THE ASSOCIATION BETWEEN DEPRESSIVE SYMPTOMS AND NEGATIVE AFFECT
THROUGH THE EXPLORATION OF AN INDIVIDUAL FACE THRESHOLD

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Abstract

An individual’s emotional state can be measured through depressive symptoms and negative affect. A face threshold measures cognitive control through a double-staircase procedure as it underlines the individual's response to a stimulus and is the point at which one’s perception starts to shift to a new facial expression. Understanding how these three concepts are related to one another will further prompt the investigation of the relationship between negative affect and a face threshold as well as between depressive symptoms and a face threshold. The objective of this study is to analyze the correlation between depressive symptoms and face thresholds as well as between negative affect and face thresholds. A Pearson’s correlation test and a generalized linear model determined that there was no correlation present between depressive symptoms and negative affect through the exploration of an individual face threshold. This further encapsulated how negative affect and depressive symptoms are independent of an individual’s face threshold. This research can be used to bridge the gap between how an individual’s emotional state can influence their perception of others’ mood or affect.

Keywords: [Negative affect, face threshold, depressive symptoms, mood]
Dedicated to my brother, Conrad Gainski

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Introduction

Experiences and events in our everyday lives prompt a wide array of emotional responses that vary from individual to individual. Individuals’ perceptive responses to stimuli are encapsulated through an individual’s face threshold. To its core, the face threshold represents the point at which the individual’s perception starts to shift to a new facial expression than they saw previously and accordingly measures an individual’s cognitive control. For the purposes of this study, the participants’ face threshold will be measured through a double-staircase procedure which allowed for the intensity of the stimulus to be altered after each check based on the subjects’ perceptual responses of either “neutral” or “sad” to each stimulus which is captured by face images of a human male actor shown in (Figure 1). These images are the stimuli in this study.

Figure 1. This figure shows the face threshold scale from 1-11, with 1 being indicative of maximally sad and 11 representing completely neutral.

The psychology terms “mood” and “affect” are used to indicate an individual’s emotional state. Affect is the immediate physical expression of an emotional state in the short-term that demonstrates more reactive responses such as facial expressions like frowning or eyes wrinkling, while mood is a state of emotion that occurs during the long-term timeframe and is more integrated into the individual’s personality (Martin, 1990). Affect and mood can range in their descriptions such as being dysphoric, euthymic, and euphoric (Martin, 1990). Affect is most
accurately determined by taking into account previous observations as well as the conditions of the setting that the individual is in (Martin, 1990).

Both affect and mood are prompted by circumstances and events, however the distinguishing factor that differentiates the two terms relies on their temporal nature. Moods can last for hours, days, weeks, or even months whereas affect, unless it is trait affect, is more prone to fluctuating and immediate changes in emotion. Both affect and mood can be visually seen through physical signs such as body language. An individual will immediately express their emotions based on the experiences they encounter. While, mood is depicted based on the state of feeling as internal and external events drive changes in behavioral patterns such as gestures, tone of voice, facial expressions, perception, reflexes, cognition, and behavior (Russell, 2003).

Previous studies have shown that trait affect encompasses a long lasting effect (Riepl et al., 2016). Individuals’ trait affect can have an influential role in the emotion regulatory strategies (Arger, Sanchez, Simonson, & Mezulis, 2012; Nelis, Bastin, Raes, Mezulis, & Bijttebier, 2016; Hamilton et al., 2017).

Equally important, the tripartite model postulates that anxiety and depression share a similarity pertaining to negative affect (Anderson & Hope, 2008). The Mood and Anxiety Symptom Questionnaire (MASQ) was created by psychologists David Watson and Lee Anna Clark in order to find a means of measuring depressive and anxiety symptoms within these Tripartite constructs (Watson & Clark, 1991; Buckby et al., 2007). Anxiety and depression can consequently be distinguished from one another by low positive affect being linked with depression and high physiological hyperarousal being linked with anxiety (Anderson & Hope, 2008).
One study examined how stress, coping mechanisms, and maintenance patterns impact depression through the exploration of mood, negative affect, and lower positive affect (Dunkley et al., 2017). Daily affect was studied through having the subjects fill out the Positive and Negative Affect Schedule (PANAS) questionnaire (Watson et al., 1988; Dunkley et al., 2017). Overall, the study developed two complex models, the within-person and between-person structural models in order to better understand what prompts and maintains negative affect and a low, positive affect in depression (Dunkley et al., 2017). The study goes on to also utilize daily mood changes as well as how depressive mood is maintained in individuals with depression (Dunkley et al., 2017).

