Understanding the Influence of the Behavioral Inhibition and Approach Systems on Mood Disorders

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RATIONALE

Significance (Project Question or Focus)

With approximately 5% of the U.S. population dealing with bipolar spectrum disorders, these individuals tend to struggle with their careers, abuse alcohol, and perform underwhelmingly in academics (Nusslock et al., 2009). Understanding the correlation of behavioral systems in children with relation to mood disorders such as bipolar disease (depression and mania) would improve psychological interventions for these children. This would, in turn, promote a better quality of life for children suffering from these disorders. There is plenty of research on adults regarding certain behavioral systems (such as the risk/reward system), but there is limited research studying the implications of these systems in children. Two such systems are the BIS and BAS systems. The behavioral inhibition system (BIS) is a neuropsychological system that influences individuals to avoid risks, while the behavioral approach system (BAS) promotes individuals to strive toward a goal.

Background Literature Review

The behavioral approach system (BAS) is a natural system in humans that encourages goal-setting and striving to accomplish these goals. The behavioral inhibition system (BIS) is an innate system within humans that encourages humans to avoid danger or anxiety-causing situations. The BAS can be referred to as the goal-striving system, while the BIS can be known as the risk-avoiding system. Cohesively called BIS/BAS, these systems have been known to influence mood disorders such as bipolar disorder. Understanding the exact correlation between the BIS/BAS and components of bipolar disorder would help clinicians during psychological interventions.

The behavioral inhibition system (BIS) has long been tied to causing anxiety. Carver and White (1994) outlines that the BIS influences anxiety in response to risky situations, which induces negative and painful outcomes, while Gray (1981) highlighted the negative feelings associated with the BIS, such as fear, anxiety, frustration, and sadness. Carver and White (1994) attempts to identify the relationship in adults between the BIS and components of mood disorders by using three scales: the Manifest Anxiety Scale (MAS) measures anxiety, the MMPI Hypomania scale measures hypomania (an aspect of bipolar disorder), and the CPI Socialization scale measures interpersonal behaviors such as self-control.

Scale	*n*	BIS	Drive	Reward	Fun Seeking
MAS	371	.58***	−.10	.13	−.03
Extraversion	381	−.14	.41***	.39***	.59***
MMPI Hypomania (9)	138	−.03	.33***	.17	.37***
CPI Socialization scale	304	.22***	−.14	.10	−.25***
Optimism (LOT)	371	−.22***	.16**	.08	.11
PANAS	498				
Negative Affectivity		.42***	−.07	.05	−.05
Positive Affectivity		−.06	.31***	.28***	.19***
GTS	207				
Negative Temperament		.45***	.06	.05	.03
Positive Temperament		−.12	.39***	.35***	.25***
Disinhibition–Constraint		−.16*	.18*	−.03	.39***
Susceptibility to Punishment	107	.39***	−.07	.05	−.21**
MacAndrews & Steele BIS	172	.59***	−.14	.06	−.10
TPQ	174				
Harm Avoidance		.59***	−.23**	−.03	−.27***
Novelty Seeking		−.11	.08	.08	.51***
Reward Dependence		.42***	.09	.28***	.15

Table 1 (Carver and White, 1994): This table breaks down the aspects of the BIS into "drive", "reward", and "fun-seeking". This table also breaks down aspects of hypomania into "harm avoidance", "novelty seeking", "reward dependence", etc. The strong correlations between "drive" and "MMPI Hypomania (9)" and "fun-seeking" and "Extraversion" are evident in this table, indicating a potential relationship between these variables.

From table 1, the 0.58 correlation between the BIS and MAS depicts the strong relationship between anxiety and the BIS. The 0.33 correlation between MMPI Hypomania and Drive and the 0.37 correlation between MMPI Hypomania and Fun

Seeking show a strong relationship between the specific mood disorder of mania and components of the BIS. While the correlation coefficients of 0.1 to 0.3 may seem very low, they actually depict strong relationships in the field of psychology.

The behavioral approach system (BAS) dysregulation theory has been consistently supported through numerous studies over the last two decades. The BAS dysregulation theory says that the fluctuations between BAS activation and BAS deactivation result in mood changes and, essentially, bipolar disorder. In individuals with a high BAS sensitivity, striving towards accomplishing a goal causes BAS activation, which is associated with increased anger and anxiety that contribute to the hypomania/mania aspects of bipolar disorder. Whether individuals with a high BAS sensitivity accomplished these goals, BAS activation is followed by BAS deactivation. If the goals were accomplished, the individuals would continue to set challenging and eventually impossible goals, risking failure; if the goals were unaccomplished, the individuals would be dealing with failure. Either way, failure to achieve goals would result in BAS deactivation, presenting the depressive aspects of bipolar disorder (Urošević et al. 2008).

