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Effectiveness of a Novel Paradigm Examining the Impact of Phubbing on Attention and Mood

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Abstract

Human beings are social in nature, but what happens when a tool used to facilitate social interaction instead acts as a disruptor? "Phubbing" describes everyday interruptions in social interactions that occur due to mobile device use (e.g., texting, receiving calls; Chotpitayasunondh & Douglas, 2018). Little is known about how phubbing influences our cognitive and emotional functioning. The aim of the present study is to explore the initial effectiveness of a novel experimental manipulation of phubbing during a joint problem-solving task, evaluate its impact on mood and anxiety-related attention bias, and explore the moderating role of trait anxiety and phubbing induced changes in mood on these effects. Undergraduate students ages 18 to 41 (M_{age} = 20; N = 83) were partnered with a confederate to complete a timed anagrams task, with or without interruption from the confederate's mobile device. Self-rated mood was measured, and anxiety-related attention bias was assessed before and after the task. There was a significant main effect of Time (pre- to post-task) on happy mood, happiness ratings dropped in the phubbing condition and did not change in the control condition. Threat bias trended in the predicted direction, threat bias increased in the phubbing condition and decreased in the control condition. Low to medium levels of trait anxiety predicted greater anxious mood in the control condition compared to the phubbing condition. Sadness induced by phubbing predicted higher levels of threat bias and difficulty disengaging from threatening stimuli compared to control. The novel paradigm successfully manipulated phubbing in face-to-face interaction.

Keywords: phubbing, technoference, attention bias

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Effectiveness of a Novel Paradigm Examining the Impact of Phubbing on Attention and Mood

Mobile devices have become ubiquitous, with 96% of adults in the United States owning a cell phone (Pew Research Center, 2019). The latest research on smartphone usage indicates that the typical smartphone user checks their phone an average of 63 times a day and the average time spent on smartphones is 171 minutes (2 hours 51 minutes) a day, 261 minutes (4 hours 33 minutes) if you include tablets (Turner, 2021). Despite the frequency of mobile device use, little is known about how daily mobile device use directly influences our cognitive and emotional functioning, particularly, the consequences of mobile device use during social interaction.

Phubbing

The cell phone is a common disruptor of social interaction, with 86% of smartphones users reporting they check their phone while interacting with friends and family (Turner, 2021) and 89% stating they used their phone during the most recent social gathering they attended (Rainie & Kickuhr, 2015). “Phubbing” and “technoference” describe everyday interruptions in social interaction that occur due to mobile device use (Chotpitayasunondh & Douglas, 2018; McDaniel & Coyne, 2016). A product of the words, “phone” and “snubbing,” phubbing disrupts social interaction in the form of texting, reading notifications, and receiving calls while actively engaging with another person during face-to-face interaction (Pathak, 2013). The term “phubber” describes the person engaging in phubbing behavior, and the term “phubbee” describes the person receiving the phubbing behavior (Chotpitayasunondh & Douglas, 2018).

Phubbing occurs across various situations involving social interaction, such as dining at a restaurant, listening to a lecture, or during a meeting. Existing research examines phubbing in different environments, such as in professional settings, including educational (Nazir, 2020;

Ugur & Koc, 2015) and workplace settings (Roberts & David, 2017). Across different professional settings, phubbing directly and indirectly impacts cognitive and emotional functioning. In the classroom, students report student cell phone use during a lecture results in loss of attention and poor grades (Tindell & Bohlander, 2012), while the teachers who were phubbed report feeling an increase in aggressive mood, evaluate their teaching performance negatively, and consider phubbing to be disrespectful (Nazir, 2020). In the workplace, studies found employees whose supervisors phubbed them felt the supervisor undermined their trust, which led to decreases in employee engagement and job satisfaction (Roberts & David, 2017; 2020). Employees who were phubbed by their boss also felt high feelings of social exclusion (Yasin et al., 2020).

In addition to examining phubbing in professional interactions, studies examine the impact of phubbing in romantic relationships. For couples in serious relationships, smartphone use causes tension, especially in ages 18 to 29; 42% of 18-29-year-olds reported their phone distracted their partner when spending time together face-to-face and 18% have argued about the amount of time spent online (Lenhart & Duggan, 2014). Common feelings associated with being phubbed by a romantic partner include sadness, neglect, isolation, anger, annoyance, loneliness, and jealousy (Krasnova et al., 2016). When a person engages in phubbing behavior, their partner relates the cause of the displaced focus of the phubber to views of being less interesting or less important as the content on their phone, resulting in feelings of neglect, jealousy, and exclusion (Krasnova et al., 2016). Ultimately, phubbing in relationships is related to lower levels of relationship satisfaction, more depressive symptoms, and more conflict over technology, with higher levels of conflict in individuals with highly anxious attachment styles (McDaniel & Coyne, 2016; Roberts & David, 2016; Wang et al., 2017).

Research on phubbing draws on social and neuroscience-based theories to explain disruptive effects of phubbing. The Social Prescence Theory emphasizes the role of nonverbal behaviors, including body orientation, eye gaze, facial expression, body lean, and gestures, in social interaction (Patterson, 1983; Short et al., 1976). These nonverbal behaviors serve as immediacy cues which communicate attentiveness and intimacy during interaction, more so than verbal communication, (Andersen et al., 1979; Mehrabian & Ferris, 1967) and impact how an interaction is perceived as well as the quality of the interaction (Chotpitayasunondh & Douglas, 2018). Maintaining eye contact conveys the message that you are being attended to resulting in feelings of closeness and intimacy (Andersen et al., 1979; Vanden Abeele et al., 2019). During an instance of phubbing when gaze is redirected to the cellphone, eye contact is broken and the phubee's perception of the quality of interaction decreases (Rainie & Kickuhr, 2015). Breaking eye contact and disengaging conveys a message of disinterest and leads to feelings of social exclusion or rejection (David & Roberts, 2017). The Social Exclusion Theory explains perceived exclusion in social settings is a source of anxiety and leads to negative emotional disturbances including aggression, depression, and loneliness (Baumeister & Tice, 1990; Leary, 1990). Although the phubbee remains in the physical presence of the phubber, they are nevertheless shut out of social interaction, suggesting potential negative emotional disturbances due to perceived social exclusion from phubbing.