The study concluded that the severity of depression was only related to negative affect while other factors such as avoidant coping, event stress, problem-focused coping, paths pertaining to self-criticism, and negative and positive affect only demonstrated significance when the effects of depressive symptoms were controlled for (Dunkley et al., 2017). Although this paper will not include participants with depression, it will be investigating depressive symptoms in relation to negative affect recognition through the exploration of an individual’s face threshold in order to determine if an association exists.

Another study’s primary objective outlined the use of brain imaging to help identify cohesive transdiagnostic dimensions of dysfunction in the “negative affect” circuit for threat reactivity and regulation as well as dysfunctions in the “cognitive control” circuit in order to further assess interactions between brain circuits and dysfunctions (Williams et al., 2016). The study’s aim was to evaluate if these indicated brain circuit-defined dysfunctions are linked to behavioral performance such as social functioning and productivity (Williams et al., 2016). The study utilized individuals' detection thresholds aimed to connect brain symptoms and behavior
(Williams et al., 2016). The neurological responses to threats using masked facial expressions as the stimuli in this study were represented by a wide range of facial expressions such as: fear, anger, sadness, happiness, and neutral (Williams et al., 2016).

This study used the MASQ as a 12-week follow up in order to evaluate the change or stability of the symptoms presented in the participants (Williams et al., 2016). The conclusions drawn highlight the connection between the brain circuit domains and observed behaviors, which are critical to understanding the mechanisms of anxiety through a neurobiological approach to these disorders (Williams et al., 2016). The significance of this study is that it uses negative affect, the MASQ questionnaire, and an individual detection threshold in order to better understand the mechanisms behind these disorders. Understanding these concepts and their role in studies will be critical to understanding the association between these variables.

One study examined if there is an association between negative thinking and negative affect and if they can be used as predictors of depressive symptoms (Stefanovic et al., 2022). The study recruited participants through social networking services and flyers with a great majority of their subjects being psychology students and assessed momentary negative affect and momentary levels of worry through an experience-sampling method (Stefanovic et al., 2022). Participants were divided into two groups and received 10 daily signals on their mobile phones that allowed them to respond to questions concerning their current moods and thoughts (Stefanovic et al., 2022). The statistical analysis consisted of exploring group differences in depressive symptoms through t tests and an ALS algorithm that clustered individuals in accordance with the estimates of a vector autoregressive (VAR) model (Stefanovic et al., 2022).

The findings concluded that Group 1 had higher mean levels of worry and higher levels of depressive symptoms in comparison to Group 2 (Stefanovic et al., 2022). These findings
ultimately suggested that there is a strong association between negative affect and their temporal stability which is a valuable feature of depressive symptoms (Stefanovic et al., 2022). Likewise, my paper will be using depressive symptoms and negative affect in order to further analyze their association through a face threshold.

Affect recognition is the ability to determine someone’s emotional state based on their visual and nonverbal cues (Bänziger, 2014). A research study investigated the correlation between affect recognition and confidence judgments in women with depression. The study consisted of a sample of 45 female participants with depressive disorders and a control sample of 30 healthy females (Fieker et al., 2016). These two sample groups were comparative in nature when discerning their abilities to accurately identify facial emotion expressions followed by confidence judgements (Fieker et al., 2016). The study determined a negative correlation between self-assessed depression and response confidence (Fieker et al., 2016).

The study went on to conclude that self-assessed depression is associated with low response confidence for emotional faces and therefore, it is important to analyze how confidence plays into emotional recognition since underconfidence can create interpersonal insecurity in depression (Fieker et al., 2016). This study encapsulates how both sample groups were able to accurately identify the emotions, yet there was a link between the sample of female participants with depressive disorders and their lower confidence judgments of emotion processing (Fieker et al., 2016). With depression being classified as a mood disorder, the significance of this study proposes the question of if depressive symptoms further indicate difficulties associated with mood and to further discern the association between mood and affect recognition.

In essence, emotions and perceptions are interconnected as perception is based on an individual’s interpretation of sensory information and emotions can ultimately determine
distortions in perception through driving attentional and interpretational biases (Mirams et al., 2014). The tendencies displayed by a state of high negative affect include psychological distress, such as nervousness and irritability (Mirams et al., 2014). Given this, individuals who display sad moods and tendencies associated with depressive symptoms and negative affect may experience susceptibility to visual illusions (Zadra & Clore, 2011). As a result, an individual's emotions play an influential role in the perception of the environment (Zadra & Clore, 2011). Naturally, it is expected that individuals depicting tendencies of negative affect and depressive symptoms converge to reflect lower face threshold values.

