MINDFULNESS INFLUENCE ON STRESS IN THE OBSERVATION OF A HUMAN-ANIMAL INTERACTION

A Thesis
by
SAVANNAH LEE

Submitted to the School of Graduate Studies
at Appalachian State University
in partial fulfillment of the requirements for the degree of
MASTER OF ARTS

August 2022
Department of Psychology

MINDFULNESS INFLUENCE ON STRESS IN THE OBSERVATION OF A HUMAN-ANIMAL INTERACTION

A Thesis
by
SAVANNAH LEE
August 2022

APPROVED BY:

Doris Bazzini
Chairperson, Thesis Committee

Lisa Emery
Member, Thesis Committee

Lisa Curtin
Member, Thesis Committee

Rose Mary Webb
Chairperson, Department of Psychology

Marie Hoepfl, Ed.D.
Interim Dean, Cratis D. Williams School of Graduate Studies

Abstract

MINDFULNESS INFLUENCE ON STRESS IN THE OBSERVATION OF A HUMAN-ANIMAL INTERACTION

Savannah Lee
B.S., University of Florida
M.A., Appalachian State University

Chairperson: Doris Bazzini

The purpose of the present study was to determine whether there are therapeutic benefits for stress reduction derived from observing a virtual human-animal interaction, and whether mindfulness instructions can enhance these effects. After experiencing a mildly stressful cognitive task, participants ($N = 162$) watched one of three videos involving either a live cat being pet, a live cat not being pet, or a toy cat being pet, with either instructions to engage in mindfulness practice or not. They then completed measures of state-stress, mindfulness, and positive and negative mood. No significant influence for instruction condition or video condition on stress reduction was found, but exploratory analyses revealed that watching the video of a toy cat being pet led to more negative mood, higher ratings of mindfulness, and higher reports of post-manipulation stress relative to both of the live cat videos. Research with animals is challenging, but with the impact that animals have on millions of people, it is important to continue the pursuit of understanding in what way animals can influence humans.

Acknowledgments

I would like to express my deepest appreciation to Dr. Doris Bazzini for aiding in the research process from start to finish and listening to my spew of various ideas over the years. Many thanks to the rest of my cohort, for providing support, cheering me on and sharing my love of animals. I am also grateful to Dr. Andrew Smith, who provided advice and helped in the research process in more ways than one. I would also like to thank my committee members, Dr. Lisa Emery and Dr. Lisa Curtin, for supporting my journey on this passion project and keeping me grounded to realistic expectations. Lastly, I'd like to recognize the inspiration for this project, my two cats Arwen and Ridley, for providing love and encouragement throughout my Graduate career.

Dedication

This project is dedicated to all those who have found comfort, love, and support from their furry, scaley, or feathered friends.

Table of Contents

List of Tables

List of Figures

Introduction

Animals have held a place among humans for 2.5 million years, whether it be for food, hunting, transport, or protection (Waal, 2010). The transition from animals being regarded as a resource to being domesticated and considered a companion happened approximately 12,000 years ago (Young, 1985). In the modern world, companion animals are usually birds, cats, dogs, fish, horses, reptiles and small mammals. Pet ownership in the United States has peaked relative to previous years, with 67% of families having welcomed a pet into their household; dogs and cats being the most common (American Pet Products Association, 2020).

There seems to be a general belief that pet ownership corresponds with greater well-being among people (Amiot & Bastian, 2014; Bao & Schreer, 2016; Centers for Disease Control and Prevention [CDC], 2019), relative to non-ownership, albeit much of the research evidence is correlational in nature. In research involving animals, there is variability in research outcomes that are likely due to the unique nature of including two complex organisms (a human and a non-human animal) that interact in dynamic ways (Rodriguez et al., 2021).

The benefits derived from pet ownership can be connected to a variety of perceptual factors levied by owners that include the belief that pets provide greater social and emotional support than people (Pendry & Vandagriff, 2019), facilitate social interactions, reduce feelings of loneliness and isolation (Edney, 1995; McConnell et al., 2011; McNicholas & Collis, 2000), enhance a sense of acceptance, belonging, self-esteem, emotional stability, and security (Friedmann et al., 1983). Pets have also been suggested to be a source of unconditional affection while also providing consistency in pleasurable day to day activities (Edney, 1995). Pets can also serve in a more assistance-based role for those with physical or psychological disabilities, such as blindness or epilepsy (Edney, 1995). Companion animals also allow the handler to reappraise

stressors by increasing attentional focus, allowing them to determine the stressor to be less threatening and even allow for better management of stress in response to the stress cue (Nittono et al., 2012; Pendry & Vandagriff, 2019). These improvements in both physical and mental health likely lead to a stronger bond with the animal, augmented by the shared feelings of trust and dependability. Additionally, physical and mental health benefits accompanying pet ownership have been demonstrated in regard to decreased blood pressure rates and reduced fear and anxiety (Barker & Wolen, 2008; Siegel, 1993). In a review of 30 different studies performed between 1990 and 2007, it was determined that a majority of the results found support for a positive association between human health and the presence of animals (Friedmann & Son, 2009).

Animal Assisted Therapy, State Anxiety, and Stress Reduction

Animal Assisted Therapy (AAT), also known as Pet-Assisted Therapy, made its first appearance as far back as the 1800's in mental hospitals, though not in the traditional sense observed today (Serpell, 2000). In the 1800's, small domestic animals were permitted to wander the grounds of mental health institutions as a way to improve morale of the patients living there. It was not until the 1960's though that AAT was brought beyond the walls of mental health institutions. Dr. Boris Levinson was the first to use a dog in a therapeutic session with a child when he unintentionally left his dog alone with a child that was proving to be quite difficult, and when he returned, the child was talking to his dog (Velde et al., 2005).

The modern-day AAT is a method implemented by a therapist using a trained animal to assist in achieving personalized goals through a facilitated interaction between the patient and the animal (Halm, 2008). These goals consist of improving social, emotional, cognitive and even physical functioning, and is unique for each individual and their treatment plan (Boyer &

Mundschenk, 2014). AAT has many benefits in the clinical settings, one of which is a believed level of trust fostered by lack of judgment with the animal that can super-cede those felt for the human counselor (Chandler, 2012). In a derivation of AAT, called Animal Assisted Activities (AAA), animals are used in recreational programs, such as visitation to hospitals or living facilities, but the sessions are not personalized to the individual and are more directed towards quality of life, not necessarily long-term improvement (Animal Assisted Intervention International, n.d.).

A variety of animals are used in AAA and AAT to achieve therapeutic outcomes. Clearly, particular animals and their adaptability to domestication and bonding with humans make some more appropriate to serve in therapeutic settings. The animal exemplar of therapy animals is typically a dog (as demonstrated by earlier points about the evolution of AAT), but AAT can include cats, horses, small mammals, and even fish, all of which are among the most common household pets.

AAT and AAA have been implemented in many settings, including in-patient medical centers, college campuses, hospice centers, and homes for the elderly. This wide range of applications for AAT and AAA are due to the impact these interventions have on stress. An analysis of 28 AAT studies has shown that this therapeutic practice is effective at reducing physiological and subjective stress reactivity (Ein et al, 2018). Even brief interactions with therapy dogs can lead to significantly reducing stress indicators, and increased relaxed states in people (Thrasher, 2016).

State-anxiety, coined by Spielberger (1966), is an impermanent psychological response consisting of unpleasant feelings of tension and apprehensive thoughts. It is also commonly elevated in the presence of fear inducing cues, which is known to be mitigated with the

involvement of an animal interaction (Pendry & Vandagriff, 2019). This relationship between stress reduction and therapeutic interactions with animals was explored by Shiloh et al. (2003), who had participants pet a real turtle or rabbit, or a toy turtle or toy rabbit, and then measured state-anxiety after inducing stress by telling participants they would be holding a tarantula. Their measure for state-anxiety consisted of the state-anxiety part of the State-Trait Anxiety Inventory (STAI), which is a self-report measure that looks at feelings of tension, nervousness, worry and apprehension (Spielberger et al., 1970). The authors also conducted a manipulation check for predisposition towards animals using the Companion Animal Semantic Differential, and found that the stress reducing effect applied to both animal lovers and people with differing attitudes towards animals. They found that petting a real animal reduced state-anxiety as compared to the toy animals, but was not due necessarily to the different tactile sensations of a turtle versus a rabbit. Because a turtle' shell and rabbit's fur are so compositionally different, and both real animals reduced stress symptoms, Shiloh et al. (2003) argued that real vs. toy target differences were not due to tactile sensations but the quality of being alive in the real animal.