Neuroscience-based theories like the Social Baseline Theory provide converging evidence that when we are in close proximity of others, the brain is less vigilant toward potential threat compared to when we are alone (Beckes & Coan, 2011). Conversely, social isolation or rejection results in the brain operating in a vigilant state (Beckes & Coan, 2011). When proximity is disrupted, brain activity associated with self-regulation of emotions is more active

(Coan et al., 2006), suggesting negative cognitive impacts of disruption in social connection, such as from phubbing.

Individuals are more likely to phub those closest to them, such as family or friends, compared to strangers, likely due to comfort levels and social norms (Al-Saggaf & MacCulloch, 2019). However, similar trends in adverse consequences of phubbing present across different types of relationships, including romantic, familial, and professional (Al-Saggaf & MacCulloch, 2019). While limited, previous studies suggest disruption in social interaction due to mobile device use impacts cognitive functioning by disrupting attention, and emotional functioning by increasing negative mood and affect. To expand our knowledge of how phubbing is perceived, we must investigate potential factors that influence the relationship between phubbing and mood by experimentally manipulating phubbing in a controlled setting. To this end, we created a novel experimental phubbing paradigm, and report on its initial effectiveness in the present study.

Anxiety-Related Attention Bias

Anxiety-related attention bias (AB) refers to a cognitive process which indicates selective and exaggerated attention to threat-related stimuli at the expense of attention to non-threat or positive stimuli (MacLeod et al., 1986). AB is increased in people evidencing clinical and sub-clinical levels of anxiety (Bar-Haim, 2010; Cisler & Koster, 2010; Waters et al., 2013). It is often measured through the dot probe task, which measures reaction times (RT) to threatening and neutral stimuli in the form of angry and neutral facial expressions. The RT is calculated by subtracting the mean threat-cue RT from the neutral-cue RT, with higher scores indicating a greater anxiety-related attentional bias towards threat.

Three types of AB scores are measured and calculated: threat bias, disengagement, and vigilance, each representing different types of dysregulated attention patterns related to anxiety.

Threat bias refers to the exaggerated sensitivity to threat-related stimuli, compared to neutral or positive stimuli, outside of conscious control (Bar-Haim, 2010; MacLeod et al., 1986). An attentional bias towards threat is related to anxiety disorders such as GAD, while bias away from or avoidance of threat is related to fear, such as with phobias (Roy et al., 2015; Waters et al., 2013). Disengagement refers to the degree which a threat-related stimulus grabs a person's attention and impairs adaptive attentional redirection to a positive or neutral stimulus, resulting in a delay in withdrawal of attention (Cisler & Koster, 2010). Disengaging from threat-related stimuli is more difficult for high trait anxious adults than for low trait anxious adults (Leleu et al., 2014; Sheppes et al., 2013). Vigilance refers to overestimating the possibility of potential threat and attending selectively to threat-related stimuli (In-Albon et al., 2009). The interchange of expecting and attending to threat results in over vigilance and is theorized to be both an effect and cause of anxiety, with anxious people detecting a threatening stimulus quicker than non-anxious people (In-Albon et al., 2009).

The Present Study

Existing literature examining the impact of phubbing on the cognitive and emotional functioning of the phubbee is limited, and to our knowledge, no other studies to date manipulated phubbing in face-to-face interaction. Rather, previous used and retrospective surveys (McDaniel & Coyne, 2016), interviews (Nazir, 2020), and online animations (Chotpitayasunondh & Douglas, 2018) to depict social interaction and measure the effects of phubbing. These results provide insight into phubbing behavior and consequences, but do not reflect the effects of phubbing scenarios in real-time.

The present study aims fill that gap in the research and explore the initial effectiveness of an experimental manipulation of phubbing during a face-to-face, joint problem-solving task, and

evaluate the impact of being phubbed on mood and AB. We tested the hypothesis that participants in the phubbing condition, relative to an active control condition, will show a decrease in positive mood, increase in negative mood, and increase AB following the joint problem-solving task compared to control. In exploratory analyses, we investigated potential factors that influence the relationship between phubbing, mood, and AB, including levels of trait anxiety. To deeper examine how phubbing was perceived, we conducted additional exploratory analyses looking at phubbing-induced changes in mood as a moderator in the relationship between phubbing and AB.

Method

Participants

The study sample consisted of 83 adults, ages 18 to 41 (M = 20, SD = 4.25), with 80.8% between 18- and 20-years-old. All participants were undergraduate students at Hunter College, City University of New York and received course credit for participating in the study. Participants were randomly assigned to either the Phubbing or Control conditions. There were 53 females (63.9%) and 30 males (36.1%). Self-reported race and ethnicity were as follows: 26.5% Asian, 31.3% White, 13.3% Black, 1.2% American Indian/Alaska Native, 1.2% Native Hawaiian, 6.0% Mixed Race, 20.5% Other; 30.1% identified as Hispanic/Latino.

Procedure

Participants spent approximately 1.5 hours total in the laboratory. Once informed consent was obtained in the general seating area, participants were escorted to a private booth equipped with a desktop computer and instructed to work on a series of questionnaires relating to mood, affect, and anxiety, along with providing demographic information. All questionnaires were administered on Qualtrics. Next, the participant was partnered with a confederate, a research assistant, to complete a timed anagrams task with or without interruption from the confederate's

mobile device. AB was assessed before and after the task using the dot probe. Self-rated mood was measured before and after the task.

