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The Role of Vocal Hostility on Mood: Initial Development of an Alternative Stress Paradigm

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The Role of Vocal Hostility on Mood: Initial Development of an Alternative Stress Paradigm

ABSTRACT. Maltreatment, such as physical or emotional abuse, can alter one's later emotional regularity and responses to stimuli. To be able to study the effect of maltreatment on later stimuli response, appropriate laboratory paradigms need to be available, which is not currently true. The purpose of the study was to investigate the effect of vocal hostility stimuli on mood change as preliminary steps toward the creation of a laboratory paradigm. Participants were recruited from a regional university in southeast United States and asked to react to recorded audio with a hostile tone. Study 1 found that participants' mood did not differ based on the level of hostility they were exposed to, although participants indicated they would expect a more negative mood had the situation been real. Additionally, participants could not always differentiate between the hostility levels, indicating adjustments to the study stimuli might be needed. Study 2 investigated whether longer exposure to hostility might impact the relationship between hostility and mood. Results of Study 2 replicated Study 1, suggesting other factors would need to be considered in the adjustment of our stimuli to create a useful paradigm.

JAQUOY SOWELL

I got involved in a faculty-mentored undergraduate research project because I wanted to expand my knowledge with research. I contacted professors to express my interest in research to expand my skills. Research is a huge part of the



psychology field, and I wanted to research something more in-depth than what is available in the classrooms. The research was built upon another student's previous research. I was introduced to the topic and I found it very interesting. I found that researching the topic was my favorite part. There was so much interesting information that I found that dealt with the effects of vocal stimuli on individuals. It may seem like the topic is known but prior research showed the in-depth effects of vocal and facial stimuli on individuals. This research project gave me the experience of all the work that is put into a research project. This research experience also prepared me for graduate school, as I am currently getting my Master's degree. This allowed me to do a more in-depth research than what is done in a class, which helped me conduct research in my Master's program. The advice I would give other students would be to reach out to your professors if you want to conduct research. The majority of your professors conduct research daily. Reach out if you have an idea of what you want to research but make sure that you contact a professor that specializes in that topic. Research may seem tiresome but you have to find what interests you. Other than research and school, I spend my free time with family and friends. I also love to hike, cook/bake, shop, and meditate.



JENNIFER GRAY

Originally from Gaffney, SC., I completed a PhD at University of Wyoming before joining the faculty at USC Upstate. My current area of research seeks to bridge social, cognitive, and developmental psychology and the law by understanding how emotions, experiences, and extra-legal factors influence decision-making. I have published in *The Journal of Applied Social Psychology*, *Applied Cognitive Psychology*, *The Journal of Psychology: Interdisciplinary and Applied*, *Journal of Interpersonal Violence*, and *Journal of Forensic Psychology*

Practice. I have presented at the following conferences: American Psychology and Law

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Conference, Association for Psychological Science, Southeastern Psychology Association Conference, and SC Upstate Research Symposium.

Jaquoy's motivation was evident from the beginning. He asked to become involved in research. He had a Student Research Assistantship over the summer to work on this project. Through this experience, he developed greater information, literacy, and scientific reasoning.



CHRISTA CHRIST

I have been teaching in the Psychology Department at USC Upstate since the Fall of 2018. Although originally from Oregon, I earned my Ph.D. from the University of Nebraska-Lincoln. My research focuses on the biological basis of stress reactivity and individual differences in social and risky behaviors resulting from stress exposure. My work has been most recently published in *Current Psychology*, *Sex Roles, Physiology & Behavior*, *Journal of Contemporary Criminal Justice*, and *Journal of Family Violence*.

Introduction

In 2019, there were 656,000 substantiated cases of child maltreatment and neglect with a rate of 8.9 victims in 1,000 children [1]. Child maltreatment impacts emotion regulation, emotion recognition, and emotional displays [2]. Children who experience maltreatment often display emotional, behavioral, and developmental problems [3]. Psychological stressors, including childhood maltreatment, activate and affect the hypothalamic-pituitary-adrenal axis (HPA), which is found to process external experiences into internal functioning [3]-[4]. Anxiety can occur with the presentation of certain emotional stimuli used to distinguish someone's emotions, such as facial expressions and vocal tone, when the stimuli is perceived as threatening [5]. A maltreated child can also show heightened sensitivity towards angry or threatening vocal stimuli [6]. The repeated exposure to physical abuse and/or emotional maltreatment allows the individual to recognize a negative stimulus quickly, which is thought to be because it was necessary for them to survive in their environment [7].