The stress-reducing aspects of live versus toy animals was further corroborated by Beetz et al. (2012). They had children aged 7-11 years old with insecure-avoidant or disorganized attachment patterns complete the Trier Social Stress Test for Children. Each child was then randomly assigned to either interact with a therapy dog; a friendly, young female lab assistant; or a toy dog. Stress was measured through salivary cortisol levels before, during, and after exposure to the respective conditions. They found that across conditions, stress response was lowest in the therapy dog condition. Furthermore, although there was greater reported stress reduction for the toy dog condition compared to the friendly human condition, it was not as strong as what was found for the therapy dog condition. Beetz et al. (2012) also found a negative correlation

between how much physical contact occurred between the live dog and child and cortisol levels across time. That is, the stress-reducing effect of the therapy dog was not just due to the mere presence of a live animal, but the intensity of the physical interaction and active petting of the dog (Beetz et al., 2012).

Shiloh et al. (2003) proposed that animals may facilitate stress reduction through a combination of positive associations and experiences (Nagengast et al., 1997; Wilson, 1991) and an attentional shift away from the anxiety-provoking stimulus (Brickel, 1982). Nagengast et al. (1997) applied the idea of positive associations through an examination of blood pressures and heart rate. Systolic, diastolic, arterial blood pressure, heart rate, and behavioral distress were measured in order to determine physiological and psychological arousal either with or without the presence of a dog during a stressful health examination. The children serving as the participants tended to display increased blood pressure when the dog was first introduced, which serves as the evidence for a positive association of excitement due to the initial presence of the dog, leading to an overall decrease in blood pressures and heart rate.

The attention-shift hypothesis proposed by Brickel (1982) suggested that animals reduce emotional discomfort through distraction. Using evidence from competing response theory, Brickel (1982) explains how animals act as emotionally laden stimuli that are particularly discernable. This distraction provided by the animal serves as a way to reallocate cognitive resources away from an anxiety-provoking stimulus. Nittono et al. (2012) made similar arguments about the positive emotions elicited by viewing image of "cute" animals. They found that such images promoted more careful behavior in fine motor tasks due to a narrower attentional focus. They also found that individuals who view cute images before completing a global-local letter task have higher rates of focused attention to different presented stimulus

features. Thus, through this diversion created by either an actual animal or an image of one, anxiety levels can be decreased, due to the non-aversive consequences provided by the animal distractor.

Pendry and Vandagriff (2019) conducted a study concerning stress reduction through animal interaction with a hands-on condition, an observation condition, and a slideshow condition. The hands-on condition allowed the participants to directly interact with the therapy animals, for the dogs in groups of 5 and the cats individually. The observation condition allowed participants to watch others engage with the animal from 8 feet away and were instructed to refrain from direct interaction with the animal. The slideshow group watched a presentation consisting of photos of the same therapy animals used in the other groups, having no interaction with the animals. Salivary cortisol levels were taken 25 minutes before the exposure to the animals and 25 minutes after to allow for the appropriate cortisol levels to be displayed for the experiment and to remove any outside influence on these levels. The hands-on group experienced the strongest decrease in salivary cortisol levels, while the observation group had a weaker, but still significant, reduction in these levels. They argued that by simply watching someone interact with a dog or cat, salivary cortisol levels decreased at the second highest rate, succeeded only by direct interaction with the animals.

These findings for the direct contact group are supported by the idea that animals provide a nonjudgmental and trustworthy atmosphere through the experience of social support and physical contact (Ditzen et al., 2007; McNicholas & Collis, 2000). Pendry and Vandagraff (2019) speculated that the observation group experienced decreased stress due to the perceptual and psychological mechanisms involved in watching a direct animal interaction. It is possible that a concurrent activation of positive associations (Shiloh et al., 2003) occurs via recalling a

memory of a similar interaction through cued recall (Fisher & Craik, 1977), taking the perspective of another individual (Batson et al., 1997), or an attentional shift away from an internal stress stimulus (Brickel, 1982) when interacting with a live animal or watching another person doing so. Though the direct interaction may be more physically engaging, the observation group would experience past positive memories of their own interaction with a familiar animal. The observer would still experience the stress reduction, although not as strong, because they are able to connect a past memory of an animal interaction to an observed interaction in the present moment.

One testament to the power of watching animals to evoke positive states in people is the popularity of animal videos posted on social media. For example, as of 2014, there are more than 2 million cat videos on YouTube with nearly 26 billion total views, with an average of 12,000 views per video, making cat videos one of the most popular YouTube video categories (Marshall, 2014). Myrick (2015) argued that motivators for watching these cat videos online is rooted in mood management, procrastination, and individual differences – specifically affinities towards felines. Respondents in Myrick's (2015) study reported internet cat viewing frequency, cat affinity and ownership, big five personality traits, shyness, well-being, affective support, emotional states, procrastination, online cat and dog media consumption, and enjoyment of online cat media. Results demonstrated a significant relationship between personality types and emotional benefits of consuming cat media. Specifically, a significant increase in positive emotions (hope, happiness, contentment) as well as a significant decrease in negative emotion (annoyance, anxiety, sadness, guilt) after watching cat media was found. What remains to be seen is whether watching videos of animals online could result in similar outcomes or improvements as seen in AAT and other stress-reduction interventions with animals.

In summary, there is support for the psychological benefits of human-animal interaction, whether direct or vicarious, for stress reduction. However, a shortcoming of this research is that it mostly relies on correlational designs that fail to eliminate pre-existing preferences for animals. Furthermore, the small number of studies that have investigated this phenomenon experimentally have speculated on cognitive processes (e.g., attentional shift), but not specifically measured or controlled for them. This study introduces a controlled experimental view that accounts for pre-existing preferences for animals as well as a measure for cognitive processes.

Mindfulness and Therapeutic Interventions

For more than a decade, scientists and researchers have searched for a true definition of mindfulness. The difficulty in establishing an exact definition results from the multiple meanings of mindfulness across the world, as well as its use across many different fields. Mindfulness, also known as *sati*, is an ancient word, with olden meanings ranging from spiritual to physical. *Sati* was first translated to English in the late 1800s by the Buddhist scholar T.W. Rhys Davids (1881). The difficulty in defining mindfulness comes from *sati,* since its meaning emphasizes mindfulness as an experience, rather than a practice, and is one of the first steps towards enlightenment in Buddhism (Rhys Davids, 1881).

Mindfulness is a technique used in psychotherapy to help patients address both physical and psychological discomforts. The idea behind this multifaceted technique is derived from Jon Kabat-Zinn, who developed this meditative technique from Buddhist practice. Kabat-Zinn started out at Massachusetts Institute of Technology, where he was introduced to the Buddhist philosophy. From here, he opened his own Stress Reduction Clinic and applied Buddhist teachings to develop what we know today as mindfulness (Shea, 2018). This later evolved into the more science-contextualized Mindfulness Based Stress Reduction (MBSR).

MBSR is a treatment plan involving mindful meditation and yoga. The most common mindful meditation is known as the body scan, where the individual focuses their attention starting at the top of their head, moving all the way down through their body to their toes, acknowledging every physical sensation along the way (Selva, 2020). Although it is applicable to many different individuals, some potential negative side effects of mindfulness are physical discomfort, muscle tension and relaxation-induced anxiety (Nam & Toneatto, 2016). There are many different MBSR techniques, making it a treatment option for children, young adults, adults and older adults.

