Impairment or underestimation? Negative illusory bias in depressive symptoms and theory of mind

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Impairment or underestimation? Negative illusory bias in depressive symptoms and theory of mind

Jaclyn Boyer

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Abstract

Theory of Mind (ToM) is the social-cognitive skill of attributing beliefs, feelings, and intentions to others in order to predict their future behavior. Past research on ToM and depression is quite ambiguous; some studies have found significant impairment of ToM performance in depressed individuals, while others have found that depressed individuals perform better than those without depression. The purpose of the study was to clarify this ambiguity by considering the phenomenon of negative illusory bias (NIB) as a potential mediating variable. NIB refers to the tendency of competent individuals to underestimate their abilities. Therefore, along with measures of ToM and depression symptomology, the present study composed and administered original measures of NIB in an attempt to capture the interplay of these three concepts. All 13 participants in the study were Butler undergraduate students. While the original hypothesis was not supported by a mediational analysis, the data revealed significant relationships between depressive symptomology and performance assessment. Limitations of the study and implications for future research are discussed.

Keywords: depression, Theory of Mind, negative illusory bias, performance, college students
INTRODUCTION

Theory of Mind and Depression

The social world of humans is highly complex. Fortunately, social-cognitive skills, such as Theory of Mind (ToM), enable individuals to better navigate their social worlds. ToM refers to the ability to attribute specific mental states (beliefs, feelings, desires, and intentions) to others, and then use these attributed mental states to predict others’ behavior (Premack & Woodruff, 1978). Like any trait, ToM ability varies from person to person. Further, the literature has demonstrated that many groups suffer from deficits in ToM ability, including those with autistic spectrum disorders (Baron-Cohen, 1995), psychotic disorders (Kettle, et al., 2008), and eating disorders (Russell et al., 2009). In addition to these psychiatric disorders, research suggests that those with mood disorders also experience deficits in ToM ability, although the research is limited (Wolkenstein et al., 2011). The limited research has resulted in a rather ambiguous understanding of the relationship between mood disorders such as depression and ToM ability. Therefore, the goal of the present study is to help clarify some of the ambiguity by considering the role negative illusory bias may play in the relationship between depression and ToM.

The current literature on depression has revealed that depressed individuals have poorer social functioning than non-depressed individuals, due to social cognition deficits (Weightman et al., 2014). Depressed individuals, then, have shown deficits in higher-order social cognition, such as ToM. However, because ToM is a multifactorial trait, research suggests that depressed individuals may not perform poorly on all aspects of ToM (Wang, et al., 2008). There are two major aspects of ToM, the social-perceptual (decoding of mental states based on observable information), and the social-cognitive (reasoning about mental states in order to predict future
behavior; Wang, et al., 2008). Past research has found that depressed individuals do not always perform poorly on ToM tasks involving the social-perceptual aspect. Specifically, social-perceptual ToM is often measured by the Reading the Mind in the Eyes Test (RMET; Baron-Cohen et al., 2001). Participants are presented with pictures of various facial expressions that are cropped to only show the photo’s eyes. Participants are then asked to identify the emotions of the people in the pictures. Using the RMET, Kettle et al. (2008) failed to find a significant difference in decoding ability between depressed individuals and the community control group. Additionally, Wolkenstein et al. (2011) found that depressed subjects were significantly more accurate in decoding negative stimuli on the RMET than healthy controls. The RMET performance of participants with depressive symptoms in these two studies demonstrates a lack of impairment in this aspect of ToM. Additionally, Bourke et al.’s (2010) study on the interpretation of facial expressions of emotion found that depressed individuals possess a significant selective attention towards sad facial expressions while away from happy expressions. Although the differences in the severity of depression may account for differences in performance on the decoding ToM tasks, even individuals with mild forms of depression performed significantly different than healthy individuals (Cusi et al., 2013). Therefore, the literature suggests that individuals displaying depressed symptoms, although they may possess selective bias, are still capable of decoding mental states.