Task Design

Anagrams Task. The instructions for the timed anagrams task followed the instructions for the Word Construction Game (Ammons & Ammons, 1959). The anagrams consisted of a combination of easy, hard, and insolvable words (MacLeod et al., 2002). The participant and confederate were instructed to construct possible words from basic letter combinations for a total of six minutes. The research assistant administering the directions highlighted working as a team and stated the task would be scored and compared to those of other students.

Phubbing Manipulation. Phubbing was manipulated in the experimental condition by three separate interruptions during the six-minute anagrams task. The manipulation was structured similarly to the classic Still Face Paradigm but modified to include a mobile device and to take place in peer context (Braungart-Rieker et al., 1998; Myruski et al., 2017). The task consisted of three phases: Free Interaction, in which the confederate worked with the participant on the anagrams task; Disengagement, in which the confederate disengaged from the task three times to attend to their mobile device; and Recovery, in which the confederate re-engaged in the task and worked with the participant for the remainder of the time.

The first phase of the task was referred to as the Free Interaction phase. This phase began at the start of the task and lasted exactly two minutes (0:00-2:00). At the two-minute mark, the research assistant sent a scripted message on the computer via WhatsApp to the confederate's mobile device, an iTouch used for the study set to vibrate mode. The confederate took out the mobile device and read the message for approximately ten seconds before returning to the task. This interruption marked the beginning of the Disengagement phase which lasted two and a half

minutes (2:00-4:30). At the 2:45 mark, the research assistant sent a longer scripted message to the confederate, which the confederate read for approximately ten seconds and responded to for approximately 20 seconds. The third and final disruption was in the form of a phone call at the four-minute mark. The research assistant called the confederate's mobile device via the Facebook Messenger application. The confederate acted out a vague, scripted conversation for about 30 seconds: "Hello. Yes. That's right. I'm not sure. Maybe later. Ok sounds good." The confederate broke eye contact, leaned away, and oriented their body slightly opposite from the participant for all instances of phubbing. The end of the phone call marked the end of the Disengagement phase and the beginning of the Recovery phase (4:30-6:00). The confederate relinquished control of the pen to the participant immediately following the end of the phone call, leaned in closer, and reengaged with the participant working on the anagrams task for the remaining time.

Participants in the control condition received the same set of instructions and word combinations without interruption throughout the entire six minutes. The confederate followed the lead of the participant throughout the task and maintained neutral affect. Measures were taken to ensure the participant could not complete the task without cooperation from the confederate. A six-minute timer was projected onto the screen at the front of the room in both conditions. While participants used this timer to gauge how much time was remaining for the task, this timer served as a signal for the confederate to check their phone in the event technological issues presented themselves. Thus, if the confederate did not receive a message, the confederate knew it was time to pull out their mobile device engage in phubbing behavior.

Anxiety-Related Attention Bias

AB was assessed before and after the joint problem-solving task using the reaction time-based dot probe task (MacLeod et al., 1986) using angry and neutral faces (Figure 1). Three measures of AB were generated: threat bias, vigilance, and disengagement, each representing distinct disruptions in attention towards threatening stimuli (angry faces). Each trial began with a fixation cross shown in the center of the screen (500 ms), followed by a pair of faces (500 ms), then a target pointing to the left or right. Participants were instructed to indicate the direction which the target is pointing as quickly and accurately as possible using their dominant hand and the mouse buttons. The target would not disappear until a response was made, followed by an intertrial interval consisting of a blank screen (500ms).

AB scores were calculated by subtracting the mean threat-cue reaction time (RT) from the neutral-cue RT, with higher scores indicating AB towards threatening stimuli. Disengagement scores were calculated by subtracting the mean RT for neutral cues following neutral-neutral pairs from mean RT for neutral cues following threat-neutral pairs, with higher scores indicating difficulty disengaging from threatening stimuli. Vigilance scores were calculated by subtracting mean RT for threat cues following threat-neutral pairs from mean average RT for neutral probes following neutral-neutral pairs, with higher scores indicating vigilance towards threatening stimuli.

Measures

Trait anxiety was measured in the beginning of the study. Mood was measured before and after the joint problem-solving task.

Anxiety. The Mood and Anxiety Symptom Questionnaire (MASQ) was used to assess general distress anxiety (GDA) and anxious arousal (AA) in the beginning of the study (Clark & Watson, 1991; Corral-Frías et al., 2019). Participants rated how they felt in the past week on 62

items using a scale ranging from 1 (*Very Slightly or Not at All*) to 5(*Extremely*). Schalet et al. (2014) suggested a cutoff score of 25 for GDA and AA.

Mood. The Analog Mood Scale (AMS) was used to assess three different internal mood states: anxious, sad, and happy (Athanasou, 2019). Participants rated how they were feeling at the moment on a scale from 1-30. The AMS was administered before and after the partner task.

Results

Baseline Measures

Table 1 shows baseline AB (threat bias, disengagement, vigilance), subjective trait anxiety (MASQ-AA, MASQ-GDA), and subjective mood (AMS Happy, Sad, Anxious) for the phubbing and control conditions. There was a significant difference in anxious mood measured by AMS-Anxious between conditions (t = -2.30, p = .02). Pearson correlations were conducted to examine associations among baseline AB, anxiety, and mood (Table 2).

Main Analyses

To test the hypothesis that participants will show a decrease in positive mood, increase in negative mood, and increase in AB following the joint problem-solving task in the phubbing condition compared to control, repeated-measures ANOVAs were conducted with Condition (phubbing, control) as the between-subjects variable and Time (pre-task, post-task) as the within-subjects variable, separately for each AB score (threat bias, difficulty disengaging, vigilance) and mood rating (happiness, sadness, anxiety). There was a significant main effect of Time on happiness, $F(1,81) = 4.08$, $p = .05$. Happiness ratings dropped from pre- (M = 14.4, SD = 8.39) to post-task (M = 12.55, SD = 7.39) in the phubbing condition and did not differ pre- (M = 14.5, SD = 6.29) to post-task (M = 14.82, SD = 5.91) in the control condition (Figure 2). The analysis with threat bias as the dependent variable did not reach significance but trended in the predicted

direction: threat bias increased in the phubbing condition (M = 2.81 versus 4.48) and decreased in the control condition (M = 2.85 versus -0.19). No significant effects emerged for the other mood ratings or AB scores.