Nilsson and Kazemi (2016) determined five core elements of mindfulness after reviewing 33 cross-cultural descriptions of mindfulness from various traditions. *Awareness* appeared in more than half of the definitions they analyzed and is likely the most well-known aspect of mindfulness. Another common theme, *ethical-mindedness*, is the idea that the individual can contribute to justice, peace and an ecological balance in the world and society. The third common theme is *external events*, which highlights the importance of external stimuli and happenings outside of the body. One must be aware of the outside environment in order to become comfortable and accept the inability to predict or control external circumstances. *Cultivation* is the development of character, providing a counterbalance to negative events and allowing for extensive insight of the self. The final core element is of *present-centeredness*, or being aware in the present moment and viewing one's experiences and thoughts nonjudgmentally. This is the element of mindfulness that is most relevant to the current investigation on what elements of AAT help contribute to reductions in anxiety.

Mindfulness has been applied in the clinical setting through MBSR. Originally meant as a solution to the lack of chronic pain management due to its ability to induce a detached

observation of the self and insight into actuality of present phenomena, it has now been developed as a way to help with psychological morbidity. Psychological morbidity is an anxious, depressive mental state that can occur when a person receives a medical diagnosis, such as cancer (Tobin et al., 1993). This psychological morbidity leads to ruminative thoughts (e.g., inability to process emotions, repetitive acknowledgment of dark thoughts), jumpstarting the cycle of anxious and depressive symptoms for newly diagnosed individuals. Through the implementation of mindfulness and group therapy techniques, Deckersbach et al. (2012) found that when levels of mindfulness increased, levels of rumination decreased, and that mindfulness was an effective interrupter for rumination.

More recently, MBSR has been applied to stress reduction, depressive tendencies, substance abuse and emotional well-being (Niazi & Niazi, 2011). Through a meta-analysis of 9 studies, it has been found that MBSR techniques lead to reduced stress, anxiety, depression, and burnout as well as increased job satisfaction (Ghawadra et al., 2019). In these MBSR therapies, oftentimes a meditation is the preferred way for mindfulness practice, either sitting upright in a chair or cross legged on the ground (Baer, 2006).

In a study by Cordon et al. (2009) looking at attachment styles and perceived stress, participants filled out self-report assessments in both a pre and posttest format. Participants were then enrolled in an MBSR program for 8 weekly 2.5 hour sessions, and were also instructed to apply what they learned in the MBSR program for 45 minutes a week outside of the sessions. Both the secure and insecure attachments style groups experienced significant decreases in perceived stress scores.

Attempts at establishing MBSR among effective anxiety treatments that include Cognitive-Behavioral Therapy (CBT), Exposure Therapy, and relaxation techniques show

promise. A meta-analysis conducted by Khoury et al. (2013) found MBSR to be superior to mere relaxation, imagery, art therapy or psychoeducation across an analysis of 200 studies and it was inferior only to CBT for treatment of anxiety disorders.

Often related to mindfulness is Autonomous Sensory Meridian Response (ASMR). ASMR results in a static-like sensation, often referred to as 'tingles' that travel from the skull down the spine. To achieve the tingling sensation, audio-visual stimuli are used, with certain actions, or 'triggers,' resulting in the ASMR state. This has been seen to assist in stress reduction and pain management, while also acting as a form of intense relaxation (Barratt & Davis, 2015). Barratt and Davis (2015) also found that one of the most common triggers is slow movements, causing an ASMR state in 53% of participants, with repetitive movements also being very popular at 36%. These slow and repetitive movements could be, for example, a form of animal interaction during an AAT session.

Mindfulness and MBSR are widely applicable, since an individual does not need to be in a lab setting or a counseling session to apply the techniques. Due to the basis on meditative practices in MBSR, once the individual learns how the process goes, they would no longer require guidance or direction from an outside source and can practice at home. This opens up many possibilities for at-home state stress reduction.

Purpose of the Present Study

Independent research has shown the benefits of mindfulness-related therapeutics such as ASMR, as well as AAT, in reducing stress and anxiety, but not certain elements that are shared between these approaches. Although Shiloh et al. (2003) proposed explanatory mechanisms related to attentional shift away from a stressor by means of petting an animal as a reason for lessened perceived stress, this was not directly measured. Furthermore, the act of petting an

animal embodies the types of repetitive movements that evoke relaxation in ASMR inductions and would instigate the present-centeredness element encompassed in mindfulness if given directed attention to certain aspects of the activity.

This study assessed whether observing an interaction between a person and an animal can reduce reports of stress, and through what mechanism this response occurs. Specifically, I examined whether it is the interaction itself, elements of the motion or sensory stimulus embodied by the human target (e.g., stroking a pet's fur), or the simple presence of a live animal that may result in stress reduction, thereby allowing for the determination of which types of interaction in therapies yield the best form of stress reduction in AAT.

AAT and mindfulness make effective treatment companions, with evidence that both act as successful stress reducers. By introducing aspects of ASMR, this study aimed to determine if mindfulness will mitigate stress during a non-clinical observation of an interaction with a live animal. By utilizing an online survey, participants completed a stress-inducing task and recorded levels of stress before being randomly assigned to receiving either a Basic Instruction set or a Mindfulness Instruction set. They then watched a video of a person petting a live cat with a slow, repetitive motion, petting a toy cat with a slow, repetitive motion, or observing a live cat sitting with a person, but not being pet. Then they completed the same stress measure again, after watching the video, followed by a mindfulness and a mood measure. The design was 3 (Video Condition: Live Cat Being Pet vs. Live Cat Not Being Pet vs. Toy Cat Being Pet) X 2 (Instruction: Mindfulness vs. Basic) X 2 (Time Point: Pre vs. Post experimental manipulation) with stress specified as the within-subjects factor.

Hypothesis 1: I predicted a main effect for instruction type, such that those who received the mindfulness instructions will report a greater state stress reduction (pre-test score minus post-test score) compared to those who received the Basic Instruction set.

Hypothesis 2: I also predicted a main effect for Video Condition, such that those who watched the Live Cat Being Pet will report greater stress reduction compared to those who watched the Live Cat Not Being Pet and the Toy Cat Being Pet.

Exposure to animal interactions, even vicariously, has been argued to elevate positive emotional states (e.g., Myrick, 2015). Furthermore, mindfulness is associated with reduced negative emotion (Aung, 1994). Exploratory analyses examined whether either manipulation led to possible enhanced mood.

Pilot Test

Prior to the start of data collection for the study, a pilot test was conducted to determine if the characteristics of the video stimuli were sufficient for the different aspects of ASMR and an animal interaction (e.g., slow repetitive movements, appearance of the cat). In the pilot test, individuals answered a series of verbal questions regarding the video and the cat presented in the video. The cat used for the study was black in color. Thus, for both Live cat Conditions, individuals were asked yes/no questions with regards to the cat's demeanor during the video: "Did the cat appear grumpy?," "Did the cat appear judgmental?," "Did the cat appear content?."

Across different cultures, the color black is associated with negativity (Adams & Osgood, 1973). Because of this negative association with the color black, black cats fall victim to what has been called, the Black Cat Bias (BCB). They are commonly seen as having less affectionate demeanors and people report having a harder time reading a black cat's expression compared to a lighter colored cats expression (Jones & Hart, 2020). This bias seems to be rooted in

superstitious beliefs (Jones & Hart, 2020), and causes a large number of black cats to be left alone and without a home in animal shelters across the nation more so than any other colored cat regardless of age (Kogan et al., 2013). These superstitious beliefs were what prompted the inclusion of the demeanor questions for the cat in order to determine if there is negative influence present.

Other aspects of the video manipulation included items regarding how boring the video was, how silly it seemed, and perceived passage of time across the conditions. For each of the videos, individuals were asked if they found anything to be distracting, and whether they felt less stressed after watching the video. Individuals provided verbal answers. They reported that the live cat in the videos did not appear grumpy or judgmental and did appear content. They also said that the video was interesting, not boring, and that the toy cat video itself was not "silly." It was determined that the video presented would be 1-minute long, since participants in the pilot test claimed that the 2-minute long video seemed to be too long, and invited distractions. Many of the participants in the pilot stated that they felt more relaxed after watching the video. The results of the pilot showed that the 1-minute videos are appropriate, and should manipulate the targeted variables.