Converse et al. (2008) looked at the relationship between mood and the social-cognitive aspect of ToM. This aspect of ToM differs from the social-perceptual aspect in that, instead of inferring another’s mental state from a visual cue, social-cognitive ToM gauges whether an individual can distinguish their own perspective from someone else’s (Wellman, 2014). This requires inference and perspective-taking, which are often influenced by incidental mood
(Converse et al., 2008). In the first experiment of the study, Converse et al. (2008) used music to deliberately induce a sad or happy mood in participants, and then had them complete the false-belief task. The false-belief task is used to assess social-cognitive ToM, whether one can distinguish between what they know and what others know (Converse et al., 2008). The results revealed that individuals in the happy condition were significantly less likely to employ ToM than those in the sad condition (Converse et al., 2008). In the second experiment, participants played a communication game to evaluate egocentric interference. An accurate interpretation of communication requires the use of ToM to consider another’s beliefs and perception (Converse et al., 2008). However, one’s own beliefs, knowledge, and perception can interfere in their ability to grasp a critical difference in perspective, thus making them less likely to employ ToM. The results showed that participants in the happy condition behaved more egocentrically, meaning they were less likely to consider another’s perspective, but instead relied heavily on their selective perspective (Converse et al., 2008). In general, the study is important, because it suggests that happiness relies on egocentric default in inferring about others, while sadness incorporates knowledge about others more deliberately by the employment of ToM (Converse et al., 2008, p. 729).

Despite studies that have found little to no impairment in the performance of depressed individuals on the two separate domains of ToM (decoding and reasoning), it is important to note that there are also a number of studies that have found significant impairments in performance (Ladegaard, et al., 2014; Bora & Berk, 2016; Wang et al., 2018). Although the inconsistency in findings may be due to the lack of reliability in past ToM measurements (Martin et al., 2017), the purpose of the present study is to clarify some of the inconsistencies by examining theoretical explanations of depressed individuals’ ambiguous performances on ToM tasks. Specifically, this
study aims to look at the role self-concept and egocentrism plays in depressed individuals’ ability to perform on ToM tasks. A particularly interesting finding in the literature, is how well depressed individuals do on the perspective-taking task, compared to a non-depressed control group (Ferguson & Cane, 2017). The perspective-taking task is often used to measure the social-cognitive domain of ToM. Harkness et al. (2010) found that, despite the inconsistencies in the findings, in general, depressed individuals tend to perform more poorly in this domain compared to the social-perceptual domain. That is, depressed individuals are better able to decode or “take the perspective” of another in a sad mood, compared to non-depressed individuals, but they often fail to explain or predict future behavior of those same individuals (Harkness et al., 2010). By examining self-concept through the phenomenon of negative illusory bias, the present study aims to further the understanding of this finding.

**Negative Illusory Bias**

Depression, more specifically, major depressive disorder (MDD) is marked by symptoms, such as low mood, social withdrawal, rumination, or concern with negative self-views and feelings of worthlessness (American Psychiatric Association, 2013). Past research has found that the negative self-concept depressed individuals hold of themselves can produce cognitive distortions that, “impact cognitive tasks by modulating negative expectations of performance,” which in turn directly impact the cognitive process (Ferguson & Cane, 2017, p. 10). While the research on how exactly negative ruminations affect cognitive tasks is inconclusive, the current topic of research has revealed that depression alone may not impair ToM performance, but rather difficulties in performance stem from individuals that hold existing negative expectations of their performance (Ferguson & Cane, 2017).
Typically, the phenomenon of negative illusory bias is related more to academic or occupational performance, but exploring negative illusory bias in the context of ToM may add to the current literature. Negative illusory bias is a relatively new term within the field, so there is limited research on this particular phenomenon. Negative illusory bias is typically discussed in relation to its more researched counterpart, positive illusory bias. Positive illusory bias refers to the idea that children with externalizing behavior patterns, such as aggression or ADHD, maintain an overall positive view of themselves despite contrasting external information (Gresham et al., 1998). Owens et al.’s (2007) review of self-perceptions in children with ADHD found that despite social, academic, and behavioral impairments, children with ADHD tend to overestimate their own competence in these same domains. More pertinent to the current study, Hoza et al. (2004) examined the influence of comorbid depression on self-perceptions of children with ADHD. By comparing self-perception patterns across three groups (children with ADHD and comorbid depression, children with ADHD but without depressive symptoms, and non-impaired control) they found that children with ADHD but without depressive symptoms overestimated their competence significantly more than children with ADHD and depression (Hoza et al., 2004). Therefore, the research on self-perceptions in children with ADHD suggests that depressive symptoms mitigate positive illusory bias to more modest self-evaluations (Owens et al., 2007).