Verbal communication is important because emotional state can be perceived by expression of voice [8]. The expression of one's voice can send an arousal cue to elicit an emotional response [8]. Emotional information can be used through vocal tones and words that are used every day [9]. Although the most common cues are facial and body expressions, vocal communication can also influence one's perception of mood [9]. Facial expressions are perceived when next to an individual, whereas vocal tone and communication do not need physical interaction [10]. In an abusive environment, aggression can be presented in facial displays and vocal tone [7]. Individuals in abusive environments are more exposed to a hostile environment that may include a hostile tone of voice.

While research has demonstrated that maltreated children recognize and respond to emotional displays differently from their non-maltreated counterparts, additional research has examined how a history of maltreatment impacts the ability to handle stress. Cortisol, the primary stress hormone, can range in high or low levels in maltreated individuals [11]. The most common way to measure stress response is the Trier Social Stress Test (TSST), which creates a stress-induced environment based on social evaluation [12]. However, the stress induction of the TSST is limited by factors such as a participant's biological aspect rather than their emotional response to stimuli [13] and individuals' previous exposure to a stressor [14]. Additionally, social evaluation may be stressful, but it is not a similar threat to emotional stimuli, such as anger. For these

reasons, we began to create a paradigm that could provide a stimulus for mood change and be more relatable.

Prior to working with maltreated children, we must determine if our newly created stimuli are being perceived as hostile, while only causing minimal discomfort in our participants. Therefore, we examined the role of the level of vocal hostility, varying aspects of the stimuli such as speaker demographics (Study 1) and the length of the hostility exposure (Study 2), on perceptions of the hostile audio clips. The following was hypothesized: 1) Individuals would perceive higher levels of hostility when exposed to increased hostility through the different audio files. 2) High hostility levels in the audio files would produce higher reports of negative mood. We also explored the previous experience of participants with varying hostility levels to identify the most appropriate stimuli for future use with children.

Method: Study 1

Participants

The participants ($N = 108$) were enrolled in classes at a regional university in the southeast United States and averaged 20.50 years old ($SD = 4.65$). The participants were predominately female (83.3%), with males (14.8%), transgender males (0.9%), and gender-variant/non-conforming (0.9%) accounting for the remainder of the sample. Participants identified as White (50%), Black (45.4%), Asian (2.8%), American Indian (1.9%), Middle Eastern/North African (0.9%), and/or Other (0.9%). Participants gave written consent prior to participating and received course credit for completing the study. Students who did not want to participate were given an alternate assignment for class credit

Materials

Hostile Auditory Cue Stimuli

Sixteen stimuli, approximately 25 seconds in length where the speaker accused the target of breaking an expensive item, conveying four levels of hostility (low, medium-low, medium-high, and high) by four adult actors (male middle-aged adult, female middle-aged adult, male young-adult, and female young adult) were created [15].

Questionnaires

Perceptions of Hostility. To measure the perceived hostility of the audio stimuli, participants were asked to rate “How hostile or angry would you say the person sounded?” on a 10-point scale (*Not at all* to *Extremely*).

Previous Experience with the Experimental Audio File Hostility Level. Single-item questions were researcher created to measure the typicality of the specific level of hostility presented in the audio stimuli. *Considering all the times you’ve been scolded/reprimanded by an authority figure:* 1) “What percentage of the time would you say that this same level of hostility you heard in the audio file has been used?” and 2) “Do authority figures typically scold you with more or less hostility than you heard in the audio file?”

Participant Mood. The 10-item negative subscale of the Positive and Negative Affect Scale (PANAS) was used to measure participants' mood [16]. This subscale has words that describe negative affect (e.g., hostile, upset, and irritable) that are rated on a 5-point scale (*Very slightly/Not at all* to *Extremely*).