Methods

Participants

After performing a power analysis, it was determined that 246 participants were required in order to achieve sufficient power ($\alpha = 0.95$). After recruiting through the Appalachian State SONA system of psychology undergraduates, 275 participants received course credit upon completion. One hundred thirteen participants failed the manipulation check (79 lost from the Basic Instruction Condition and 23 from the Mindfulness Instruction Condition; 35 lost from the

Live Cat Not Being Pet, 23 from the Live Cat Being Pet, and 38 from the Toy Cat Being Pet Video Conditions). The first manipulation check question, "Did your instructions tell you to focus on your breathing, thoughts, sensations and feelings?" lost 94 to incorrect answers. The second manipulation check question, "Was the cat in the video a real cat?" lost 31 to incorrect answers, and the final manipulation check question "Was the cat in the video being pet?" also lost 31 participants. Participants responded to each question even if they previously answered a manipulation check question incorrectly, so there were multiple participants who got more than one manipulation check question incorrect. This loss of 113 participants reduced power from 95% to 80%, potentially compromising the ability to detect an influence of the instruction or video type on stress.

A total of 162 participants (67.9% female, 29.6% male, and 2.5% non-binary) were retained after accounting for the manipulation check and were randomly assigned to either Instruction Condition and Video Condition (66.7% Basic Instruction set, 33.3% Mindfulness Instruction set; 31.5% Live Cat Not Being Pet, 38.9% Live Cat Being Pet, 29.6% Toy Cat Being Pet). Participant age ranged from 18 to 27 (M = 19.7, SD = 1.40). Participants, overall, had a relatively positive attitude towards cats (M = 5.08, SD = 1.90), with just over half having owned a cat before (55.6% having previously owned a cat, 44.4% never having owned a cat). Of those that had never previously owned a cat, 97.2% had previously interacted with a cat before. All procedures followed the principles of the American Psychological Association's (2017) guidelines for human participants' research. This study (Study # 22-0151) was deemed exempt by the Appalachian State Internal Review Board (IRB) on January 14th, 2022. This study was also pre-registered on Open Science Framework (https://osf.io/23arn) prior to data collection.

Materials

Stress Task

The mental stress task was a modified version of the traditional "Stroop color-word conflict test" (Stroop, 1935). The modified Stroop test involves the presentation of color names in their own or in different colors, and each word is shown on a screen by itself at 1-second intervals for 5 minutes (Morris et al., 1990).

The participants were asked to determine if the color and word were the same or different, and responded by pressing the respective keys for "match" or "doesn't match." Their response needed to be made within a 1-second interval, and if either the response was incorrect or there was no response, the word "INCORRECT" would appear in red for 2 seconds. A time of 2 seconds was used instead of the previously established 1 second due to the likelihood that participants would have varying levels of computer processing power, and that some of their computers may require more time to load the next screen.

Participants were told in the instructions that for every mistake, there would be an added word-color pair to the task. There was also a stressor connected to self-esteem, by telling the participants that their score would be compared to other individuals participating in the same task. These instructional stressors were important to include to ensure that the participants were actively engaging in the task and motivated to answer correctly (Morris et al., 1990). No word-color pairs were *actually* added to the task when the participants gave an incorrect or timed-out response, and accuracy scores were not recorded. Before starting the task, participants were shown detailed instructions, then simple instructions with examples of a word-color match and a word-color mismatch. This task was created directly in Qualtrics after randomizing word-color

pairs in excel. A total of four colors were used for both the word and the color of the font: Red, blue, yellow, and green.

Psychological Stress Measure

The stress portion of the Depression Anxiety and Stress Scale short form (DASS-21) was used as the measure for state stress both before and after instruction and video exposure. The DASS-21 is best for research purposes, and the items on this short-form test were selected based off good factor loadings, coverage of subscales within each scale, and item means (Lovibond & Lovibond, 1995b). The stress scale of the DASS-21 was included in the initial DASS because of its distinction from depression and anxiety and its ability to specifically measure state stress and tension. Although there are often concerns regarding validity of short form measures, Henry and Crawford (2005) determined the DASS-21 to be an effective and valid measure for the dimensions of depression, anxiety, and stress (Cronbach's $\alpha = .93$). The stress measure alone in the DASS-21 has also been shown to be effective and valid by itself (Cronbach's $\alpha = .90$) (Henry & Crawford, 2005).

The short form measure used in this study consisted of seven questions with answers scored on a Likert-type scale from "Did not apply to me at all" (0) to "Applied to me very much, or most of the time" (3). Some examples of questions asked in the stress measure include, "I feel as though I am using a lot of nervous energy," "I find myself getting agitated," and "I am finding it difficult to relax." The language of the questions was changed to direct the question to ask of the task for the pre-test or video for the post-test. A sum score of the seven questions was used to determine levels of state-stress.

Instruction Sets

Participants were randomly assigned to receive either a Basic Instruction set or a Mindfulness Instruction set before watching the video. Basic Instruction sets included traditional instructions as follows: "For the next few minutes, you will be watching a video, so please take a moment to ensure there are no distractions while you are attending to the video. Be comfortably seated. Continue when you are ready." The Basic Instruction set had a time-gate of 15 seconds before the "next" arrow appeared in order to ensure that participants read the instructions. The Mindfulness Instruction set also had a time-gate, but of 30 seconds, and is as follows:

> "For the next few minutes, you will be watching a video, so please take a moment to ensure there are no distractions while you are attending to the video. Be comfortably seated. While watching the video, bring your attention to the physical sensation of breathing: the air moving through your nose or mouth, the rising and falling of your belly, or your chest. Focus on any thoughts, sensations, or feelings that you experience while watching. Breathe in, breathe out, and continue when you are ready."

Bishop et al. (2005) stated that concentrating on breath and taking note of sensations, thoughts, or feelings that arise is a basic mindfulness meditation technique, and therefore should evoke a mindfulness state during the video.

Video Stimulus

Participants were randomly assigned to watch a video on their own device of either a live cat being pet, a live cat not being pet, or a toy cat being pet. The Live Cat Being Pet Condition (see Figure 2) contains aspects of both ASMR and a live animal interaction. A woman is wearing neutral colors and sitting on the ground with her legs crossed. The frame of the camera excludes her face and allows for a direct visual of her torso and lap. The cat is laying across her lap, and

occasionally turns its head, flicks its tail, and stretches or licks its paws. In the petting conditions, the woman is petting the cat slowly and repetitively. In the Live Cat Not Being Pet condition, the woman's arms are down by her side (see Figure 3). Each video length is about 1 minute. The same black cat was used in both live cat videos to maintain temperament. A life size toy black cat was used for the remaining video, maintaining the visual properties of the live cat without being a live animal. In this video, the toy cat is also across the owner's lap, and is also being pet in a slow, repetitive motion (see Figure 4).

Mindfulness Measure

The Mindful Attention Awareness Scale (MAAS) short form for state measures was used to determine mindfulness state in participants after the video. The MAAS was selected over the Five Facet Mindfulness Questionnaire (FFMQ) due to its concentration on self-related experiences and maintaining awareness of personal experiences, whereas the FFMQ's various facets only selectively involve self-awareness (Zhuang et al., 2017). The MAAS was initially developed to assess individual differences in mindfulness states over time (Brown & Ryan, 2003), but short forms are also found to reliably measure mindful attention and awareness in the form of state-mindfulness ($\rho = .92$) (Osman et al., 2015). The short form measure used in this study consisted of five questions with answers scored on a Likert-type scale from "Not at all" (0) to "Very much" (6). Sample items included, "I was doing something without paying attention," and "I was finding it difficult to stay focused on what was happening." A sum score of mindfulness was used (Cronbach's $\alpha = .830$), with lower values reflecting higher rates of mindfulness, and higher scores reflecting lower rates of mindfulness.

