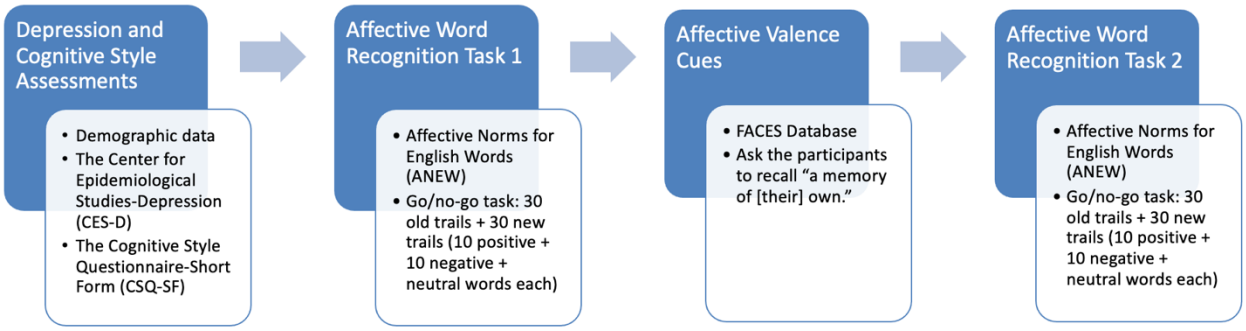
	Num of Participants (N =20)
Gender (Mage = 19, SD = .973)	
Male	9 (45%)
Female	11 (55%)
Race/Ethnicity	
White/Caucasian	15 (75%)
Black or African American	3 (15%)
Asian or Asian American	2 (10%)
Middle Eastern	1 (5%)
Depression History	
Clinical depression	6 (30%)
"Unsure"	1 (5%)
No depression history	13 (65%)
Current Treatment (if applicable)	
Antidepressants	4 (20%)
Psychiatric medication	2 (10%)
Psychotherapy	7 (35%)
History of serious head injury	
Concussion	4 (20%)
Depression status	
CES-D >= 16	8 (40%)
CES-D < 16	12 (60%)

Figure 1



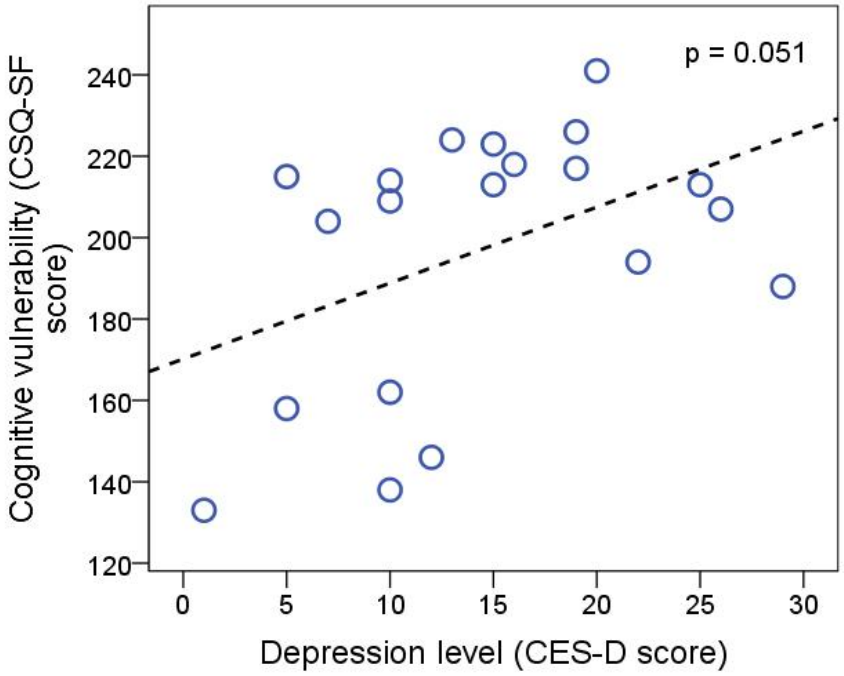
Note. A developmental model of depression based on the CV models of depression.