Procedure

Participants gave informed consent, were randomly assigned to one of the 16 hostile audio stimuli, and asked to imagine how they would feel if the person on the audio file were speaking directly to them. After listening to the file, participants rated the perceived hostility level of the stimulus, their own experiences with hostility, and complete the PANAS twice (based on their current mood and their belief about how they would have felt in a real-world scenario with that hostility level). They were also randomly assigned to a second audio file and rated the hostility in the audio file as compared to the first one they heard. Participants then completed demographic questions before being debriefed.

Results and Brief Discussion: Study 1

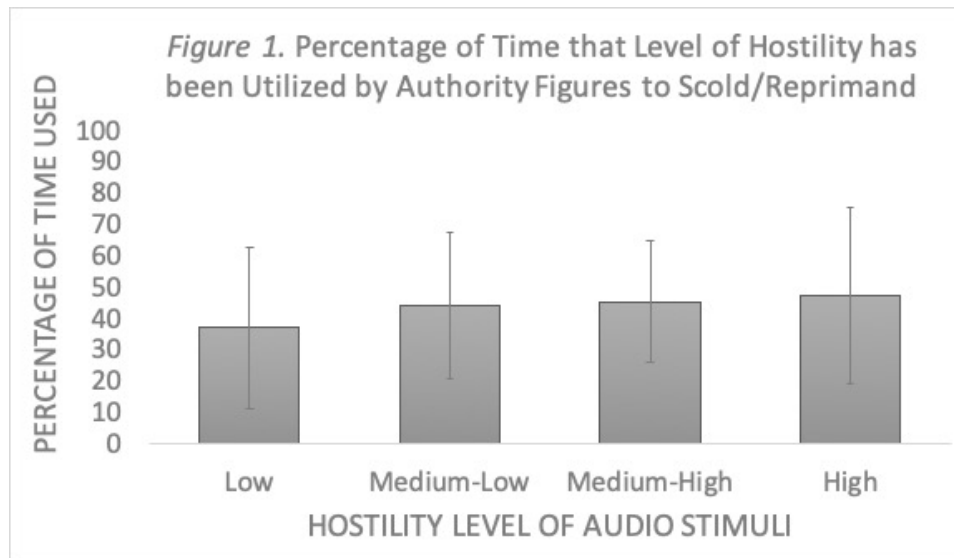
Based on a between-groups ANOVA of our data we found support for hypothesis 1. There was a difference in perceived hostility in the audio stimuli ($F(3,104) = 25.06$, $MSE = 2.65$, $p < 0.001$), the low hostility stimulus was rated as the lowest level of hostility ($M = 4.25$, $SD = 1.87$), high hostility was rated as the highest level of hostility ($M = 8.35$, $SD = 1.34$), and the two moderate stimuli created were rated in between (medium-high hostility audio stimuli: $M = 6.33$, $SD = 1.76$; medium-low hostility audio stimuli: $M = 5.96$, $SD = 1.45$). However, it should be noted that it may be somewhat difficult for individuals to determine differences in hostility levels because there was no significant difference in hostility ratings between the medium-low and medium-high audio stimuli. Additionally, when we asked participants to compare hostility level from the first stimuli to a second audio stimuli, only 68.5% of participants were accurate.

When listening to the first audio stimulus, participants were asked to consider their actual mood resulting from the file (actual mood), as well as what they would expect their mood to be if the situation were not hypothetical, but rather they found themselves in a real situation with hostility exposure of the same level (predicted mood). It was expected that listening to higher hostility would produce greater negative mood (Hypothesis 2). Results of a mixed-groups factorial ANOVA (stimulus hostility level x mood type) showed our hypothesis was not supported. There was no difference in mood across the levels of hostility ($F(3,102) = 1.60$, $MSE = 156.32$, $p = 0.193$) regardless of mood type ($F(3,102) = 0.23$, $MSE = 28.95$, $p = 0.875$). However, participants did report a higher predicted mood ($M = 30.28$, $SE = 1.00$) than actual mood ($M = 21.30$, $SE = 0.89$; $F(1,102) = 143.23$, $MSE = 28.95$, $p < 0.001$).