This paper will investigate the association between trait affect, depressive symptoms, and a face threshold. My hypothesis is that there is a strong negative correlation between depressive symptoms and a face threshold as well as a strong negative correlation between negative affect and a face threshold. Furthermore, the higher the anhedonic depression subscale of the MASQ and the negative affect subscale of the PANAS trait questionnaire, a lower face threshold data will follow which indicates that the participant answered mostly “sad” as most of their responses for the 10 images presented to them. The negative correlation between trait measures will depict that as trait negative and anhedonic depression scores increase, the face threshold values will decrease. This study will further contribute to research that emphasizes the connection between the influence of individuals’ emotions on their perception of others’ mood or affect.

Methods

Participants

The focus of this study is on individuals between 18-35 who are native English speakers with a minimum of a high school diploma. The study was advertised in the Champaign-Urbana
communities through flyers and online on the Beckman Institute website. Participants were reimbursed after 3 scanning sessions. None of the participants had a history of neurological disorders or disease or were taking medication for psychiatric disorders. Additionally, the participants neither exhibited a history of recreational drug abuse nor a history of alcohol abuse. The participants in the fMRI studies were right-handed and signed a consent form prior to their participation in the study. They did not have knowledge of the study prior to participating. These procedures were approved by the Institutional Review Board of the University of Illinois. This study was conducted at the Beckman Institute at the University of Illinois at Urbana-Champaign.

Materials

The MASQ is a self-report questionnaire that measures depressive symptoms and was created by psychologists, David Watson and Lee Anna Clark (Watson & Clark, 1991). The questionnaire in this study consisted of a list of 39 feelings, sensations, problems and experiences. Examples of items included: ‘felt faint,’ ‘was proud of myself,’ and ‘had pain in my chest.’ For each list item, the participant indicated on a scale from A to E, the level to which they experienced the item with A being not at all, with B being a little bit, with C being denoted as moderately, with D being quite a bit, and with E being denoted as extremely.

The MASQ is based on a 1-5 scale and this study will only be focusing on the anhedonic depression scale. The purpose of the MASQ is to measure the low levels of positive affect as well as account for other symptoms that can distinguish between depressive disorders and anxiety disorders (Bredemeier et al., 2010). Within the anhedonic depression subscale, each item is scored on a Likert scale ranging from 1 to 5, with 1 being not at all and 5 being extreme (Lee et
This study will consist of 39 total items with 17 items measuring anxious arousal subscale with and 22 items measuring anhedonic depression with a possible range from 22-110.

The PANAS is a self-report questionnaire studies trait affect and was created by psychologists: David Watson, Lee Anna Clark and Auke Tellegen (Watson et al., 1988). The scale is used to measure aspects such as state affect, trait affect, and emotional fluctuations in a given period of time (Tran, 2013). Overall, the aim of the questionnaire is to study the negative and positive effects (Watson et al., 1988). In this study, the questionnaire consisted of 27 words and phrases that describe different feelings and emotions. The participant had a range of answers to choose from, with 1 being very slightly or not at all, 2 being a little, 3 being denoted as moderately, 4 being quite a bit, and 5 being denoted as extremely. The participant was instructed to mark their answer based on the extent that they have felt during the past few weeks with the number range provided in the space provided next to each item. Examples of a word from the list include: cheerful, active, distressed, and alert. This study consisted of 13 questions measuring negative trait affect with a possible range from 13-65.

The anhedonic depression subscale of the MASQ and the negative affect subscale of the PANAS trait questionnaire will illustrate how the scores may correlate with the participant's perceptual face threshold on the neutral or sad faces presented in the scanner. The face threshold represents the shift of a participant’s perception of one facial expression to another, such as from sad to neutral or neutral to sad. This study only used sad and neutral faces during the behavioral task.
Procedure

Two replicate sessions, session B and session C were used in this study. Prior to the start of sessions B and C, the participants were instructed to fill out the PANAS questionnaire on paper with 13 items measuring negative trait affect and 14 items measuring positive trait affect. For the purposes of this study, only the negative trait scores will be analyzed. Following this, the behavioral task on the computer was explained to the participants. This task measured the subjects’ face thresholds through a double-staircase procedure. The participants were presented with 10 face images of the same human male. For each image, the subject answered either “sad” or “neutral” a total of 10 times. The face threshold was scored on a scale from 1 to 11 with 1 depicting the most sad and 11 being completely neutral. The participants were given a practice session to familiarize themselves with the task prior to beginning.

Based on the subject’s results from the threshold check test, the face threshold values were adjusted accordingly to the results. After 3 runs with the same numbers that were already adjusted, there was another threshold adjustment made after the third check. The face threshold values were not changed in between the runs. These changes are made based on if the subject begins to answer more than half of their responses as either “sad” or “neutral,” demonstrating a bias. Some images were repeated depending on the subject’s face threshold.