In contrast, negative illusory bias refers to the trend of competent children underestimating their abilities, and thus, avoiding challenging tasks that they are likely to succeed in (Harter, 1983). Gresham et al. (1998) compared positive and negative illusory bias in children by measuring how a group of children rated themselves and how others rated them across academic and social self-concept domains. In regards to the academic domain, the study
did not find significant differences in discrepancies of self and other ratings between the positive illusory bias and negative illusory bias groups (Gresham et al., 1998). In the social domain, however, the results revealed that children in the negative illusory bias group (more than two standard deviations discrepancy) scored themselves relatively low on the Social Skills Rating System (SSRS) even though peers viewed them as, “desirable playmates” (Gresham et al., 1998, p. 157). Therefore, because research suggests that negative illusory bias plays a role in the social domain, it may influence performance on ToM tasks. Additionally, Gresham et al. (1998) found that the negative nondiscrepant group of children was the most at-risk group for a variety of negative outcomes, such as learned helplessness and the later development of depression. Similarly, the research notes that when an individual’s low self-concept is inconsistent with external appraisals, it suggests that the individual is too self-critical or possesses a negative self-view, which is a hallmark of depression (Gresham et al., 1998). Although there is limited research on negative illusory bias among adults, depression, and ToM, the current study was conducted with the intent to pursue the topic in these particular realms, because there are obvious connections that warrant exploration.

**Purpose of the Present Study**

In general, the literature on the relationship between depression and ToM is inconsistent. The purpose of this study is to further our understanding of this complex relationship. While there are inconsistencies in the performance of depressed individuals on ToM tasks, a common finding of the research is that depressed individuals perform better on the social-perceptual tasks, as opposed to the social-cognitive tasks. Therefore, it seems that depressed individuals may not be as impaired as initially thought. I hypothesize that some of the perceived impairment of depressed individuals’ ToM performance is not necessarily due to cognitive impairments, but
rather underestimations of ToM skills. Specifically, the study’s hypothesis is that negative illusory bias mediates the relationship of depression and ToM, influencing the process of performance on specific ToM tasks.

**METHOD**

**Participants**

Following IRB approval, the present study utilized Butler University’s online undergraduate research and participant program, SONA, in order to draw participants from the student population. The sample consisted of 13 participants (N=13), and tables 1.1-1.6 summarize their demographic information. The tables include information about the participants’ gender, age, racial/ethnic background, year in school, major, hours of sleep, and any diagnosed mental disorders. All participants were full-time undergraduate students and single. Students choosing to participate in the study were asked to sign an informed consent form (see Appendix A). Throughout the steps of the study, participants’ information was kept confidential. Finally, once the study was completed, participants were debriefed and given the opportunity to ask questions and voice any concerns.

**Materials**

The materials in this study were used to measure the three main factors examined in this study: depression, ToM, and negative illusory bias. The materials used were based on those shown to be reliable and valid within the previous literature.

**Center for Epidemiological Studies – Depression** (CES-D; Radloff, 1977). The CES-D is designed to measure depressive symptomatology in the general public and does not measure the presence of Major Depressive Disorder. The CES-D presents a series of 20 statements and asks
the participant to indicate how they felt in relation to these statements on a Likert scale (Radloff, 1977).

**The Revised Hinting Task** (Martin et al., 2017). This is a frequently used measure of the social-cognitive aspect of ToM, or the ability of individuals to make correct inferences about another’s meaning when they do not explicitly say what they mean. During the administration of the Hinting Task, participants hear a short story about two people. One person says something with intended meaning to hint at what they want the other person to do. After the story is read, participants are asked to explain what the character directing the hint really means. If the participant gets the intended meaning correct, they receive a score of 2. If the experimenter has to read a second prompt and the participant then gets that correct, they receive a score of 1. If the participant does not get either prompt correct, they receive a score of 0. There are various versions of the Hinting Task, but this study used Martin et al.’s (2017) version with 42 stories. Therefore, participants could score between 0-84.

**Reading the Mind in the Eyes Test** (RMET; Baron-Cohen et al., 2001). The RMET measures the social-perceptual domain of ToM. Participants receive a packet consisting of 36 cropped photos showing just individuals’ eyes. There are four adjectives included with each photo and participants are instructed to circle which word best describes the mental state of the individual in the photo. If the participant chooses the correct adjective, they receive a score of 1, and if they choose incorrectly they receive a 0, producing a possible range of 0-36.

**The Negative Illusory Bias Index (NIBI).** Given the very limited research on NIB, measures were developed using available positive illusory bias measures and conceptually inverting the items on those measures, so to measure the opposite phenomenon. The NIBI consisted of two performance assessment questionnaires and three additional tests along with the Shipley-2 IQ
test (Shipley, Gruber, Martin & Kline, 2009). The three other tests measured a variety of skills, such as general mathematics, spatial, and emotion recognition abilities (see Appendix B). The NIBI was composed in order to measure the process of performance. The prospective performance assessment questionnaire was used to gather an overall sense of performance ability participants believed they possessed before taking a series of tests. The four different tests were intended to actually capture the participants’ performance abilities. And finally, the retrospective performance assessment questionnaire was used to measure participants’ sense of performance ability after taking the tests.