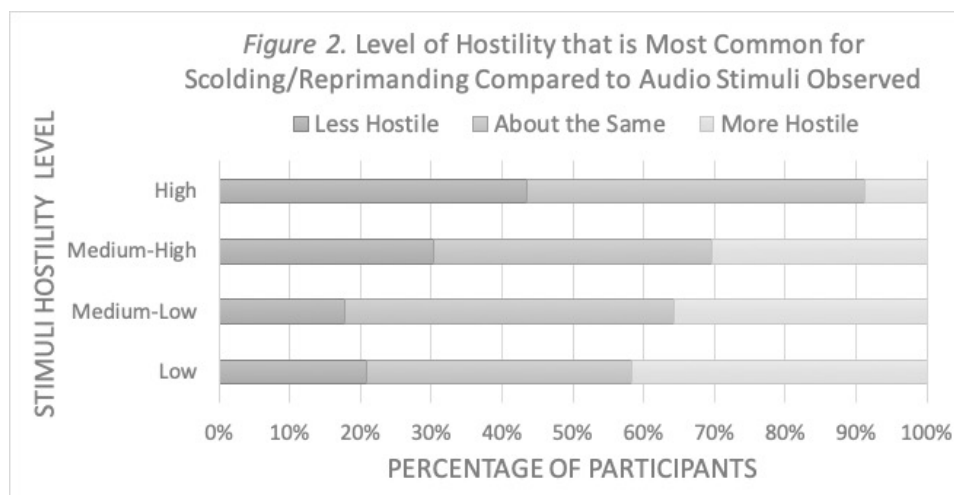
Although these findings were not hypothesized, there is evidence that individuals are poor at predicting how their mood would be affected in the real-world based on a hypothetical situation [16]. Therefore, the hypothetical situation recorded in the audio file may not provide the most accurate estimation of how hostility affects mood. However, further exploration showed the higher the participant rated the hostility of the audio stimulus, the more negative they also rated their mood ($r = 0.35$, $p < 0.001$). These findings might suggest that our results support our hypothesis that higher hostility produces a moderately higher reporting of negative mood, but that individual perceptions of hostility is more important than the actual level of hostility.

The most similar level of hostility reported by participants to be used by authority figures in their own life seemed to be the medium-high level (see Figure 1 & 2), suggesting it might be the

most ethical and realistic to use for future studies. However, there were no statistical differences between the frequency of hostility level used by authority figures, suggesting that participants experience a wide range of hostility normally.



Note. Participant indication of the frequency with which they have heard the level of hostility used in the audio stimuli they observed for the study when being scolded or reprimanded by an authority figure in their real life. Between-groups ANOVA indicated no significant difference between groups, $F(3,70) = 0.58$, $MSE = 554.18$, $p = 0.631$.



Note. Participant indication of whether the hostility level typically used by authority figures to reprimand or scold them in their real life was less, similar, or more hostile compared to the level of hostility in the audio file they observed in the study. Chi-Square analysis indicated no significant difference between group frequencies, $\chi^2(6) = 8.93$, $p = 0.178$.

In addition to the concern of the situation being hypothetical, it is also possible that the hostility stimuli (25 seconds exposure) were too brief to produce a negative mood. Indeed, the length of

exposure was shorter compared to previous research [17]. Therefore, we conducted a second study to determine if the length of the hostile stimuli impacted the effect of hostility level. We still expect that perceived higher levels of hostility, based on the audio file assigned, would produce higher reports of negative mood. However, we expect that because the results of Study 1 showed no effect, that the relationship may only be significant when the hostility exposure is longer. To explore factors that might make the stimuli more realistic, we also included in the second study questions related to factors individuals perceived as being most impactful to their mood in a hostile encounter.

Methods: Study 2

Participants

The participants ($N = 145$) were enrolled in classes at a regional university in the southeast United States and averaged 19.84 years old ($SD = 3.05$). Participants identified as male (20%), female, (79.3%), and non-conforming (0.7%), as well as White (49.7%), Black (38.6%), Hispanic (13.8%), Asian (6.2%), American Indian (1.4%), and/or Middle Eastern/North African (0.7%). Participants gave written consent prior to participation in the study and received course credit for completing the study.