Moderation Analyses

A series of hierarchical linear regressions using SPSS PROCESS version 3.5 (Hayes, 2017) were run to test moderating effects of mood (happy, sad, anxious) and trait anxiety (anxious arousal, general distress anxiety) on the relationship between phubbing and AB (threat bias, vigilance, difficulty disengaging) and mood (happy, sad, anxious).

Anxiety as a Moderator

Anxious Arousal. To investigate potential factors that influence the relationship between phubbing, mood, and AB, a hierarchical linear regression was run to examine the moderating effects of trait anxiety (AA, GDA) on mood (happy, sad, and anxious) and AB (threat bias, vigilance, disengagement) in the phubbing versus control conditions, covarying for mood and AB pre-task. AA [b = 0.50, p = .02] significantly moderated the effects of condition on anxious mood. A significant interaction [$R^2change$ = 0.03, p = .03] showed participants with low [b = 5.32, $t(78)$ = 3.08, p = .00] and medium [b = 4.17, $t(78)$ = 2.89, p < .01] levels of AA had higher anxious mood after the partner-task in the control condition, and lower anxious mood in the phubbing condition (Figure 3). No significant interactions emerged with other mood ratings or AB scores.

General Distress Anxiety. GDA [b = 0.53, p = .04] significantly moderated the effects of condition on anxious mood. The significant interaction with GDA [$R^2change$ = .03, p = .04] showed similar findings to AA, there were higher levels of anxious mood after the partner-task in the control condition compared to the phubbing condition for participants with low [b = 5.19,

$t(78) = 3.00$, $p = .00$] and medium [$b = 3.74$, $t(78) = 2.67$, $p < .01$] levels of GDA (Figure 4). No significant interactions emerged with other mood ratings or AB scores.

Change in Mood as a Moderator

Sad Mood. To deeper examine how phubbing was perceived, a hierarchical linear regression was run to investigate the moderating role of phubbing-induced changes in mood (happy, sad, and anxious) in the relationship between condition (phubbing, control) and AB (threat bias, vigilance, disengagement). Change in sadness from pre- to post-task significantly moderated threat bias [$b = 5.14$, $p = .00$] and disengagement [$b = 5.30$, $p = .00$]. Significant interactions with threat bias [$R^2change = 0.09$, $p = .00$] and disengagement [$R^2change = 0.07$, $p = .01$] showed those who had a greater increase in sadness induced by phubbing showed greater bias towards threatening stimuli [$b = -13.50$, $t(76) = -2.18$, $p = .03$] and difficulty disengaging from threatening stimuli [$b = -12.59$, $t(76) = -1.97$, $p = .05$] compared to control (Figures 5 & 6). No significant interactions emerged with vigilance.

Anxious Mood. No significant interactions emerged for change in anxious mood as a moderator in the relationship between phubbing and AB.

Happy Mood. No significant interactions emerged for change in happy mood as a moderator in the relationship between phubbing and AB.

Discussion

The purpose of the current study was to test initial effectiveness of a novel experimental manipulation of phubbing during a joint problem-solving task and evaluate its impact on mood and anxiety-related attention bias. It was hypothesized that participants in the phubbing condition, relative to an active control condition, will show a decrease in positive mood, increase in negative mood, and increase in anxiety-related attention bias following the joint problem-

solving task. Additionally, the study explored the moderating role of individual differences in trait anxiety, as well as the moderating role of changes in mood induced by phubbing, on these effects.

The main finding from this study is happiness was significantly reduced from pre- to post-task in the phubbing condition compared to control, indicating the novel paradigm was successful in examining the impact of phubbing on mood. These results suggest everyday disruptions in social interaction due to mobile device use negatively impact mood, supporting our hypothesis and aligning with previous research highlighting the negative effects of phubbing (Al-Saggaf & MacCulloch, 2019). Although the analysis with threat bias as the dependent variable did not reach significance, it trended in the predicted direction: threat bias increased in the phubbing condition and decreased in the control condition.

To gain a deeper understanding of the relationship between phubbing and AB, exploratory analyses were run to investigate the moderating role of how phubbing was experienced. Specifically, we looked at how changes in mood induced by phubbing moderated the relationship between phubbing and AB. Results indicated participants who felt sadder after being phubbed showed greater bias towards threat and difficulty disengaging from threatening stimuli. These results suggest phubbing impacts AB, but only when phubbing is experienced in a negative way. Building on previous research, phubbing may be experienced as a form of social rejection or exclusion (Beckes & Coan, 2011; David & Roberts, 2017; Krasnova et al., 2016; Yasin et al., 2020), resulting in negative cognitive and emotional disturbances such as increases in sad mood and anxiety-related attention bias towards threatening stimuli. Future studies should include the Affiliative Tendency and Sensitivity to Rejection Scale (Mehrabian, 1970) to investigate the relationship between being phubbed, sensitivity to rejection, and AB.

While participants who had an increase in sad mood after being phubbed showed greater bias towards threat and difficulty disengaging from threatening stimuli, participants in the control condition who had a decrease in sad mood showed greater bias away from threat and a quicker reaction to rid the threatening stimuli during the dot probe task. Both a bias towards threatening stimuli and a bias away indicate problematic dysregulation of attention patterns (Roy et al., 2015). Bias towards threatening stimuli is linked with distress anxiety disorders as mentioned above, while bias away from threatening stimuli is linked with fear-based disorders, such as phobias (Roy et al., 2015; Waters et al., 2013). The joint problem-solving task without the interruption from the confederate's mobile device may have induced feelings fear, frustration, or failure as a result of the difficult and insolvable anagrams and, with the presence of a confederate, feelings of insecurity. Taken together, this serves as possible explanation for the bias towards threatening stimuli in the phubbing condition and away from threatening stimuli in the control condition.