**Demographic Questionnaire.** In order to describe the sample of participants and identify any possible and notable trends in the data, participants were asked to report gender, age, race, year in school, academic major, G.P.A., and sleep data.

**Procedure**

Once participants entered the lab, they were greeted by an experimenter who gave them the informed consent form to look over and sign if they chose to participate in the study. In order to ensure confidentiality, participants were assigned a random number to collate their data; no participant names were used on any data. Participants then completed the various measurements discussed above (CES-D, Hinting Task, RMET, NIBI, etc.). After the participant finished the RMET, the NIBI was administered using the procedure outlined in Appendix C. At the end of the study, participants were debriefed and given contact information if they wished to ask questions or voice concerns. The study used the data to conduct both correlational and mediational analyses in order to establish any significant mediating effects of NIB on the Depression-ToM relationship.
RESULTS

Descriptive Statistics

The descriptive statistics for this study can be found in Table 2. The table displays the maximum, minimum, mean, and standard deviation of the primary variables of interest (CES-D, Hinting Task, RMET, and NIBI). On average, the participants reported a low CES-D total score ($M=10.54$), yet high variation in scores ($SD=10.56$). The participants also performed moderately on the revised hinting task ($M=56.00$, $SD=9.48$), and RMET ($M=27.54$, $SD=3.73$). In terms of the NIBI, participants performed best on the emotion recognition test ($M=4.08$, $SD=0.49$), and performed the weakest on the math test ($M=2.08$, $SD=1.19$). Finally, on average, the participants rated their overall performance on the prospective questionnaire moderately high ($M=43.85$, $SD=7.53$), and their overall performance on the retrospective questionnaire lower than on the prospective questionnaire ($M=39.38$, $SD=10.18$).

Correlational Results

Table 3 displays the correlations between the variables of interest (CES-D, Hinting Task, RMET, and NIBI). Following analysis, at the 0.05 level of significance, the data showed a moderate positive correlation between the math test total score and the spatial test total score, $r=+0.596$ ($N=13$), a moderate positive correlation between the RMET total score and the emotion recognition test total score, $r=+0.609$ ($N=13$), and a moderate positive correlation between spatial test total score and IQ total score, $r=+0.558$ ($N=13$). At the 0.01 level of significance, the data showed a very strong positive correlation between the prospective questionnaire and retrospective questionnaire, $r=+0.909$ ($N=13$). Additionally, at the 0.01 level of significance, the data showed very strong negative correlations between the CES-D total score and the
prospective and retrospective questionnaires, \( r = -0.817 \) (N=13), and \( r = -0.863 \) (N=13), respectively.

**Mediational Results**

A standard mediational analysis was conducted to determine whether NIB mediated the effect of depressive symptomology on ToM performance. The Hayes (2017) PROCESS model of mediation was conducted with CES-D total score as the IV, prospective and retrospective performance assessments as the mediators, and revised hinting task total score as the outcome variable (see figure 1). The data revealed the path from CES-D total score to prospective performance assessment to be negative and statistically significant (\( b = -0.5824, SE = 0.1237, p < 0.001 \)). Additionally, the path from CES-D total score to retrospective performance assessment was negative, significant, and stronger than the path between CES-D and prospective performance assessment (\( b = -0.8316, SE = 0.1467, p < 0.001 \)). This suggests that those who reported higher CES-D total scores, experiencing more depressive symptomology, rated their performance as low before a series of tests, and even lower after taking the tests.

Next, the path from CES-D total score to the outcome variable, revised hinting total score was positive but not significant (\( b = +0.3769, SE = 0.5675, p = 0.5232 \)). The path from the first mediator, prospective performance assessment, to the ToM measure (revised hinting total score) was negative but not significant (\( b = -0.6411, SE = 0.9663, p = 0.5237 \)). The path from the second mediator, retrospective performance assessment, to the ToM measure was positive but not significant (\( b = +0.7558, SE = 0.8151, p = 0.3779 \)). The indirect effect of ToM performance via prospective performance assessment (IE= +0.3734) was positive and nonsignificant: 95%CI= (-0.9701, 1.6834). The indirect effect of ToM performance via retrospective performance
assessment (IE= -0.6286) was negative and nonsignificant: 95%CI= (-2.2184, 0.8379). Based on the discovery that the relationship between X→Y was not significant, and that the mediating effects were also not significant, the hypothesis that NIB mediates the Depression-ToM relationship was not supported.