To implement these findings into psychological interventions, understanding the cause of these fluctuations is essential. Psychologists have called events causing this flux BAS activation/deactivation events. These events could trigger either activation or deactivation of the BAS by failing to achieve or set a goal. To mitigate the harmful risks of these events, psychological interventions have attempted to prepare individuals with a high BAS sensitivity and their family members to identify and understand these triggers.

Diving deeper, specific motivations within the BIS and BAS systems have been known to influence different moods. Meyer, Johnson, and Carver (1999) found that certain motivations, as represented by the BIS/BAS scale, influence either mania or depression. For example, fun-seeking motivation from the BAS system was correlated to mania, and reward responsiveness was primarily associated with depression. This contradicts the work done by Nusslock et. al, where they generalized the BAS system instead of inspecting various components of it. Additionally, Meyer, Johnson, and Carver investigated the BIS system and found that BIS sensitivities were exclusively related to depression. Additionally, while the opposing influences of the BIS and BAS may indicate an inverse relationship between these systems, the adverse is known to be true. Referring back to the research by Carver and White, anxiety had a strong relationship with the BIS but no relationship with the BAS (or a marginal correlation to where it is negligible).

The inconsistencies between the research done by Nusslock et al. and Meyer et. al should be studied to determine whether generalizing the BAS system categories as one system would be an accurate predictor of its effect on mood disorders. While most of the previous studies regarding BIS/BAS and mood disorders use limited forms of questionnaires (self-response, parent, or clinician), the limited forms of questionnaires could potentially result in bias, affecting the results of their research. To reduce the risk of such bias, utilizing all three questionnaires (self-response, parent, and clinician) is necessary. Additionally, the current research focuses on trends in adults. Although ages 15-19 is determined to be the "peak age" for developing bipolar disorder, very minimal research has been conducted on this age group regarding effective psychological interventions. Therefore, understanding this relationship in teenagers would improve psychological interventions for a vulnerable demographic. The lack of research regarding this issue inspired the project of using various BIS/BAS, and bipolar disorder screening questionnaires filled out by parents, clinicians, and children to understand the relationship between BIS/BAS and bipolar disorder.

SPECIFIC AIMS

We seek to address the following Specific Aims:

Specific Aim 1.

To conduct an analysis that determines the correlation between components of BIS/BAS in children and aspects of bipolar disorder (depression and hypomania).

Specific Aim 2.

To compare the relationship between BIS/BAS and bipolar disorder in children between children's self-reported data, parent-reported data, and clinician-reported data.

RESEARCH DESIGN

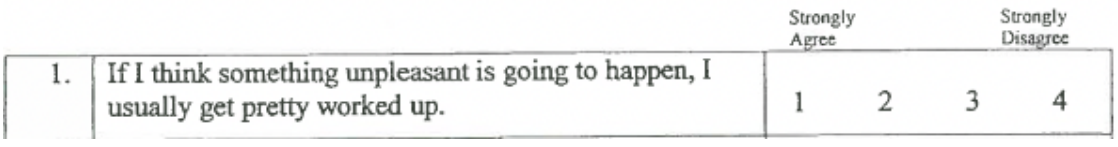
Specific Aim 1.

To conduct a meta-analysis that determines the correlation between components BIS/BAS in children and aspects of bipolar disorder (depression and hypomania).

Motivation and Hypothesis:
Bipolar disorder typically develops between the ages of 13 and 19, but the entirety of the research conducted on the relationship between BIS/BAS and bipolar disorder has utilized data from adults. Therefore, understanding this relationship in children would improve interventions for bipolar disorder, which would assist in treating the disorder before it develops. Understanding the relationship between specific components of BIS/BAS and bipolar disorder would further improve psychological interventions by offering more intricate relationships.

Supporting Preliminary Data:
There is no supporting preliminary data collected by either my lab or me.

Methods:
This research will be conducted through a meta-analysis that analyzes data collected from numerous sources used in similar research. A meta-analysis would be appropriate as the data gathered is verified and cleaned, allowing a smooth and reliable analysis. The self-reported data regarding BIS/BAS scores of children were collected through the "self-report BIS/BAS for Youth ages 10-17" form. The self-reported data regarding mood from children and adolescents was gathered through the APSD youth self-report form–which focuses on social behaviors such as impulsivity–the Youth Mania Rating Scale (YMRS) self-report form–which scores aspects of mania–and the EDI-II 60 self-report questionnaire–which measures mood. These questions in these surveys are catered towards children in the sense that they avoid harsh questions included in parent and clinician questionnaires, such as "have you considered suicide in the last week" and instead, include questions such as "In the past two weeks, how often have you felt happy". The scoring for all these scales is done by assigning a certain number for the frequency of each mood or behavior.