Given that individual differences in trait anxiety did not strongly and significantly correlate with state anxious mood, we were interested in how those differences might moderate the relationship between phubbing and anxious mood. Trait anxiety measured by MASQ-GDA and MASQ-AA captures different elements than state anxiety measured by AMS-Anxious, potentially explaining the lack of correlation between the two. While the MASQ captures a number of symptoms related to anxiety within the past week, such as trembling hands and startling easy, the AMS is vague with one question asking participants to rate their current anxious state on a scale from 1-30. Analyses were run to test the moderating role of individual differences in trait anxiety on the relationship between phubbing and anxious mood. Results showed participants with low and medium levels of trait anxiety had higher anxious mood when

there was no interruption from the confederate's mobile device compared to the phubbing condition. Participants were instructed to complete a task in a limited amount of time knowing their scores were to be compared to those of other students, potentially triggering performance anxiety. When the confederate disengaged from the task in the phubbing condition, the participant may have been distracted by the phubbing (Tindell & Bohlander, 2012), or even perceived it as a lack of interest in the task, thus downplaying pressure and inhibiting anxious mood. Meanwhile, participants unable to complete the unsolvable anagrams without disruption may have had greater feelings of frustration and fear of social rejection due to failure, resulting in perceived anxious mood. These results were only significant for participants with low and medium trait anxiety. Although not significant, results showed little to no difference between groups for participants with high trait anxiety. Sample size may play a role in this result, with uneven levels of clinically anxious individuals. A suggested cutoff for anxiety measured by the MASQ is 25; 72% of the study sample scored under 25 for GDA and 60% scored under 25 for AA. Another possible reason for the lack of difference in highly anxious individuals is those with high anxiety are more likely to overgeneralize fear across contexts or events (Sep et al., 2019). While non-anxious individuals may perceive phubbing as downplaying the significance of the anagrams task, highly anxious individuals are unable to distinguish the difference. Additional research is needed to distinguish the effects of phubbing without the presence of a difficult task.

Strengths of the Present Study

The key strength of the current study is that it is among the first to experimentally manipulate phubbing in face-to-face interaction in a controlled lab setting. By doing so, this study addresses limitations in previous research on phubbing, which predominantly use retrospective surveys (McDaniel & Coyne, 2016), interviews (Nazir, 2020), and online

animations (Chotpitayasunondh & Douglas, 2018) to depict social interaction and measure the effects of phubbing. Second, this study was the first to examine the relationship between phubbing and anxiety-related attention bias, which has not been previously considered. The results highlight the interaction between the emotional impact of phubbing and the cognitive impact, implying phubbing does not directly impact anxiety-related attention bias, rather how phubbing is perceived plays a role. Results also provide insight to the relationship between phubbing in performance anxiety, which can be applied to anxiety-provoking situations such including presentations, first dates, and job interviews.

Limitations and Future Directions

The most notable shortcoming of the current study is the sample size, with more participants in the phubbing versus control condition. The control condition was approved by the IRB later in the study than the phubbing condition, resulting in a greater number of participants in the phubbing condition compared to control. Timing of recruitment plays a role as well, the participants in the control condition were recruited in spring semester while participants in the phubbing condition were recruited in fall and springs semesters. Other limitations include population, which was comprised of an undergraduate student sample lacking a normal distribution of age, gender, and anxious mood. For the purpose of this pilot study, the study sample was sufficient. However, future studies should expand the sample size to represent different populations.

Another limitation of the current study joint problem-solving task using anagrams. Although this task was chosen specifically for this population as it relates to students working together on an assignment or project while ensuring the participant could not continue without the participation of the confederate, it is not generalizable to the greater population. Future

studies should take this into consideration when applying this paradigm to different populations. Comparing various scenarios of interaction across a broad sample would be advised, such as the effects of phubbing during an anagrams task compared to the effects of phubbing during a relationship building exercise. Both scenarios involve disruption in social interaction, but one situation invokes heightened frustration allowing to control for fear of failure or performance anxiety. Comparing various degrees of urgency around phubbing during this situation would be interesting as well in future studies. Possible conditions include the confederate explaining there is an emergency, apologizing for phubbing, disengaging for trivial reasons, or providing no reason at all. Identifying differences in the effects of phubbing during these conditions can help improve relationships and workplace moral by potentially lessening the negative emotional and cognitive impact of phubbing.

A possible limitation of the current study may also include using the AMS to rate state anxiety. Using the AMS was helpful in this pilot study as it is a quick measure that can be repeated throughout the study without taking up too much time. However, the measure is vague, asking participants to rate their perceived anxious mood on a scale from 1-30. Considering anxious mood can be interpreted differently between individuals, future studies should consider using other measures, such as the State-Trait Anxiety Inventory which measures symptoms of anxiety providing a more reliable score.

The last noted limitation of the current study is the method in which anxiety-related attention bias was measured. While the dot probe has been frequently utilized to measure AB, recent literature underscores low reliability of mean AB scores (Rodebaugh et al, 2016), suggesting the incorporation of more reliable metrics for measuring AB. Future studies should

utilize more reliable metrics, such as eye tracking, or include trial level AB variability in addition to mean AB.