The goal of the double-staircase procedure was for each subject to achieve a balance of “sad” and “neutral” responses in order for the participant to get half of them correct so that the task is deemed neither too easy nor too difficult. Following the completion of this task, the participants were instructed to go into a functional neuroimaging (fMRI) machine. In order to account for confounding variables and obtain the most accurate results, the average was taken of each participant’s face threshold in sessions B and C. After sessions B and C, the participants
filled out the MASQ questionnaire with only the scores from the anhedonic depression subscale being analyzed.

Results

Behavioral Results: The Correlation Between Negative Affect and Depressive Symptoms Through the Exploration of a Face Threshold

A correlation test was used to examine the relationship between trait affect and the participants’ face threshold (Figure 2). Trait negative scores were plotted on the x-axis and face threshold scores were plotted on the y-axis. The results indicated that there was no correlation between negative trait affect and face thresholds, $r(23) = .232, p = .265$. This correlation test revealed that there was no correlation between negative trait affect and face thresholds, 95% CI [-0.180, 0.574].

![Figure 2](image)

Figure 2. Relationship between negative affect and participants’ face thresholds taken by the Positive and Negative Affect Schedule questionnaire and behavioral task during sessions B and C. Pearson’s $r = .232, p = .265$. Trendline further indicates that there is no correlation between trait negative scores and a face threshold.
A correlation test was also used to examine the relationship between depressive symptoms and the participants’ face threshold (Figure 3). Depressive symptoms were plotted on the x-axis and face threshold scores were plotted on the y-axis. Inconsistent with the primary hypothesis, there was no correlation between depressive symptoms and an individual’s face threshold, \( r(23) = -0.0126, p = .953 \). This correlation test revealed that there was no correlation between negative trait affect and face thresholds, 95% CI [-0.406, .384]. The correlation test presented a few significant outliers on both ends of the extremes for depressive symptoms that both depicted a low face threshold of between 2-4.

![Figure 3](image-url)

**Figure 3.** Relationship between depressive symptoms and participants’ face thresholds taken by the Mood and Anxiety Symptom Questionnaire and behavioral task during sessions B and C. Pearson’s \( r = -0.0126, p = .953 \). Trendline further indicates that there is no correlation between depressive symptoms and a face threshold.
A generalized linear model is used to illustrate anhedonic depression scores and negative trait scores as predictors for face threshold values (Figure 4). The fitted values are plotted on the x-axis while the actual face threshold values are plotted on the y-axis. The coefficient estimate in the predictor variable, anhedonic depression scores, shows no correlation, \( r(24) = -0.0227, p = 0.505 \). The results from the coefficient estimate in the predictor variable, trait negative scores, show no correlation, \( r(24) = 0.120, p = 0.202 \).

\[ Figure 4. \] Relationship between depressive symptoms and negative affect in relation to face thresholds. Depressive symptoms and negative affect were used as fitted values and face thresholds were used as data values. Pearson’s correlation for anhedonic depression scores, \( r(24) = -0.0227, p = 0.505 \). Pearson’s correlation for trait negative scores, \( r(24) = 0.120, p = 0.202 \).
Discussion

To its core, this study is centered around exploring if there is an association or underlying relationship between depressive symptoms and negative trait affect through the exploration of a face threshold. Furthermore, I am also investigating if a correlation between negative trait affect and an individual’s face threshold exists and similarly examining if there is a correlation between depressive symptoms and an individual’s face threshold. Through analyzing the subjects’ scores in the MASQ and PANAS trait questionnaires in relation to their face threshold value, I was able to see if a relationship between these variables exists based on running two Pearson correlation tests and a generalized linear model examining the Pearson coefficient to determine the strength between the two variables being examined.

Both Pearson's correlation coefficients for (Figure 2; Figure 3) indicated that the results were not significant as both were well above the level of statistical significance of 0.05 and further illustrated that there is no association between depressive symptoms and an individual’s face threshold as well as no association between negative affect and an individual’s face threshold. The generalized linear model (Figure 4) ultimately underlined how the relationships between depressive symptoms and negative affect through the exploration of a face threshold are neither linear nor additive. The fitted values are substantially different from the actual face threshold values, suggesting no coherent correlation of depressive symptoms and negative trait affect through the exploration of an individual's face threshold. Due to the lack of correlation between the fitted and actual values, there was no need to display a trendline to showcase this further explanation of the lack of correlation. While analyzing the results, a majority of the scores fell between 40-80 and correspond to a face threshold of between 4-8, further suggesting
that the lack of correlation as a low to medium anhedonic depression score correlated to a face threshold that is in between sad and completely neutral.