Figure 2



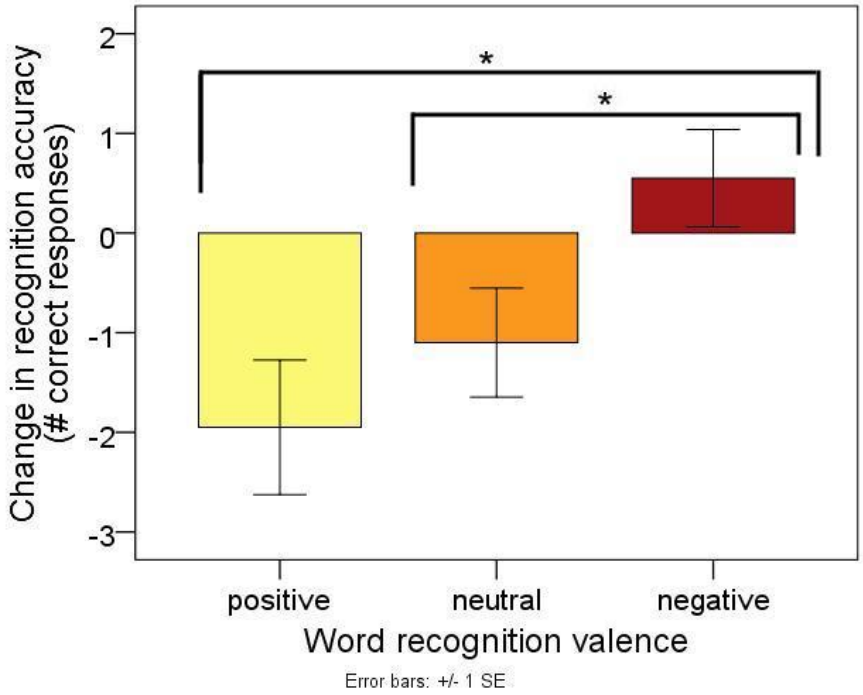
Note. Study design and procedure.

Figure 3



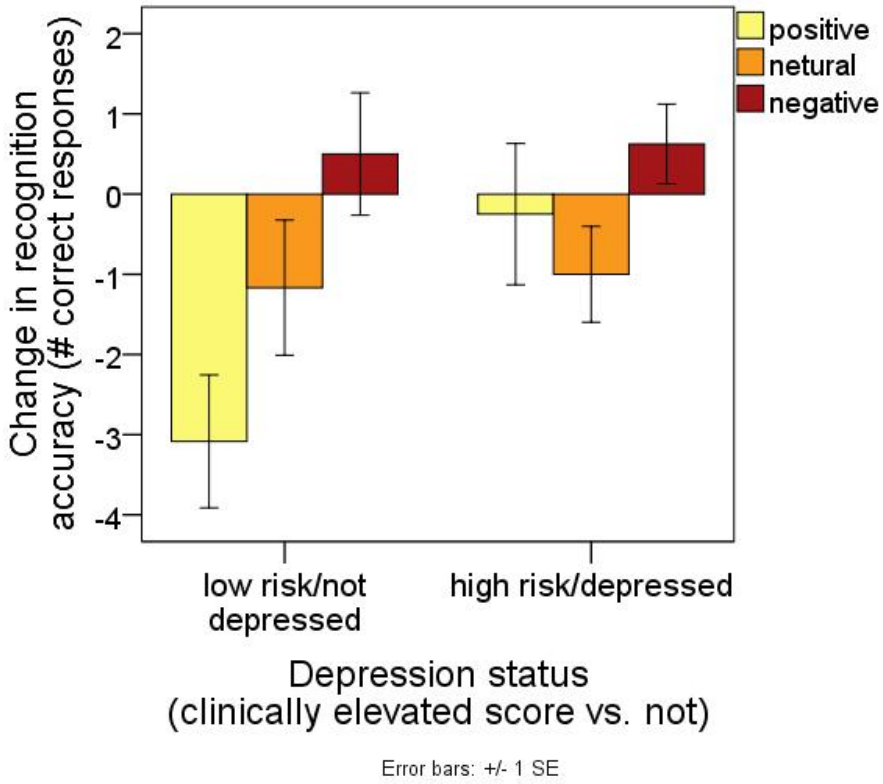
Note. Correlation between depression level and cognitive vulnerability ($r = .44$, $p = .051$)

Figure 4



Note. Main effect of word valence on changed performance (+/- *SE*). Comparison is significant at the 0.05 level (2-tailed)

Figure 5



Note. Nonsignificant effect of word valence X depression status on changed performance (+/- 1*SE*)