Conclusion

The current study is among the first to successfully manipulate phubbing in face-to-face interaction in a controlled lab setting using a novel paradigm. The phubbing manipulation shows the negative emotional impact of phubbing on mood, consistent with existent literature, and provides a deeper look at the moderating role of trait anxiety on these effects. Additional results provide a preliminary look at the cognitive impacts of phubbing on anxiety-related attention bias and suggest phubbing itself does not directly impact anxiety-related attention bias, rather how phubbing is perceived, or its emotional impact, predicts the influence of phubbing on anxiety-related attention bias. Results also provide insight to the relationship between phubbing in performance anxiety, which can be applied to anxiety-provoking situations. Taken together, this study highlights the need for continued research on phubbing in face-to-face interactions in a controlled setting.

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Appendix A

Table 1

Descriptive Statistics for Age and Pre-Task AB Scores, Subjective Anxiety, and Subjective Mood

	Phubbing		Control			
Variable	*M*	*SD*	*M*	*SD*	*t*	*p*
Age	19.93	3.76	20.68	5.11	-0.76	.45
Threat Bias	2.76	30.2	2.85	24.19	-0.01	.99
Disengagement	4.91	26.91	-0.19	25.53	0.82	.42
Vigilance	-2.15	23.61	3.04	23.50	-0.94	.35
MASQ-AA	25.62	8.85	26.25	8.78	-0.31	.76
MASQ-GDA	20.84	7.08	19.68	7.96	0.68	.50
AMS-Happy	14.40	8.39	14.50	6.29	-0.06	.95
AMS-Sad	5.55	6.31	7.29	7.21	-1.13	.26
AMS-Anxious	6.75	7.39	10.68	7.31	-2.30	.02

Note. MASQ-AA = Anxious Arousal; MASQ-GDA = General Distress Anxiety; AMS-Happy = Happy Mood; AMS-Sad = Sad Mood; AMS-Anxious = Anxious Mood.

Table 2

Bivariate Associations Between Study Variables

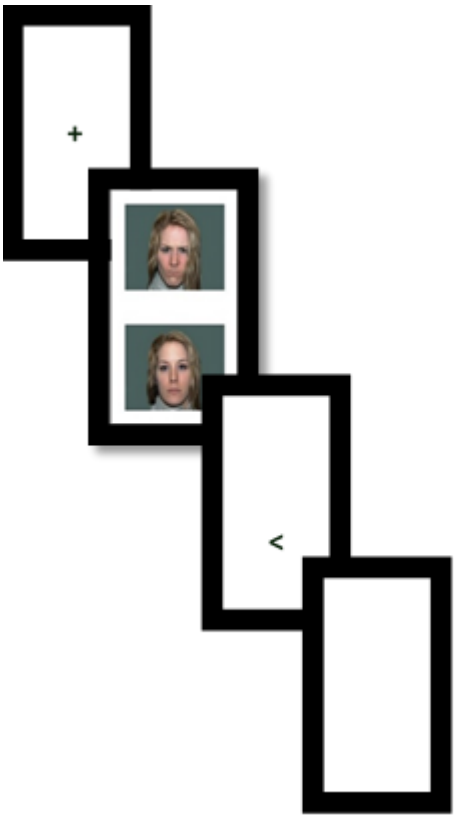
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. MASQ-GDA	-							
2. MASQ-AA	0.700**	-						
3. AMS-Anxious	0.295**	0.190	-					
4. AMS-Sad	0.513**	0.317**	0.386**	-				
5. AMS-Happy	-0.156	-0.037	0.058	-.209	-			
6. Threat Bias	0.070	0.006	0.126	-0.072	0.153	-		
7. Vigilance	0.108	0.105	0.139	0.090	0.171	0.492**	-	
8. Disengagement	-0.022	-0.087	0.010	-0.157	0.011	0.630**	-0.367**	-

Note. *p < 0.05; **p < 0.01

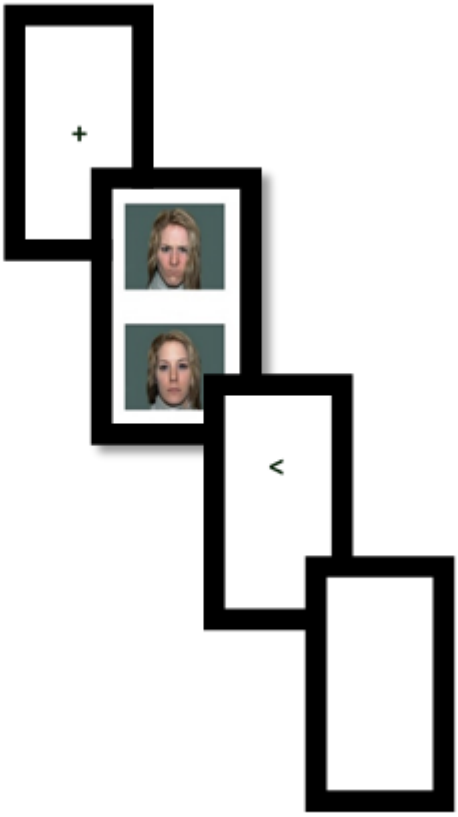
Appendix B

Figure 1

Example of trial types in the dot probe task



a. A neutral-cue trial in which the probe follows the neutral stimuli (neutral face).



b. A threat-cue trial in which the probe follows the threatening stimuli (angry face).