		Strongly Agree			Strongly Disagree
1.	If I think something unpleasant is going to happen, I usually get pretty worked up.	1	2	3	4

Figure 1: This is the first question provided by the BIS/BAS self-report form, where agreeing with the statement means you choose a lower score, while disagreeing means you choose a higher score. The total score for the remaining questions is added up to make a decision on the diagnosis.

Figure 1.1 shows how the frequency of certain behaviors or moods is assigned a number. In question 1 of the BIS/BAS self-report form, strongly agreeing that the participant gets worked up in anticipation of unpleasant events is assigned 1 point while strongly disagreeing is assigned 4 points. At the end of the survey, the total number of points is summed and compared to a range of scores that determine the level of activation of the BIS or BAS systems.

Essentially, a variety of self-report questionnaires, referred to as measures, for children were used to gather data regarding mood and behaviors related to bipolar disorder, and using many measures effectively negates the biases between the self-report versions of these forms. Each column of the data table includes a measure, while each row contains an entry with the scores for the individual for each of these measures.

Data Analysis:
The programming language "R" would be utilized in conducting data analysis on the dataset. R is the ideal programming language for this project as it provides a wide range of statistical libraries while incorporating an optimal and efficient statistical computing environment. This essentially allows a thorough statistical analysis while creating comprehensive graphs. The dataset would initially be subsetted to include variables relevant to only bipolar disorder and BIS/BAS, but as the project develops, the dataset could potentially be further subsetted based on other demographic variables. To determine the strength of the relationships between variables, the correlation coefficients of one-variable and two-variable regressions will be compared. One-variable regressions would show the influence of one dependent variable on an independent variable while a two-variable regression would show the influence of two independent variables on one dependent variable. In psychology, a correlation coefficient greater than 0.4 is considered strong while a correlation coefficient between 0.2 and 0.4 is moderate, and a correlation coefficient below 0.2 is considered weak. When a correlation coefficient of greater than 0.2 is identified in this research, the variables with this correlation would be further examined to determine the reliability of this correlation.

Expected Outcomes and Limitations:
Research in adults has proven a strong relationship between BIS and depression as a whole, which is a trend that is expected to continue in this research. The limitations of this aim are that only one scale is used to measure BIS, which could potentially have biases that skew the results, and using only self-reported scores from children could also potentially cause bias. The nature of questionnaires involves bias because survey participants may have biased views depending on their role; in this research, children have a different view of their behaviors than their parents, and their parents would have a different view than the clinician. Therefore, to account for this bias, various versions of the questionnaires (self, parent, and clinician-reported) must be used.

Specific Aim 2.

To compare the relationship between BIS/BAS and bipolar disorder in children between children's self-reported data, parent-reported data, and clinical-reported data.

Motivation and Hypothesis:
As mentioned in the motivation and hypothesis for *specific aim 1*, research regarding BIS/BAS and bipolar disorder focused on adults, so this research project would focus on children/adolescents. The expected outcomes and limitations section for *specific aim 1* mentions how using just self-reported data causes bias, so responses from parent-reported and clinician-reported questionnaires would reduce this bias while exploring how the type of participant influences the relationship between BIS/BAS and bipolar disorder. The outcomes would potentially allow psychologists to improve bipolar disorder interventions by understanding the biases involved with the type of participants for questionnaires.

Supporting Preliminary Data:
There is no preliminary data for this study from my lab or me, but this part of my research would be conducted after *specific aim 1*, so the data from *specific aim 1* will be used to guide this part of the study.

Methods:
Similar to *specific aim 1*, this portion of the research is a meta-analysis using the same data collected from numerous sources. The cleaned and verified data would make a meta-analysis optimal due to a smooth and reliable analysis. The

children's self-report, parent self-report, and caregiver self-report BIS/BAS scores were collected through the "self-report BIS/BAS for Youth ages 10-17" form, "Parent Report BIS/BAS" form, and "Clinical Administered BIS/BAS" form, respectively. The self-report data for children regarding mood and behaviors used the same questionnaires as for *specific aim 1*. The parent-report questionnaires used in this study were the "Expressed Emotions Parent Questionnaire," which focused on moods causing certain emotions in their children, "APSD-Parent Report" form, which scored behaviors in their children, and the "Mood Disorder Questionnaire-Parent" questionnaire, which concentrated on moods in their children. The clinician-reported questionnaires used in this study were the "K-SADS Mania Rating Scale," which reports the child's level of mania; the "psychosis supplement," which examines behaviors in children; and the "Anorexia Nervosa Supplement," which measures anxiety in the children.