Mood Measure

The Visual Analogue Mood Scale (VAMS) was used to measure participant mood at the end of the study. The VAMS is known to require low cognitive demand, allowing for the effects of the video observation to effectively be reported (Stern et al., 1997). The scales used were those of afraid, confused, sad, angry, energetic, tired, happy and tense, all on a scale of 1-7 instead of the traditional sliding scale measure. The transition from a sliding scale measure to that of a 1-7 Likert-type scale was made due to the likelihood of losing consistency across computer screens for the physical measurements, which are required in order to quantify the traditional scales' responses. A Cronbach's alpha of 0.74 for the negative mood measures (afraid, confused, sad, angry, tired and tense) allowed for the creation of a negative mood summed score. Similarly, a Cronbach's alpha of 0.75 for positive mood measures allowed for the creation of a positive mood sum score.

Thought Listing Measure

A thought listing measure was included to gain perspective on attention shift. Thought listing measures are known to be effective ways to look at different cognitive structures and processes without the participant needing to recall thoughts or events from the past (Cacioppo et al., 1997). Instead, it allows individuals the ability to simply list thoughts that are currently in their mind and readily available at the time of assessment. This free response measure allows a determination of positivity/negativity as well as the target of the thoughts the individual is currently experiencing. Participants completed this by listing current thoughts. There was not a limit on how many they could include, but instead were instructed to list as many as possible within a 2-minute time period. The "next" arrow would appear after the 2 minutes had passed. This measure was coded for topic and general affect. For topic, 2 raters determined if at least one

thought per response mentioned the video that the participant had watched. For affect, both raters coded whether the general tone of all the responses per participant were positive, negative, or neutral. For example, if the participant listed 4 thoughts, and 3 of the 4 were negative in tone, the overall tone was determined to be negative. For the coding of affect, there was an 80.4% agreement rating across all 275 participants, whereas for video-relevance there was a 99% agreement rating across all 275 participants.

Manipulation Check

A manipulation check was included to ensure the participants engaged with the video in a way that the manipulation could take effect. Questions regarding instruction set and type of video were included: "Did your instructions tell you to focus on your breathing, thoughts, sensations and feelings?," "Was the cat in the video a real cat?," "Was the cat in the video being pet?." Each question had the option to select "yes," "not," or "not sure." Participants who failed to answer any of those three questions correctly or selected the "not sure" option were removed from the study.

Demographic Information

Basic questions involving age and gender were used. Included here as well were questions regarding pet ownership ("Have you ever owned a cat before?"), experience with cats ("Have you ever interacted with a cat before?") and attitudes towards cats on a scale from 1-7, with 1 being the participant hates cats and 7 being the participant loves cats. The last question asked if the participants believed that the video they watched made them feel less stressed with "yes," "no," or "not sure" response options.

Procedure

Participants were recruited through the Appalachian State University participant pool, and sent a link to a Qualtrics survey where they provided consent. They began the survey by engaging in the 5-minute stress induction task and then filling out the stress measure. They then randomly received either Basic Instructions or Mindfulness Instructions and then watched their randomly assigned video. After the video, they filled out the stress measure again, followed by the mindfulness measure, mood measure, thought listing measure, manipulation check questions and then the basic demographic questions before being debriefed.

Results

Tests of Main Hypotheses

Descriptive statistics and inter-measure correlations for all of the dependent measures are presented in Table 1. To test Hypothesis 1 and 2, a 3 (Video Condition: Live Cat Being Pet vs. Live Cat Not Being Pet vs. Toy Cat Being Pet) X 2 (Instruction: Mindfulness vs. Basic) X 2 (Time Point: Pre vs. Post experimental manipulation) mixed factor ANOVA was conducted with stress scores as the dependent measure. Contrary to predictions, no significant main effects for instruction type on stress reduction emerged, $F(1, 162) = 0.01$, $p = 0.936$, $\eta^2_p = 0.00$. Also contrary to predictions, no significant main effect for Video Condition on stress reduction emerged, $F(2, 150) = 0.95$, $p = 0.39$, $\eta^2_p = 0.01$. There was, however, a significant within subjects effect for stress response such that reports of stress were reduced from time 1 (pre-exposure; $M = 16.1$, $SD = 5.13$) to time 2 (post-exposure; $M = 9.10$, $SD = 3.48$) across conditions, $F(1, 150) = 177.06$, $p < 0.001$, $\eta^2_p = 0.54$. No significant interactions emerged between the 3 factors, all F's < 1, p's > 0.05. The pattern of means for the 3-way design is shown in Figure 1.

Although the analyses for the main hypothesis showed no significant main effects for either hypothesis, descriptively there was some support for the Video Condition X Instruction Type interaction (see Figure 1). Trends indicated that exposure to the Live cat (when being pet or not being pet) showed more stress reduction than the Toy Cat Being Pet Condition, but these differences fail to reach statistical significance.

Exploratory Analyses

As an alternative way to explore the influence of video type on stress responses, a 3 Video Condition (Live Cat Being Pet, Live Cat Not Being Pet, and Toy Cat Being Pet) X 2 Instruction Type (Mindfulness vs. Basic) ANCOVA was conducted on the post-test stress response, with the pre-test stress measure specified as a covariate. A significant main effect for Video Condition emerged, $F(2, 149) = 6.20$, $p = 0.003$, $\eta^2_p = 0.08$. Post-hoc analyses revealed that the post-test measure of stress was higher for those in the Toy Cat Being Pet Video Condition ($M_A = 10.96$, $SE = 0.61$, 95% CI [9.76, 12.2]) than the Live Cat Being Pet ($M_A = 8.26$, $SE = 0.48$, 95% CI [7.31, 9.22]) and the Live Cat Not Being Pet ($M_A = 8.95$, $SE = 0.48$, 95% CI [8.00, 9.90]), but there was no significant difference between the Live Cat Being Pet and the Live Cat Not Being Pet. The pre-test stress measure covariate was significant, $F(1, 149) = 4.29$, $p = 0.04$, $\eta^2_p = 0.03$. All other factors were not significant, all F's < 1.25 and all p's > 0.05.

Negative and Positive Mood Assessment

Since there is evidence to suggest that exposure to an animal interaction can lead to increased positive emotion and decreased negative emotion, 3 Video Condition (Live Cat Being Pet, Live Cat Not Being Pet, and Toy Cat Being Pet) X 2 Instruction Type (Mindfulness vs. Basic) ANOVAs were conducted on measures of negative and positive VAMS summed scores, respectively. There was a significant effect on negative mood based on Video Condition, $F(2,$

80) = 3.27, $p = 0.04$, $\eta^2_p = 0.08$. Follow-up post hoc tests demonstrated that those in the Toy Cat Being Pet Video Condition ($M_A = 16.9$, SE= 1.49. CI 95% [13.98, 19.9]) experienced more negative mood when compared to the Live Cat Being Pet Video Condition ($M_A = 12.2$, SE = 1.15, CI 95% [9.88, 14.5]), t (80) = -2.53, 95% CI = [-1.46, -.160], and the Live Cat Not Being Pet ($M_A = 13.5$, $SE = 1.08$, 95% CI [11.3, 15.6]), t(80) = -1.90, 95% CI = [-1.22, 0.04]. No difference emerged between the two live cat conditions. There was no significant effect on negative mood based on Instruction Condition, F(1, 80) = 0.93, $p = 0.34$, $\eta^2_p = 0.01$. There was also not a significant effect for an interaction of Video Condition and Instruction Condition, F(2, 80) = 1.13, $p = 0.33$, $\eta^2_p = 0.03$. There were no significant effects for positive mood, all F's < 2, all p's > 0.05.