Figure 2

Phubbing reduced happiness

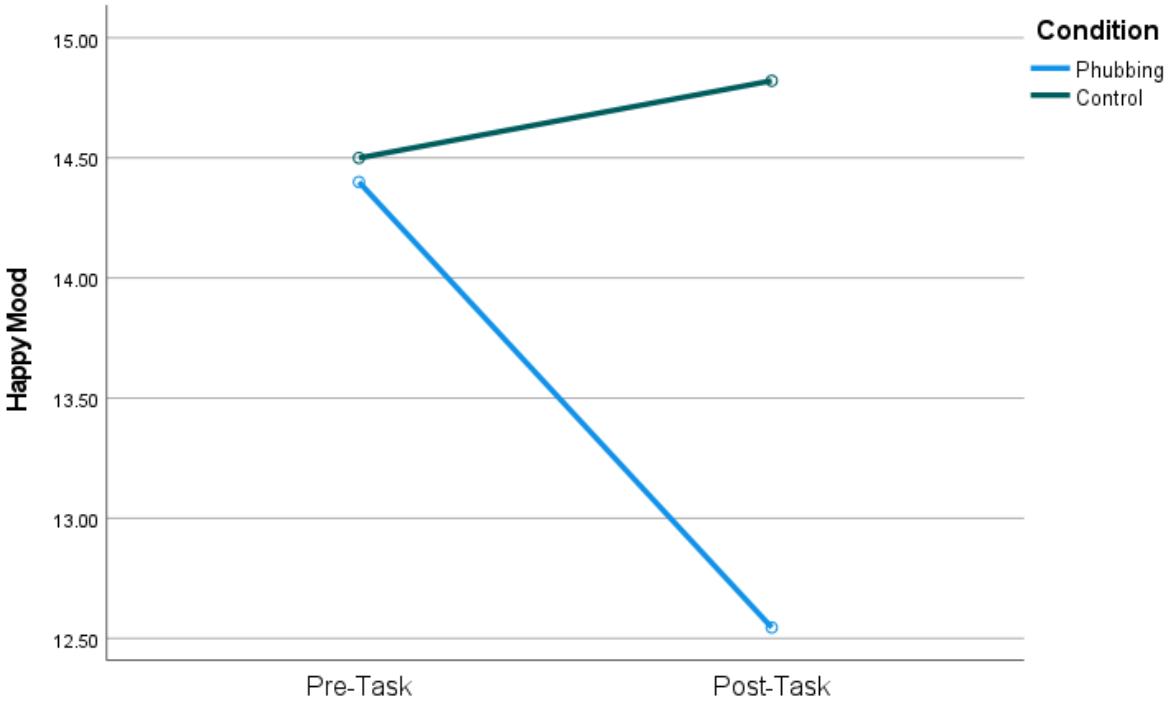


Figure 3

Low to medium levels of trait anxiety predicted greater anxious mood in the control condition

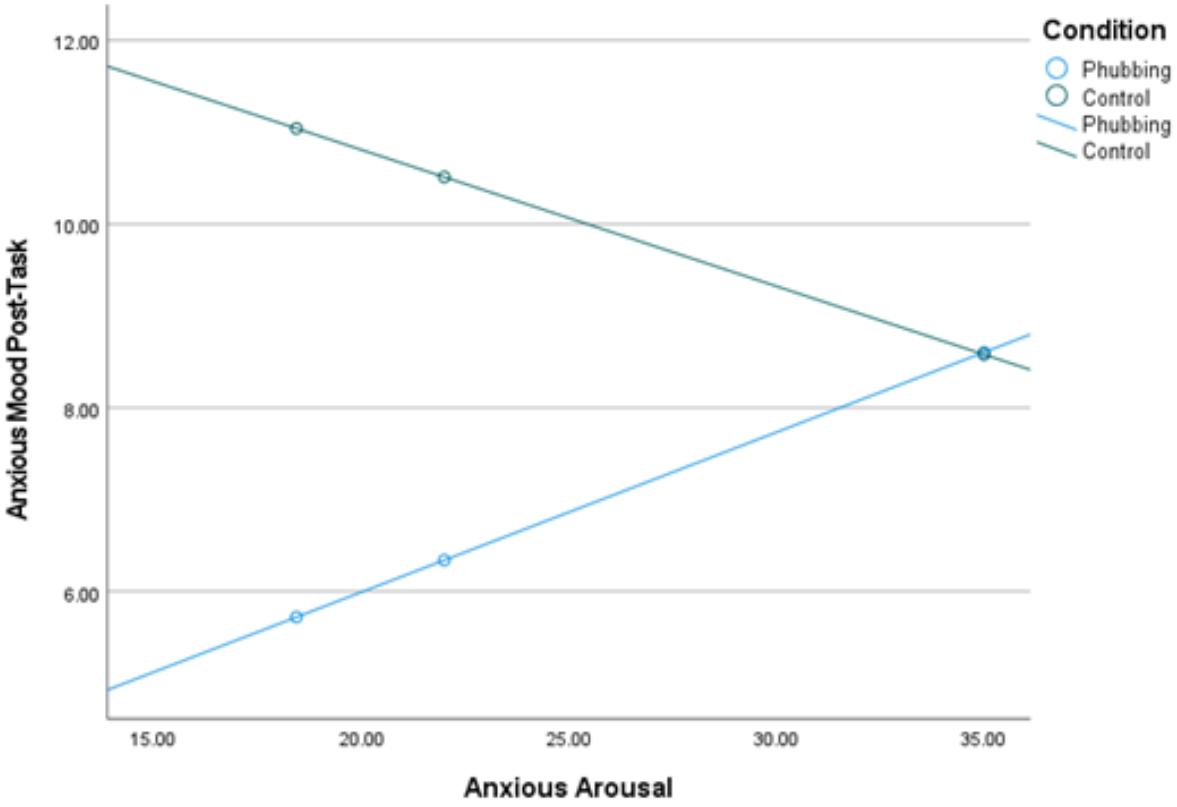


Figure 4

Low to medium levels of trait anxiety predicted greater anxious mood in the control condition