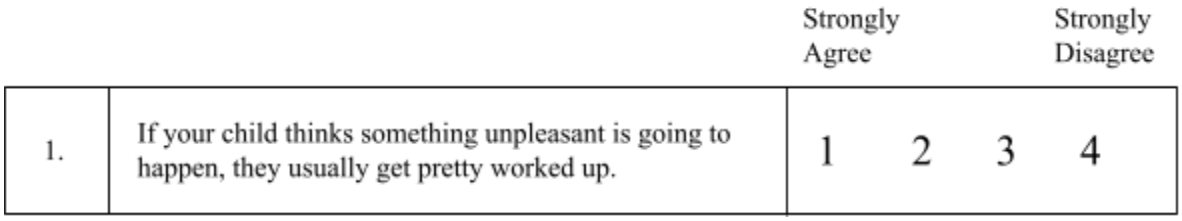


Figure 2. This is the first component on the parent-report BIS/BAS form, where agreeing with the statement means you choose a lower score, while disagreeing with the statement means you choose a higher score. This is similar to the statement from *Figure 1*, which is supposed to show how the statements on the BIS/BAS form cover similar content, but they are worded differently.

Figure 2 shows question 1 from the parent-report BIS/BAS form, which is very similar to question 1 from the self-report BIS/BAS for Youth ages 10-17 form. The difference between these two forms is that the questions are worded in a manner where children aren't asked direct questions, which could result in personal bias in the self-report form, while the questions are worded more direct in the parent report. The difference between the self/parent-reported questionnaires and the clinician-reported questionnaires is that the clinician-reported ones often ask the clinicians what they believe based on the parent's and children's responses.

The data from these questionnaires were also included in the large dataset used for *specific aim 1*.

Data Analysis:

R programming will be used for this specific aim, too, because it provides many statistical tools and has an optimal environment for data analysis. The columns of the large dataset would include the measure or demographic, while the rows would each host a different child that was studied. The dataset would be subset to only incorporate variables being used in this research related to BIS/BAS and bipolar disorder and then further subsetted into three data frames, each for one type of participant responding to the survey. One-variable and two-variable regressions would be run on the parent-reported and clinician-reported data to determine the correlation between the BIS/BAS components and bipolar disorder. The resulting correlation coefficients for these two types of questionnaires would be compared to that of the self-report surveys to determine how the role of the individual taking the survey influences the correlation between BIS/BAS and bipolar disorder. Then, a one-variable regression would be run on each corresponding variable between the three types of BIS/BAS questionnaires such as "self-reported fun-seeking score" in the self-reported form, "parent-reported fun-seeking score" in the parent-reported form, and the "fun-seeking score" in the clinician-reported form. These regressions would potentially highlight the contrasting viewpoints of children, parents, and clinicians regarding mood and behavior.

Expected Outcomes and Limitations:

The correlation between the parent-reported BIS/BAs form and the other parent-reported forms is anticipated to be distinguishably higher than the self-report correlations due to parents typically exaggerating the mood and behavior of their children. The correlations for the clinician-reported forms can be expected to lie between the self-report and parent-report correlations because the clinicians' response is more or less an average of the children and parent responses.

The limitation of this study is that, just like any other psychology-related research, the questionnaire utilizes posses bias because emotions and behaviors can be viewed differently by different people. Additionally, the questionnaires used in this research were completed anonymously online, so there is a possibility that some people who filled out these surveys weren't actually reporting real information, potentially making the data partially unreliable.

Risk and Safety

There are minimal physical risks involved in this study as the research is an analysis being conducted computationally. The identity of the participants of these surveys is confidential because the surveys were submitted anonymously, so there is little risk of connecting identity to this confidential information for the participants. Overall, there are risks or safety hazards more than in typical daily living.

Timeline

November 1, 2022: Complete R programming training modules and load dataset into an R notebook.

November 15, 2022: Run regressions on BIS/BAS and bipolar disorder and build a table with demographic information between the datasets.

December 5, 2022: Run two-variable regressions between BIS and BAS components and bipolar disorder.

January 31, 2023: Checking assumptions through finding correlations.

February 2, 2023: Developing and analyzing histograms.

February 7, 2023: Hypothesis testing through creating other various graphs.

February 24, 2023: Sensitivity analysis

March 2, 2023: Draft Results

March 14, 2023: Revise manuscript

March 21, 2023: Make a poster

March 28, 2023: Share research by uploading to OSF.

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