Mindfulness Measure

To examine whether a mindfulness state through breathing techniques or ASMR triggers occurred for participants, a 3 Video Condition (Live Cat Being Pet, Live Cat Not Being Pet, and Toy Cat Being Pet) X 2 Instruction Type (Mindfulness vs. Basic) ANOVA was conducted for the mindfulness measure. Contrary to what would be expected, there was no significant mindfulness effect based on Instruction Type, F(1, 156) = 0.30, $p = 0.59$, $\eta^2_p = 0.002$. However, there was a significant main effect for Video Condition, F(2, 156) = 3.61, $p = 0.03$, $\eta^2_p = 0.04$. Post-hoc analyses revealed that higher ratings of mindfulness were reported for the Toy Cat Being Pet Video Condition ($M_A = 15.3$, $SE = 1.09$, 95% CI [13.12, 17.4]) when compared to the Live Cat Not Being Pet Video Condition ($M_A = 11.6$, $SE = 1.09$, 95% CI [13.12, 17.4]), t (156) = -2.58, 95% CI [-1.00, -0.13], and to the Live Cat Being Pet Video Condition ($M_A = 12.2$, SE = 0.93, 95% CI [10.41, 14.1]), t (156) = -2.12, $p = 0.09$, 95% CI [-0.9, -0.03]. Furthermore, those

watching the Live Cat Being Pet Video did not report more mindfulness than those watching the Live Cat Not Being Pet Video, $t(156) = -0.48$, $p = 0.88$, 95% CI [-0.49, 0.30]).

Perceived Stress Reduction

A single yes/no/not sure question was included that asked if the participant felt as though the video they watched decreased their stress levels in order to determine if the participant felt as though their stress was decreased without the multi-question measure of stress. A comparison of this perceived decrease in stress was submitted to a Chi-square independent samples test across levels of both Instruction Type and Video Condition. The participants in the Mindfulness Instruction Condition were no more likely to report perceived decrease in stress than the Basic Instruction Condition, $X^2(2) = 1.01$, $p = 0.60$. There was also no significant difference across Video Condition, $X^2(4) = 3.57$, $p = 0.47$. Descriptively, however, more than half of the participants reported that the video made them feel less stressed (50.6%), and 35.8% said that video did not make them feel less stressed, and 13.6% reported that they were unsure if the video made them feel less stressed.

Attitude Toward Cats as a Covariate

Because previously existing attitudes towards cats could influence the effect of stress reduction based on video condition, an exploratory 3 Video Condition (Live Cat Being Pet, Live Cat Not Being Pet, and Toy Cat Being Pet) X 2 Instruction Type (Mindfulness vs. Basic) ANCOVA was conducted with the attitudinal measure as the covariate and the post-test stress measure as the dependent variable. A significant effect for Video Condition emerged, $F(2, 152) = 6.27$, $p = 0.002$, $\eta^2_p = 0.08$. A post hoc analysis revealed that those in the Toy Cat Being Pet Video Condition had higher levels of post-test stress ($M_A = 10.82$, $SE = 0.57$, 95% CI [9.70, 11.93]) compared to the Live Cat Not Being Pet Video Condition ($M_A = 8.84$, $SE = 0.47$, 95% CI

[7.90, 9.78]), $t(154) = -2.67$, $p = 0.02$, 95% CI [-1.02, -0.15]) and the Live Cat Being Pet Video Condition ($M_A = 8.24$, $SE = 0.49$, 95% CI [7.27, 9.21]), t (154) = -3.44, $p = 0.002$, 95% CI = [-1.21, -0.32]). Thus, the covariate did not change the influence of Video Condition on ratings of post-manipulation stress since it revealed the same outcome as the main hypothesis testing without the covariate.

Additionally, a 3 Video Condition (Live Cat Being Pet, Live Cat Not Being Pet, and Toy Cat Being Pet) X 2 Instruction Type (Mindfulness vs. Basic) ANCOVA was run with attitude towards cats as the covariate and negative mood as a dependent variable. The analysis demonstrated a significant main effect for Video Condition, $F(2, 78) = 3.17$, $p = 0.05$, $\eta^2_p = 0.08$. A post-hoc analysis revealed higher ratings of negative mood for the Toy Cat Being Pet Video Condition ($M_A = 16.8$, $SE = 1.51$, 95% CI [13.84, 19.9]) when compared to the Live Cat Being Pet Video Condition ($M_A = 12.0$, $SE = 1.21$, 95% CI [9.60, 14.4]), t (78) = -2.50, $p = 0.04$, 95% CI [-1.47, -0.15], and to the Live Cat Not Being Pet Video Condition ($M = 13.5$ $SE = 1.09$, 95% CI [11.29, 15.6]), t (78) = -1.82, $p = 0.17$, 95% CI [-1.20, 0.06]. There was no significant effect on negative mood for the remaining factors, all F's < 1.31, and all p's > .05. These findings are the same as indicated in the above analysis without the covariate.

Another 3 Video Condition (Live Cat Being Pet, Live Cat Not Being Pet, and Toy Cat Being Pet) X 2 Instruction type (Mindfulness vs. Basic) ANCOVA was run with attitude towards cats as the covariate but with positive mood as the covariate. There were no significant effects for attitudes towards cats on positive mood, all F's < 16.6, and all p's > 0.05.

Thought Listing Measure

An exploratory review of the thoughts listed following the experimental manipulations was conducted to examine whether participants referenced the videos. I found that 56.5% of

participants reported thoughts relating back to the video that they watched. For tone of the thoughts, 75.6% reported negative thoughts such as, “I have really been struggling,” while 21.5% reported positive thoughts such as, “I think I am feeling calm and relaxed,” and the remaining 3% reported neutral thoughts such as, “My thoughts in a descriptive way are simple”.

Discussion

The current study sought to merge two different bodies of research examining AAT and mindfulness. Previous research indicates that animals act as a form of social support, safety, and emotional support for people (Ditzen et al., 2007; McNicholas & Collis, 2000). AAT is linked to state anxiety reduction (Shiloh et al., 2003), as well as physiological indices of stress (Nagengast et al., 1997). The support provided by animal interactions is characteristic of present-centeredness within mindfulness, possibly due to the attention shift away from stressors in the environment (Nittono et al., 2012). This intersection of AAT along with cognitive aspects of mindfulness was the impetus for the current study.

Based on previous research, I had predicted that stress, induced by a modified Stroop task, would be reduced the most for those who watched a video involving a human petting a live cat relative to a similar situation with a stuffed cat, or a live cat simply sitting on a person’s lap. These predictions were not supported; stress reduction was not different based on which video the participants watched, although there was a trend in support of better stress reduction when watching a live animal interaction versus one with a toy. Recall that Shiloh et al. (2003) compared differences in state anxiety reduction across participants, who either interacted with a live animal (rabbit or turtle) or toy animal (rabbit or turtle) and found that state anxiety was reduced more for the people who interacted with the live animal. They had initially predicted that state anxiety would most benefit from tactile sensations of live animal contact, but instead found

that it was the mere presence of a live animal that led to state anxiety reduction. I found that when pre-manipulation levels of stress were held constant, less stress was reported by those who observed a person interacting with a real cat. This, however, was my supplemental analysis rather than the proposed repeated measures approach to the hypothesis test.

Similarly, Pendry and Vandagriff (2019) showed a positive influence of human-animal interaction by measuring cortisol levels for participants, who either directly interacted with an animal, observed an interaction with an animal, or watched a slideshow of an animal. They found that those who interacted directly with an animal had the lowest cortisol levels, but the group who observed an interaction with an animal also had lower cortisol levels than those watching the slideshow.

Since direct touch had not been necessary to evoke the benefit of the animal exposure in either Shiloh et al.'s (2003) study or Pendry and Vandagriff's (2019), this study theorized that the mere observation of a human interaction with a live animal would elicit a stress reducing effect. Contrary to previous research, there was no unique stress reduction in the current study for those who watched either of the live cat videos, although participants across all conditions reported lower stress at the second assessment. It is possible that since all the videos included a positive stimulus, involving a cute furry animal or animal replica, that either an attention shift away from the stressor occurred or that enough time passed to allow stress to naturally decline.

One point of departure between this study and Shiloh et al. (2003) was the familiarity participants may have had with the target animals. I chose to use a cat instead of other popular companion animals like a hamster or rabbit, since cats are one of the most popular household pets (American Pet Products Association, 2020). Cats are often seen as independent and solitary but tend to be calmer than dogs; dogs are more playful and interactive with higher levels of

energy than cats (Ollila, 2016). A cat was selected with this in mind, considering that recording various videos of a high energy animal would prove difficult and potentially lead to inconsistency across recordings.