Materials

Hostile Auditory Cue Stimuli

The hostility level and speaker demographics were simplified for study 2 given the findings of study 1. The two original audio files created by the middle-aged man portraying low hostility and medium-high hostility were used from study 1. The actor created four additional files with added length at the low and medium-high hostility levels. The content of the script did not vary in theme across the audio files, but rather the same content was repeated with similar phrases two or three times, resulting in six audio files: two levels of hostility (low vs medium-high) x three durations (25 seconds, 50 seconds, and 75 seconds).

Questionnaires

Study 2 used the same PANAS questionnaire, and previous experience with hostility levels and demographic items as Study 1. Additionally, participants were asked the question *“When considering your emotional response to others, if someone scolds/reprimands you, what plays the greatest role in affecting your own emotional state?”* Participants were able to respond to this item by ranking the randomly ordered options: 1) *“Characteristics of the person (e.g., age, gender, height)”*, 2) *“How long a person spends scolding/reprimanding you”*, 3) *“The level of hostility used”*, 4) *“The verbal/speech content used”*, and 5) *“Familiarity of the person scolding/reprimanding you (e.g., stranger vs. parent)”*.

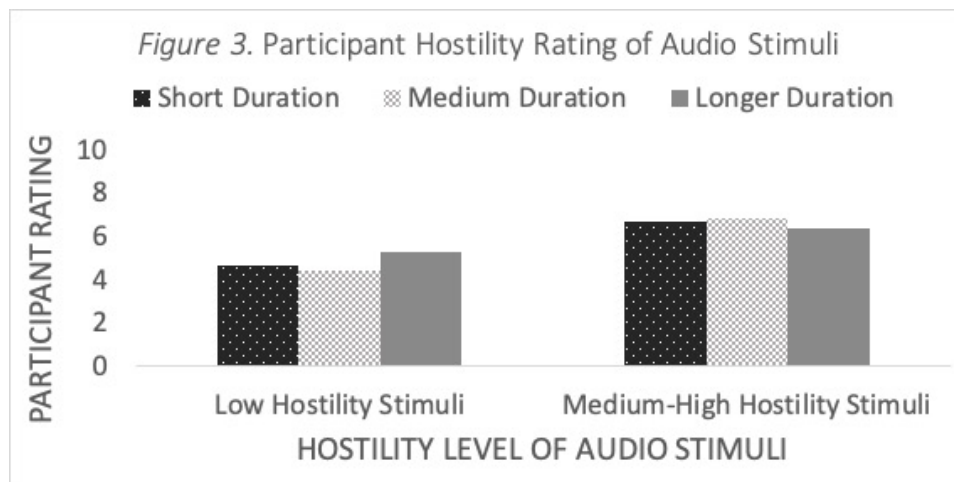
Procedure

After giving informed consent, participants were randomly assigned to listen to one of the six audio stimuli. Participants were asked to imagine how they would feel if the person speaking on the audio file were speaking directly to them, and then to rate their perception of the hostility level

they heard. Participants then completed items regarding their previous experience with hostility and the mood questionnaire twice (based on their current mood and their belief about how they would have felt in a real-world scenario with that hostility level). They were then asked to listen to a second randomly assigned audio stimulus. Participants rated if the second stimulus was more, equivalently, or less hostile than the first. Participants completed a demographic questionnaire and then were debriefed.

Results and Discussion: Study 2

Consistent with hypothesis 1 and study 1, analysis of participant ratings with a between-group ANOVA indicated that participants rated the audio stimuli categorized as medium-high hostility ($M = 6.62$, $SE = 0.23$) as more hostile compared to the audio stimuli categorized as low hostility ($M = 4.78$, $SE = 0.22$; $F(1, 109) = 34.25$, $MSE = 2.75$, $p < 0.001$). Based on the results of a between-group factorial ANOVA (hostility level \times stimuli length), the length of the hostile audio stimuli had no moderating effect on the relationship between the hostility level of the audio stimuli and the participant hostility rating ($F(2, 109) = 1.45$, $MSE = 2.75$, $p = 0.238$; see Figure 3). Also, similar to Study 1, results indicated that individuals have difficulty in determining the difference in hostility levels when there is no actual significant difference. When comparing two audio stimuli, participants were almost entirely accurate (98.2%) when the audio stimuli were actually different (low vs. medium-high). However, when the participants received an audio stimulus for the second exposure that was equivalent to their first exposure, they were less likely to be accurate (30% correct identification; 55% noted a slight difference, and 15% noted an extreme difference). This was consistent regardless of the change in length between the first and second audio stimuli presented.