I also conducted a mediational analysis on the NIBI tests (IQ, math, spatial, and emotion recognition) to investigate if there were any significant relationships between CES-D as the IV, prospective and retrospective performance assessments as the mediators, and scores on the various tests as the outcome variables (see figure 2). The data revealed a positive but nonsignificant direct effect of CES-D total score on the math test total score (DE= +0.5663, p= 0.7103), so there was no established mediation. Additionally, the data revealed a positive but nonsignificant direct effect of CES-D total score on the spatial test total score (DE= +0.0984, p= 0.1319), so again, no mediation could be established. The data also showed a negative but nonsignificant direct effect of CES-D total score on the emotion recognition test total score (DE= -0.0203, p= 0.4362). Finally, (see figure 3) the data showed a positive and significant direct effect of CES=D total score on the IQ test total score (DE= +2.1684, p= 0.0081). The indirect effect of IQ test performance via prospective performance assessment (IE= +0.7675) was positive and nonsignificant: 95%CI= (-0.5811, 2.6226). The indirect effect of IQ test performance via retrospective performance assessment was (IE= -2.5912) was negative and significant: 95%CI= (-4.9615, -0.4413).

**DISCUSSION**

Existing research on the relationship between depression and ToM is inconsistent, with some studies suggesting individuals with depressive symptoms perform worse on ToM tasks
compared to the general population, and other studies suggesting the contrary. Therefore, the current study was conducted to add insight into some of the discrepancies by considering how a cognitive phenomenon - the negative illusory bias - may mediate the Depression-ToM relationship. The hypothesis was that NIB mediated the relationship between depression and ToM. However, no significant mediation was found. This is not surprising considering there were several limitations to the study.

First, the data collection process was cut short due to the COVID-19 pandemic. Consequentially, the sample size was extremely small (N=13), especially for a study assessing subclinical levels of depression. Additionally, the study was very homogeneous, with 92.3% of participants identifying as female, 92.3% identifying as white, and the age range being from 19-22 years. Thus, the sample is not representative of the entire population. Another significant limitation was the very low level of depressive symptomology found in the sample. Therefore, the sample most likely did not adequately capture the general effect of depression on ToM ability, as depressive symptomology was not prominent. Finally, another limitation may be due to the inability of the NIBI to accurately capture the NIB phenomenon. The NIBI was constructed to assess individuals’ beliefs about, and self-confidence, in their general test-taking abilities, not specifically in ToM tests. Therefore, future studies should look at improving the NIBI, or constructing their own, because the current literature on the phenomenon of NIB is almost nonexistent.

While the original hypothesis was not supported, a few significant and interesting relationships were discovered in additional analysis. First, although the direct effect between depression and ToM ability was not significant, depression was significantly correlated with both the prospective and retrospective performance assessments. The very strong negative correlation
between the CES-D total score and the prospective performance questionnaire suggested that the higher individuals scored on the CES-D, indicating greater depressive symptomology, the lower they tended to rate themselves on how they would perform on the various tests. Additionally, the correlation between the CES-D total score and the retrospective performance assessment was also negative but stronger than the correlation with the prospective performance assessment, meaning individuals tended to rate their performance as lower after taking the tests, compared to how they thought they would perform before the tests. This is interesting because it suggests a relationship between depressive symptomology and individual performance assessment. Specifically, the pattern may provide insight into the thinking of those with depressed symptomology, in that after taking a series of tests, without even knowing how they performed, they perceived their performance as being worse than before taking the test. Therefore, this shows an overall decrease in performance confidence. More research is needed in order to understand and identify the mechanisms that influence this relationship.

Additionally, various significant correlations between the tests suggest that the new tests of the NIBI captured what they were intended to measure. The moderate and positive correlation between the NIBI math test and spatial test means that those who performed well or poorly on the math test tended to perform the same on the spatial test. Therefore, both tests may measure similar abilities, so future studies should aim to either make the tests more distinguishable, or provide alternative tests to measure different abilities. Additionally, the NIBI emotion recognition test was positive and moderately correlated with the RMET, meaning performance on the emotion recognition test was similar to performance on the RMET. This is not surprising considering both tests are used to measure emotion recognition ability. Finally, the NIBI spatial
test and Shipley IQ test were positive and moderately correlated, meaning that those who performed well or poorly on the spatial test, tended to perform the same on the Shipley IQ test.

Finally, the additional mediation analysis - whether prospective and retrospective performance assessment mediated the relationship between CES-D total score and IQ total score - revealed that the retrospective performance assessment was the only significant mediator. This suggests that despite the positive effect between depressive symptomology and IQ score, how individuals felt about their performance on the tests after taking the tests had a negative indirect effect on the relationship. Future studies should focus on why this mediation relationship is significant.