Pendry and Vandagriff (2019) used both dogs and cats in their study and did not distinguish differences between them, so it is possible that the dogs in their study were what truly led to the effects of the mere presence of a live animal on stress indices since they did not distinguish between species. Dogs are known to aid in humans feeling supported in a social setting, leading to decreased stress as the human reappraises the stressor with this perceived social support from the animal (McNicholas & Collis, 2000). It has not been shown to date whether cats do the same. Between 2017 and the present, there has been a large increase in animal adoptions, with 38% of U.S. households having at least one dog and 25% having at least one cat in 2017 (American Veterinary Medical Association, 2018). In 2022, those numbers increase to 54% of households, with at least one dog and 35% having at least one cat (American Pet Products Association, 2022). With increased pet ownership, the novelty of animals may be declining. Novelty of a stimulus is shown to increase awareness and attentional fixation (Koster et al., 2016), so the increased familiarity may be decreasing the effects that the mere presence of the live animal has previously elicited. This may account for why my findings deviate from those of previous research.

Another main difference between the present study and Shiloh et al.'s study is that their participants were able to interact with the animals in person. The present study was conducted completely online, preventing participants from interacting directly with an animal. This was done intentionally to determine whether the stress reduction might occur even in a vicarious interaction. Results of the current study suggested that the influence of watching such an

interaction was not powerful enough to reduce reported stress relative to watching a person interact with a toy cat. Thus, Shiloh et al.'s observed benefit of a live animal relative to a toy substitute were not replicated.

Using a video format, the materials for the present study was most similar to Pendry and Vandagriff's observation condition. This study's animal target was not presented in a simple image format. With the videos, the participants virtually observed someone interacting with an animal and, although it was not "in person," this shared more in common with making a direct observation compared to watching a slideshow. A potential explanation for the difference between my findings and those of Pendry and Vandagriff''s is the variability in what constitutes the "mere presence of a live animal." Shiloh et al. (2003) determined that the presence of the live animal was important for state anxiety reduction, and Pendry and Vandagriff (2019) determined that simple observation of an interaction with an animal would lead to lower cortisol levels. Perhaps since both studies occurred in person, the "presence" of an animal must be in the same room or environment, and not in a digital format where the observer could not interact with the animal even if desired. This digital format also prevented the observer from seeing how the person interacting with the animal was reacting, since the videos did not contain the person's face. In the observation condition of Pendry and Vandagriff's study, the observers could see the entire situation with the animal. In other words, they could see how the people were interacting with the animal, the sounds involved with the interaction (sweet-talking, barking, meowing, etc.), and even the smell of the animals. In a video format, this was not possible, potentially narrowing down the characteristics of "presence" required for beneficial effects of such an interaction to occur.

There is potential for an observational social benefit when watching someone interact with an animal, who is benefitting from that interaction. This phenomenon, known as vicarious reward, allows the observer to experience the same neural activation of reward as the person they are observing. In a meta-analysis by Morelli et al. (2015), a significant overlap of vicarious reward and personal reward occurred for monetary payoffs, praise, and positive emotional events, suggesting that those observing another experience a reward engages the same activation as if experiencing the reward themselves. More research is necessary in order to test this directly in relation to animals and interactions with other living things, since non-human animals involve so much variability with experience and appeal.

I also used state stress as my main measure of stress, whereas Shiloh et al. (2003) used state anxiety. Anxiety tends to be a psychological condition with continuity across events and time, and which correlates with trait anxiety; stress is a much more temporary state that is normally caused by something specific (Lovibond & Lovibond, 1995a; Spielberger, 1972). Due to the nature of the stress-inducing task in this study, as well as the present-centeredness concept of mindfulness, state-stress was determined to be the most applicable stress or anxiety measure that would also potentially be influenced by the videos presented. It is possible that because my measure of state stress was taken immediately before and after watching the video, detection of subtle changes in self-reported stress were reduced due to demand characteristics. Shiloh et al. (2003) accounted for this in their measure of state-anxiety, which is a transitory emotional response involving apprehensive thoughts and tension (Spielberger, 1966). Shiloh et al. measured a form of anxiety, which is longer lasting than stress, and were still able to detect changes across groups despite the STAI being administered three times. Perhaps participants in

the present study anticipated that the research was interested in changes in perceptions of stress and, across conditions, reported less stress due to demand characteristics of the study.

Demand characteristics are also potentially present for the stress measure, since the measure deviated from the original wording in order to accommodate the focus of this study. The traditional DASS-21 uses more present tense, while the wording in the present study used past-tense and may have drawn attention to the task or video rather than their present state-stress levels. This may have failed to capture their immediate state of mind, and instead had the participants reflecting on their state stress while they were engaged in the stress-inducing task or watching the video. Furthermore, the two measures were not worded identically across time points (time 1 referenced the task, and time 2 referenced the video) which could have attenuated an ability to compare the stress measures across time.

Furthermore, Pendry and Vandagriff (2019) used cortisol as their operationalization of stress reduction. Cortisol is a stress hormone, and acts as a physiological response to stressors and cannot be directly controlled or manipulated by the individual. Specifically, Pendry and Vandagriff used salivary cortisol, which is released within 25 minutes of an acute stressor and can remain elevated for hours afterwards (Dedovic et al, 2009; Verspeek et al., 2021). To account for this time buffer, they took a baseline measure of cortisol in the morning as soon as the participants woke up, a measure 15 minutes after the 10-minute exposure to represent cortisol levels from before exposure, and a measure 25 minutes after exposure to represent cortisol levels at the end of the exposure. Their multiple measures of cortisol provide a detailed timeline of the participants stress levels throughout the study, possibly allowing them to directly relate changes in stress levels to the exposure. Without a baseline measure of stress, there is very little information regarding stressors that may have occurred directly before the study that could have

influenced the final measure of stress. In the present study, no baseline was taken. It is possible that stressors that occurred before the stress-inducing task could have influenced the initial measure, or even the later measure, of state stress.

A part of the calming effect derived from AAT is believed to be the ritualistic behaviors that occur during a session involving an animal. Although AAT is typically done with a retrospective analysis of the interaction with the animal and not a focus on the present moment, the use of rhythmic behaviors in AAT through petting is a direct link to mindfulness, in particular the core elements of awareness and external events. I proposed that repetitive motion of stroking a cat would fall in line with Barrat and Davis' (2015) commonly reported triggers of ASMR. It is important to note that two of the three most popular triggers were auditory in nature – whispering and crispness of a sound (Barrat & Davis, 2015). The videos in the present study did not have any sound, removing the influence of various types of noise that may have served as a potential ASMR trigger, and a heightened relaxation influence of the two "petting" videos (live vs. toy) over the video simply displaying the feline. Since I also discovered significantly greater levels of mindfulness for those who watched the video involving the toy cat being pet, it is possible that the participants attended more to the motion of the petting instead of the live animal.

Because of a more passive exposure to the slow and repetitive motion of the petting, the mindfulness instructions were meant to enhance the beneficial effects of the videos by getting the participant to be more present-minded. Although extensive training is required to properly use MBSR techniques (Carmody & Baer, 2009), a more easily trained, present-centeredness guided meditation known as the body scan is useful in adjusting to a mindfulness state, although not as effectively (Gan et al., 2022). The instructions for mindfulness in the present study were based

on common body scan guidance, such as focusing on breathing. I had predicted that those who read the instructions intended to induce a mindfulness state would experience greater stress reduction than those who read the basic instruction set. These predictions were based on previous research concerning reduction of stress when interacting with an animal (Shiloh et al., 2003) and clinical mindfulness applications to aid in well-being (Ghawadra et al., 2019; Niazi & Niazi, 2011), demonstrating that each of these factors have stress reducing effects individually. Instead, those who read the instructions to engage in a mindful frame did not differ in reports of post-manipulation stress compared to the basic instructions to merely watch the video.