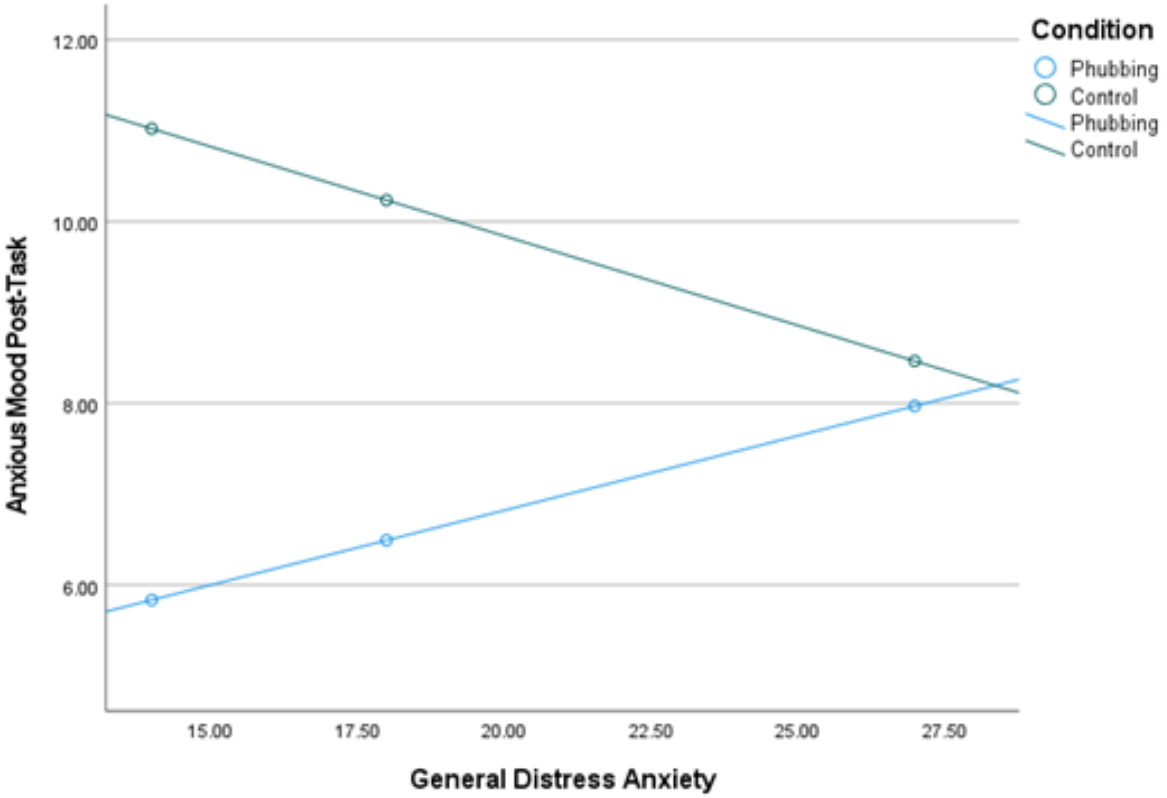


Figure 5

Sadness induced by phubbing predicted higher levels of threat bias than control

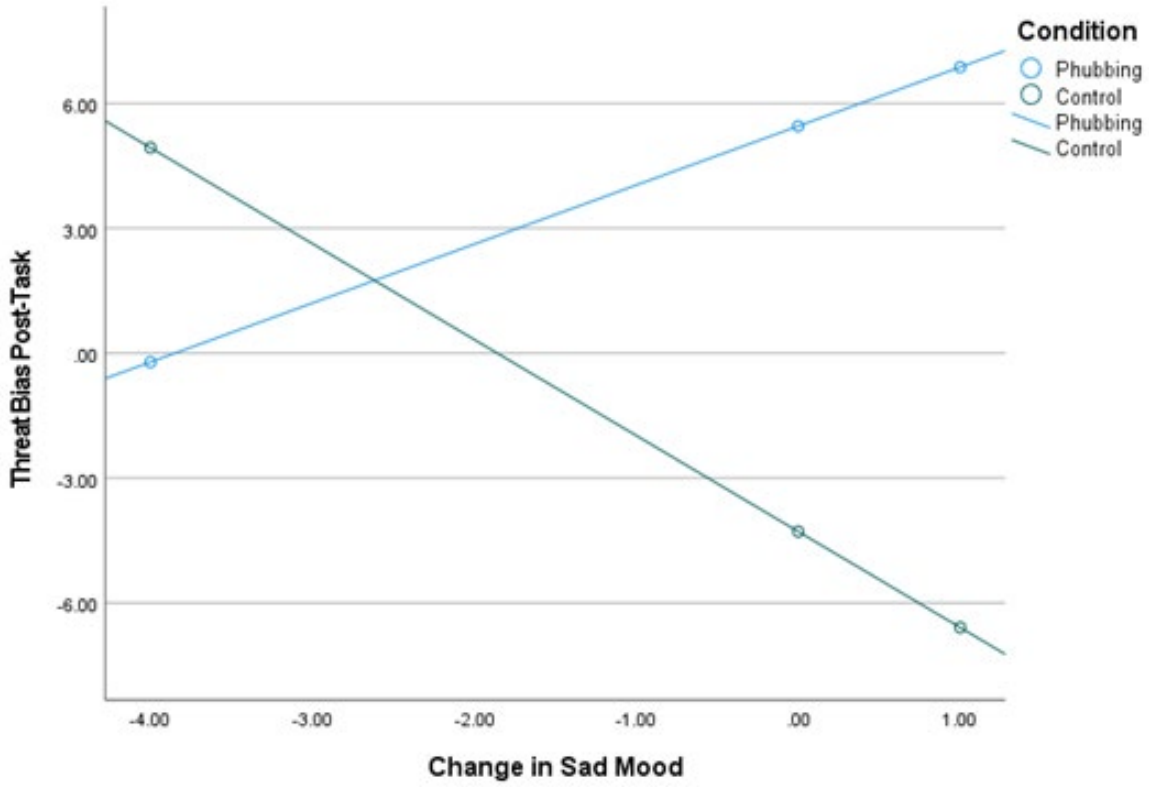


Figure 6

Sadness induced by phubbing predicted greater difficulty disengaging from threatening stimuli than control