While the current study failed to support the original hypothesis, significant correlations and mediations were discovered that warrant future research. Primarily, future research should continue to ask questions and seek answers that clear up the ambiguity and inconsistencies in the Depression-ToM literature. The current study did not look at how demographic variables, such as age, gender, and racial identity, may influence the various concepts, so future studies should consider this. Although the current study did not prove a significant effect of NIB on the Depression-ToM relationship, it did confirm a relationship between depressive symptomology and perceived performance on various tests. Therefore, future research should focus on considering the phenomenon of NIB as an important influencer or mediator. Given the limitations of the study, future research should pursue the Depression-NIB-ToM relationship by studying larger, more diverse, clinical samples.
REFERENCES


Table 1.1
*Age, GPA, Sleep*

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<td></td>
<td>Psychology, Criminology, Spanish</td>
<td>1</td>
<td>7.7</td>
<td>7.7</td>
<td>69.2</td>
</tr>
<tr>
<td></td>
<td>Psychology</td>
<td>4</td>
<td>30.8</td>
<td>30.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>13</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.6

*Psychological/Learning Disorder Diagnosis*

<table>
<thead>
<tr>
<th>Valid</th>
<th>Psychological/Learning Disorder Diagnosis</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADHD, anxiety, depression, mood disorder</td>
<td>1</td>
<td>7.7</td>
<td>7.7</td>
<td>76.9</td>
</tr>
<tr>
<td></td>
<td>Anxiety</td>
<td>1</td>
<td>7.7</td>
<td>7.7</td>
<td>84.6</td>
</tr>
<tr>
<td></td>
<td>Anxiety; mild-moderate depression</td>
<td>1</td>
<td>7.7</td>
<td>7.7</td>
<td>92.3</td>
</tr>
<tr>
<td></td>
<td>Depression/PTSD</td>
<td>1</td>
<td>7.7</td>
<td>7.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>13</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Participants were asked to list if they had ever been diagnosed with a psychological or learning disorder.
Table 2
Descriptive Statistics

<table>
<thead>
<tr>
<th>Measure</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
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</thead>
<tbody>
<tr>
<td>CES-D total score</td>
<td>13</td>
<td>.00</td>
<td>31.00</td>
<td>10.5385</td>
<td>10.56421</td>
</tr>
<tr>
<td>Revised Hinting Total Score</td>
<td>13</td>
<td>40.00</td>
<td>67.00</td>
<td>56.0000</td>
<td>9.47804</td>
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<tr>
<td>RMET Total Score</td>
<td>13</td>
<td>21.00</td>
<td>33.00</td>
<td>27.5385</td>
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<td>1.18754</td>
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<tr>
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<td>13</td>
<td>3.00</td>
<td>5.00</td>
<td>4.0769</td>
<td>.49355</td>
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<tr>
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<td>.00</td>
<td>5.00</td>
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<td>1.37747</td>
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<td>55.00</td>
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<td>7.52602</td>
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<td>13</td>
<td>18.00</td>
<td>56.00</td>
<td>39.3846</td>
<td>10.17790</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>13</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3

*Significant Correlations*

<table>
<thead>
<tr>
<th></th>
<th>Prospective Score</th>
<th>Retrospective Score</th>
<th>Spatial Score</th>
<th>RMET score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CES-D score</td>
<td>-0.817**</td>
<td>-0.863**</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Math score</td>
<td>--</td>
<td>--</td>
<td>0.596*</td>
<td>--</td>
</tr>
<tr>
<td>Shipley IQ score</td>
<td>--</td>
<td>--</td>
<td>0.558*</td>
<td>--</td>
</tr>
<tr>
<td>Retrospective Score</td>
<td>0.909**</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Emotion Score</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.609*</td>
</tr>
</tbody>
</table>

*Note.* **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).
Figure 1

*Meditation Analysis of CES-D Score on ToM Performance via Performance Assessment Questionnaires*

![Diagram of mediation analysis]

*Note.* *p < 0.05, **p < 0.01, ***p < 0.001

Figure 2

*Direct Effects of CES-D Score on Various NIBI Tests*

![Diagram of direct effects]

*Note.* None of the direct effects were significant.
**Figure 3**

*Mediation Analysis of CES-D Score on IQ Test Score via Performance Assessment Questionnaires*

\[ b = -0.5824, SE = 0.1237^{***} \]

\[ b = +2.1684, SE = 0.6416^{**} \]

\[ b = -0.8316, SE = 0.1467^{***} \]

\[ b = 3.1159, SE = 0.9215^{**} \]