Given that there is no correlation, this could be a result of how one's mood and affect does not impact their perception of others' emotions. This gives further explanation that both negative affect and an individual’s face threshold as well as depressive symptoms and an individual’s face threshold are independent of each other and do not influence one another. Ultimately, this means that in the future, other variables can be tested in relation to an individual’s face threshold and in order to support that there are associations or correlations between an individual’s face threshold and other variables such as positive trait affect.

The hypothesis was not supported since there was no negative correlation present amongst the variables examined in this study. Ultimately, there was no trend that reflected participants seeing faces negatively or a lower face threshold in relation to the scores gathered from the anhedonic depression and trait negative subscales. An important takeaway is that each individual’s face threshold value is unique to every individual and should be evaluated on a case by case basis.

There can be a multitude of factors that can account for a participant having a lower face threshold value since some face threshold values will be more impacted by their mood than others as reflected in the participants with higher anhedonic depression or negative affect scores but have higher face thresholds. Unlike the findings presented in this study, Mareckova et al. (2020) found that participants were less reactive to neutral faces, which was associated with increased self-reported anhedonia (Mareckova et al., 2020). As seen in the results, there were a select few participants that demonstrated a very high anhedonic depression score and a very high
trait negative score which directly corresponded to a very low face threshold value. However, this was not the case for most individuals based on the correlation coefficients. A study previously mentioned in this paper, examined if there is an association between negative thinking and negative affect and if they can be used as predictors of depressive symptoms and found a strong association between negative affect and depressive symptoms (Stefanovic et al., 2022).

The findings of this study demonstrated no association amongst depressive symptoms and negative affect through the exploration of an individual’s detection threshold. A major difference between my study and the study presented by Stefanovic is that I used an individual’s detection threshold as a measure to analyze the association amongst depressive symptoms and negative affect while the Stefanovic’s study did not use an individual’s face threshold as a variable to measure association between depressive symptoms and negative affect and instead primarily focused on the relationship between negative thinking and negative affect and seeing how that correlates to depressive symptoms (Stefanovic et al., 2022).

When considering alternative explanations to my results, one thing to consider is how college is negatively impacting the mental health of many students. One study mentions how loneliness and isolation can be a contributing factor to increased rates of anxiety and depression amongst college undergraduates (Moeller & Seehuus, 2019). On top of feeling isolated during college, many students are getting adjusted to the rigor in their field and for some, are figuring out how to live on their own for the first time, which are all major contributing factors that may impact their mental health and ultimately lead to an increase in depressive symptoms, negative affect, and a decrease in an individual’s face threshold.

The sample size posed a limitation in the study as perhaps a sample of only 24 participants may not be enough to fully express the depth and breadth of the data at hand, as the
outliers and anomalies caused discrepancies in the data. Another limitation is that all of the subjects either participated in only one or two sessions, which does not give very accurate results since one participant may have an outlier face threshold value during one session due to an incident that could have largely impacted how they felt during their participation in a session. This ultimately can deviate their average from what it normally would be and lead to faulty data. Lastly, some participants may have not taken the time to answer the PANAS and MASQ paper questionnaires honestly and accurately and may have not truly reflected on how they were feeling, leading to discrepancies and faults in the results.

Based on the results of this study, a new approach would be to have a larger sample size since the correlation coefficients were not significant. In order to account for the large population size of people that qualify for the study, a 95% confidence interval, and a 5% margin of error, a larger sample size of participants would be best for ensuring the most concrete trends and relationships in my data and could also contribute to stronger Pearson correlation coefficients and thus demonstrate stronger associations amongst my variables. In addition, I would also have each subject participate in more sessions in order for their corresponding face threshold averages to ensure much more accuracy within the data, leading to a greater possibility of a correlation amongst the variables.

After analyzing depressive symptoms and negative trait affect through the exploration of participants' face threshold values and utilizing Pearson’s correlation tests as well as a generalized linear model to determine the strength of their relationships, I found that there was no significant correlation between depressive symptoms and a face threshold as well as negative trait affect and a face threshold. When comparing the two relationships, there is a stronger Pearson’s correlation coefficient amongst trait negative affect and the individual’s face threshold
than the Pearson’s correlation coefficient between depressive symptoms and the individual’s face threshold. The lack of correlation presented in the results is suggestive of the idea that an individual’s negative affect or measure of depressive symptoms does not truly reflect their perception of others emotions through their face threshold value.
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