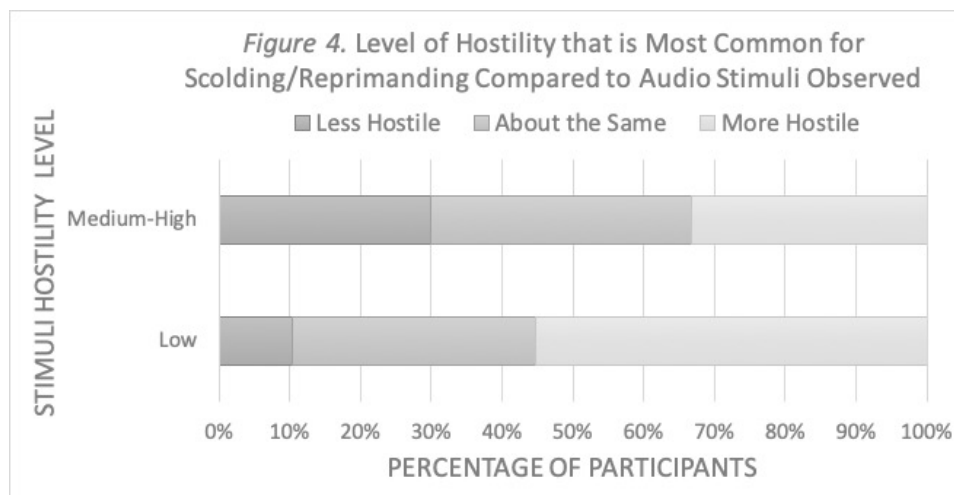
Note. Participant indication of the hostility level of the first audio stimuli exposure. Hostility levels were higher for the medium-high hostility stimuli compared to low hostility stimuli. The duration of the audio stimuli had no effect on participant hostility ratings.

Following the audio stimuli, participants were asked to consider their actual mood resulting from the hostility exposure (actual mood), as well as what they would expect their mood to be if the situation were not hypothetical, but rather they found themselves in a real situation with a similar hostility exposure (predicted mood). Results of the between-groups factorial ANOVA

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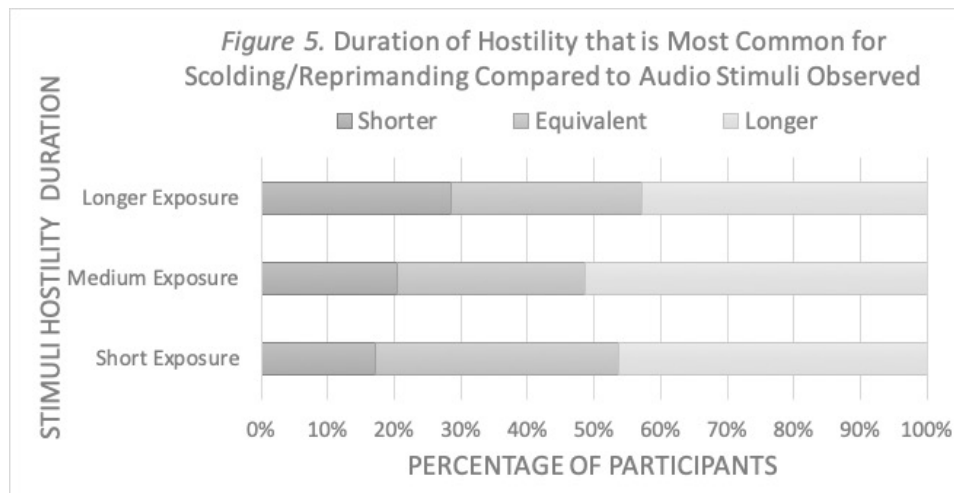
(hostility level x stimuli length) for actual mood indicated that contrary to our hypothesis 2, but similar to study 1, there was no difference in mood across the two levels of hostility ($F(1, 108) = 0.05$, $MSE = 66.95$, $p = 0.831$). There was also not a significant interaction between hostility level and stimuli length ($F(2, 108) = 0.31$, $MSE = 66.95$, $p = 0.736$). Results of a between-groups factorial ANOVA (hostility level x stimuli length) for predicted mood (Hostility Level: $F(1, 109) = 0.16$, $MSE = 100.78$, $p = 0.687$; Interaction: $F(2, 109) = 0.28$, $MSE = 100.78$, $p = 0.758$) indicated the same results as the analysis with actual mood. Also consistent with Study 1, based on a repeated measures ANOVA, participants reported a more negative predicted mood ($M = 32.00$, $SD = 9.92$) than actual mood ($M = 21.39$, $SD = 8.03$; $F(1, 113) = 149.23$, $MSE = 42.96$, $p < 0.001$), further suggesting that a hypothetical situation may not provide the most accurate estimation of how hostility affects mood. However, also consistent with Study 1, there is a significant correlation between participant rating of the perceived hostility level of the audio stimuli and both their actual mood ($r = 0.35$, $p < 0.001$) and predicted mood ($r = 0.27$; $p < 0.01$). The more hostile the audio stimuli were perceived the more negative participant mood. These findings would support that a hypothetical situation may still affect mood, but only if the situation is viewed as hostile.