IE = +0.7675

IE = -1.3179, SE = 1.0925

Note. *p < 0.05, **p < 0.01, ***p < 0.001
APPENDICES

Appendix A: Informed Consent Form

Principal Investigator: Joel M. Martin, Ph.D.; Department of Psychology; Butler University; 4600 Sunset Ave.; Indianapolis, IN 46208; 317-940-9971; jmmarti1@butler.edu

You are invited to participate in a research study as one of approximately 200 people. Before you decide whether or not you’d like to participate, you need to know enough of the procedure and its potential risks and benefits in order to make an informed decision. Please carefully read this form and feel free to ask the researcher any questions you may have regarding this study.

Purpose of Study. This study seeks to develop a new survey to measure how people process information about others.

Procedures. After signing this informed consent, you will be asked to complete a few tasks that I expect will take approximately 1 hour and 20 minutes. You will be asked to fill out a number of questionnaires measuring how you interpret information, your beliefs, vivid mental experiences, and information about yourself. Finally, you will be asked to return to the lab in about a week to complete a much briefer questionnaire that should only take about 25 minutes. Your entire time commitment across the two sessions should be less than 2 hours.

Risks and Benefits. Research studies often involve some risk. The risks of this study are thought to be minimal. You may experience some discomfort due to disclosing personal information. To minimize this risk: (1) your name will not be associated with the information you provide; rather, your information will be linked only to a randomly assigned code number; (2) you may contact the principal investigator (Dr. Joel Martin) at 317-940-9971 if you have concerns; (3) you may contact Butler University’s counseling center at 317-940-9385 if you experience undue distress. We anticipate no direct benefits for your participation, but you may receive the benefit of contributing to our understanding of how people process information about others.

Your participation in this project is completely voluntary. You are in no way required to participate in this study. Your decision whether or not to take part in the study will have no effect on your standing at Butler University. You can also withdraw from the study at any time without penalty.

Confidentiality. All information collected as part of this study will be confidential to the extent allowed by law. The information will be used for purposes of scientific publication and presentation. Your identity will not be revealed in any publication or oral presentation of the results in this research. We will take the following steps to ensure your confidentiality: (1) Participants in this study will be randomly assigned a code number. That number will be the only identifying information on questionnaires. (2) All
study data will be kept in a locked cabinet or in a password-protected electronic data file. (3) The list connecting your name & email address with your random code number will be stored separate locked drawer from this consent form and from the data, and the list will be destroyed at the conclusion of the study. (4) No names will be used in any report of the data and information will be reported as group averages. The results of this study may be used for presentation at conferences and/or publication at a later date. However, you may request to receive a copy of the results of this study when they are available by contacting Dr. Joel Martin at 317-940-9971.

Who to contact with questions? If you have any questions or concerns, please ask the researcher who meets with you, or Dr. Joel Martin at 317-940-9971 (jmmarti1@butler.edu). By signing this form, you are stating that you have read this form and have had an opportunity to ask questions about the research study. You are agreeing to participate in the study based on the information presented to you. You may choose to withdraw at any time without repercussions.

Participant’s Printed Name __________________________  Participant’s Signature Date __________________________  Date _______

Researcher’s Signature Date __________________________  Date _______
Appendix B: Negative Illusory Bias Index (NIBI)

Prospective Performance Assessment Questionnaire

On a scale of 1-5 (1 being the lowest, 5 being the highest) please indicate how well you think you will perform in relation to the following items.

A general IQ test
1. Your overall performance on the test
   1  2  3  4  5

2. Your performance relative to your peers at Butler
   1  2  3  4  5

3. Your performance relative to the general population
   1  2  3  4  5

A general mathematics test
4. Your overall performance on the test
   1  2  3  4  5

5. Your performance relative to your peers at Butler
   1  2  3  4  5

6. Your performance relative to the general population
   1  2  3  4  5

A spatial test
7. Your overall performance on the spatial test
   1  2  3  4  5

8. Your performance relative to your peers at Butler
   1  2  3  4  5

9. Your performance relative to the general population
   1  2  3  4  5

An emotion recognition test
10. Your overall performance on the emotion recognition test
    1  2  3  4  5

11. Your performance relative to your peers at Butler
    1  2  3  4  5
12. Your performance relative to the general population

Math Test

Please read each question and choose the correct answer by circling the letter corresponding with that answer.

1. For all real numbers $b$ and $c$ such that the product of $c$ and 3 is $b$, which of the following expressions represents the sum of $c$ and 3 in terms of $b$?
   A. $b + 3$
   B. $3b + 3$
   C. $3(b+3)$
   D. $\frac{b+3}{3}$
   E. $\frac{b+3}{3}$

2. If 60% of a number is 12, what is 165% of the same number?
   A. 20
   B. 22
   C. 28
   D. 30
   E. 33

3. Alex earned $3,200 per month as a teacher for the ten months from September to June. Then she took a job as a barista at a local café, where she earned $2,000 per month during July and August. What was her average monthly pay for the 12 months?
   A. $2,400
   B. $2,500
C. $2,600
D. $2,800

E. $3,000

4. A rectangle is inscribed inside of a circle in the figure below. What is the length of twice the circumference?
A. $5\pi$ in
B. $10\pi$ in
C. $15\pi$ in
D. $20\pi$ in
E. $30\pi$ in

5. If the ratio of milk cartons to juice boxes is $13:x$ and there are 39 milk cartons and 18 juice boxes, what is the value of $x$?
A. 4
B. 6
C. 8
D. 10
E. 12
Spatial Test

Please read each question and choose the correct answer by circling the letter corresponding with that answer.

1. When put together properly, the top three puzzle pieces will create one of the following shapes (A-E). Note that a side marked X has to touch X and a side marked Y has to touch Y.

A. A  
B. B  
C. C  
D. D  
E. E

2. Which image can be made from the three shapes shown?

A. A  
B. B  
C. C  
D. D  
E. E
3. Below are two separate objects, each has a dot placed in one corner, and each has five possible rotations. Choose the answer options in which the dots are placed in the same corners of the objects as in the model.

A. A  
B. B 
C. C 
D. D 
E. E 

4. Which of the following cubes can be made from the unfolded cube?

A. A  
B. B 
C. C 
D. D 
E. E 

5. 

A. A  
B. B 
C. C 
D. D 
E. E
Emotion Recognition Test

Please look at each image and choose the correct emotion the face is depicting by circling the letter corresponding with that emotion.

1. 
A. Confused  
B. Sad  
C. Mad  
D. Worried  
E. Annoyed

2. 
A. Fearful  
B. Shocked  
C. Hopeful  
D. Happy  
E. Amazed

3. 
A. Mad  
B. Angry  
C. Stressed  
D. Scared  
E. Disgusted
4. A. Ecstatic
   B. Happy
   C. Hopeful
   D. Depressed
   E. Anxious

5. A. Anxious
   B. Depressed
   C. Angry
   D. Sad
   E. Scared

**Retrospective Performance Assessment Questionnaire**

On a scale of 1-5 (1 being the lowest, 5 being the highest) please indicate how well you think you performed in relation to the following items.

1. Your overall performance on the IQ test
   1   2   3   4   5

2. Your performance relative to your peers at Butler
   1   2   3   4   5

3. Your performance relative to the general population
   1   2   3   4   5
IMPAIRMENT OR UNDERESTIMATION?

Please indicate any limitations to your performance

4. Your overall performance on the mathematics test
   1  2  3  4  5

5. Your performance relative to your peers at Butler
   1  2  3  4  5

6. Your performance relative to the general population
   1  2  3  4  5

Please indicate any limitations to your performance

7. Your overall performance on the spatial test
   1  2  3  4  5

8. Your performance relative to your peers at Butler
   1  2  3  4  5

9. Your performance relative to the general population
   1  2  3  4  5

Please indicate any limitations to your performance

10. Your overall performance on the emotion recognition test
11. Your performance relative to your peers at Butler
   1  2  3  4  5

12. Your performance relative to the general population
   1  2  3  4  5

Please indicate any limitations to your performance
Appendix C: NIBI Procedure

- AFTER RMET test the order is:
  - **Prospective questionnaire**: explain to the participants that they will be taking a series of 4 general tests, so we want to have them gauge how well they think they will do 1) overall, 2) in relation to students at Butler, and 3) the overall population
  - Take the 2 Shipley IQ tests from the back of the folder. Those are next. Have them complete both. They are not timed, and they do not have to fill out the entire test. Reiterate that it is about doing their best.
  - **Math test. TIMED: 5 min. do not show them the timer**
  - **Spatial test. TIMED: 4 min. do not show them the timer**
  - **Emotion test.** Not really timed, just whenever they are done (usually takes less than a minute).
  - **Retrospective questionnaire**: same thing as prospective. Say something along the lines of, “Now that you completed the tests, please rate how well you think you did.” Participants can add notes about limitations to their performance, but they do not have to.

- Continue on with the rest of the questionnaires.