Similar to Study 1, the medium-high level of hostility was reported to be a more similar level of hostility to be used by authority figures in the participant's own life (Figure 4). In an effort to better understand the factors that contribute to participants' perception of hostility, we analyzed participant responses to a question asking individuals to rank order (lower value corresponds to higher ranking) what specific factors they felt would have the greatest impact on their mood during real-world exposure to hostility. Both content of speech ($M = 2.50$, $SD = 1.25$) and level of hostility ($M = 2.55$, $SD = 1.27$) were indicated as the factors that would be most impactful to one's mood compared to familiarity with the hostile person ($M = 3.11$, $SD = 1.50$), duration of hostility exposure ($M = 3.29$, $SD = 1.28$), or characteristics of the hostile person (e.g., age, gender; $M = 3.56$, $SD = 1.46$).



Note. Participant indication of whether the hostility level typically used by authority figures to reprimand or scold them in their real life was less, similar, or more hostile compared to the level of hostility in the audio file they observed in the study.

In Study 2, the length of the hostile stimuli had no impact on mood. However, further examination did suggest that a significant portion of participants are used to experiencing an even greater duration of hostility (Figure 5), which may suggest that duration of hostility could still have an effect on one's mood if the exposure to hostility had been longer than the stimuli used for Study 2.



Note. Participant indication of whether the duration of hostility typically used by authority figures to reprimand or scold them in their real life was shorter, equivalent, or of a longer duration compared to the duration of hostility in the audio file they observed in the study.

Limitations

Although we are attempting to create a paradigm to eventually use with children and adolescents, they are a vulnerable population, so college students were used for our studies to be sure the stimuli were not too stressful. However, factors such as content of speech may differentiate throughout age groups, especially given the results of Study 2 that participants believe the content of the speech to be just as important as the level of hostility. A group of adults may not find a scolding about a broken item impactful compared to other situations. A child may find this impactful because they are afraid of the consequences. Therefore, future studies could alter content of speech that is more suitable for the age group of participants. Even though participants also indicated the hostility level is a factor that would be very impactful on their mood, we could have also measured participant mood both before and after the audio files to investigate mood change because it is possible that even very low levels of hostility could change mood and that additional effects on mood with increased hostility are minimal.

Conclusion

It is critical to find a level of hostility that is ethical and impactful on negative mood, as a first step in eventually creating a lab paradigm. It is important to choose a hostility level that is commonly experienced. Too high of a hostility level may produce invalid responses because it may not be commonly experienced and may also be unethical if unnecessarily distressing. We conclude that the medium-high hostility level of our stimuli is the most appropriate level of hostility experienced. It was also shown that participants negative mood was higher only if they perceived the audio clip as more hostile. However, the majority of the participants could not correctly compare hostility levels and there are still limitations to address, which suggests further research needs to be done.

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