Interestingly, watching either of the two videos involving a live cat did yield less negative mood than watching a toy cat being pet. The argument previously introduced by Myrick (2015) that watching online cat videos is done as a form of mood management is supported in the present study. This link to affective support, cat ownership, and emotional states is seen through the influence that the videos and attitudes towards cats had on mood. Accounting for an individual's positivity towards felines bolstered the influence of the videos on stress reduction and negative mood. In each case, the presence of a live cat led to more beneficial outcomes than the toy cat, even though a relaxing rhythmic motion delivered via petting was presented. It is noteworthy that watching a cat did not enhance positive mood, even when controlling for attitudinal favorability toward felines. This is echoed by Turner et al. (2003), who found that cats do not readily influence positive mood but were found to decrease ratings of negative mood. This may occur due to attentional shift away from a negative stimulus to reduce emotional discomfort, as proposed by Brickel (1982).

Limitations and Directions for Future Research

The current study had limitations regarding the materials and sample. For the video stimulus, the resolution was not very high, making the videos slightly blurry. This may have proved distracting or even annoying to the participants. Since Qualtrics has a maximum file size of 16 MB, the videos had to be compressed and a decrease in resolution occurred. Another limiting factor for the videos was that the motion of the slow and repetitive petting may not have effectively evoked a necessary threshold for an ASMR state, or enough to simulate an ASMR trigger.

The mindfulness instructions were not pilot tested to ensure validity. Mindfulness is known to require extended training, in order to yield the intended state (Kabat-Zinn et al., 1992), and therefore may be difficult to induce in a brief instruction set. Furthermore, there was nothing in place to ensure that the participants actively read or engaged with the instructions, allowing some to potentially not read it at all. Due to the sheer number of participants who failed the mindfulness manipulation check question (34%), this is likely. With a total loss of 41.1% of participants, there is potential for lessened representation of the general population due to this poor participant attrition. Because of this notable reduction in power, from 95% to 80%, the null effects may be due to the result of a Type 2 error.

The stress-inducing task used was one referenced in previous literature (Morris et al., 1990), but sources regarding the actual format were unavailable. Morris et al. (1990) had previously conducted a study using this modified Stroop task and validated its efficacy and reliability, but I was unable to find any information beyond the author's name and study title. This test was created for the current study, and it was not pilot tested to determine if it did induce stress. To enhance stress induction, I extended the time for each response to two seconds, told

participants that inaccurate or slow responses would result in added words at the end, and that their accuracy scores would be compared to other participants completing the same task. The additional words and social comparison were used in previous literature (Morris et al., 1990), but there was no direct replication of the instructions available and therefore was created for the present study. Overall, there was a decrease in stress across conditions, suggesting that the task did effectively prompt the desired response and lead to stress induction.

The sample itself was limited to students at a mid-sized Southern university. Students who participated were in a psychology course that would offer an experiential learning credit (ELC), making the study unavailable to all students on campus. This ELC is not a requirement for all majors, and therefore, limited the sample to only psychology students. Throughout the course of their studies, students majoring in psychology learn how to manage stress and anxiety, apply critical thinking skills, and conduct research (Chew, 2021). Each of these skills has potential to impact results of a study when limited to only a specific group from the general population. Knowing how to manage stress and anxiety through reappraisal, a concept taught in a traditional Cognitive Psychology course, could have impacted how the participants were able to cope with the induced stress. Unique critical thinking skills and how to conduct research, often taught to psychology students in research methodology courses, could have made participants respond how they thought the experimenter wanted them to respond, made the participants recognize some questions that were asked, or even made them think of constructs beyond the scope of the study.

Since the study was online, there was no control for external factors for each participant. Even though instructions requested that they be in a distraction-free environment, there is no way to ensure that they complied. Most participants completed the study around mid-terms and

Spring Break, potentially adding extra stress associated with assignments and travel. Further, to account for the stress inducing task's format, the survey was only compatible with laptop or personal computers, excluding individuals who attempted to participate on their cellular devices. Individuals without laptops or personal computers either had to participate on a library or other public computer or not at all. Not only would this skew the sample to only include participants who had the financial resources to own their own laptop or personal computer (limiting representation of the general population), but it also could have skewed the results, since those who didn't own their own laptop or personal computer would have had to use a publicly-available device, whose location would likely have been laden with distractions.

One caveat to consider is that when state stress was utilized as a covariate, either video presenting a live cat as compared to a toy cat, was shown to relate to post-manipulation stress. This may reflect, again, that a more sensitive measure of stress (less vulnerable to experimental demand) might be included in a future study. To maintain consistency with previous literature, it would be helpful to take repeated measure salivary cortisol as a corresponding measure, while allowing for the 20-minute buffer to occur.

Future research on the impact of human-animal interaction might consider isolating the influence of particular animal species on health and psychological outcomes. For example, AAT research might include various species of companion animals when evaluating their potential therapeutic benefits, but broad ranges in their behavioral patterns make comparisons difficult. Even when controlling for one target species, an array of variability across targets might induce different reactions of people. The present study used a black cat, but other researchers have had cats of various coat patterns in their studies, and some coat patterns may be distracting. One target animal may be calm while the other energetic. Researchers would need to pinpoint or

consider that these differences potentially influenced their findings. As stated earlier, previous literature has found variability in outcomes associated with human-animal interactions. Explanations for differences include diverse methodology, differences in animals and targeted populations, and unique opinions of animals themselves (Rodriguez et al., 2021).

Conclusions

Dyads of humans and animals are unique entities, making it challenging for researchers to identify whether and how these interactions can be positively impactful. This study sought to isolate factors within AAT or AAA that may contribute to the positive physical and mental health benefits associated with animal interactions. Stress induced by a cognitive task was not overtly reduced by watching a live animal interaction relative to one involving a toy cat resembling a real cat. Additionally, mindfulness was not enhanced by watching videos of a live human-animal interaction, which suggests that the popularity of cat videos on YouTube is likely driven by some other factors; perhaps implementation of perspective taking or mere goofiness of animals in videos that people decide to post to social media. Personal connection to an animal may be one of the critical elements influencing the benefits derived from a direct interaction (Rault et al., 2020), making perspective taking a plausible explanation if the individual is picturing their own animal engaging in behaviors presented in videos. The future of research examining the impact of human-animal interactions on well-being and daily life must continue to evaluate confounding factors that limit generalizability and clinical significance of existing knowledge. Animals act as protectors, companions, health aids, and law enforcement among many other roles and play a major part in life across continents, cultures, and ages, making the understanding of why humans experience these benefits even more important.

References

Adams, F. M., & Osgood, C. E. (1973). A cross-cultural study of the affective meanings of color. *Journal of Cross-Cultural Psychology*, *4*(2), 135-156. https://doi.org/10.1177/002202217300400201

American Pet Products Association, Inc. (2020) *2019-2020 APPA national pet owners survey.* American Pet Products Association, Inc.

American Pet Products Association, Inc. (2022) *2021-2022 APPA national pet owners survey.* American Pet Products Association, Inc.

American Psychological Association. (2017). *Ethical principles of psychologists and code of conduct* (2002, amended effective June 1, 2010, and January 1, 2017). https://www.apa.org/ethics/code/

American Veterinary Medical Association (2018). *AVMA pet ownership and demographics sourcebook.* American Veterinary Medical Association.

Animal Assisted Intervention International. (n.d.). *Glossary of terms.* https://aai-int.org/aai/glossary-of-terms/

Aung, S. (1994). The clinical use of acupuncture in oncology: symptom control. *Acupuncture in Medicine, 12*(1), 37–40. https://doi.org/10.1136/aim.12.1.37

Baer, R. A. (Ed.). (2006). *Mindfulness-based treatment approaches: Clinician's guide to evidence base and applications.* Elsevier Academic Press.

Bao, K. J., & Schreer, G. (2016) Pets and happiness: Examining the association between pet ownership and wellbeing, *Anthrozoös, 29*(2), 283-296, https://doi.org/10.1080/08927936.2016.1152721

Barker, S. B., & Wolen, A. R. (2008). The benefits of human–companion animal interaction: A review. *Journal of Veterinary Medical Education, 35*, 487– 495. http://dx.doi.org/10.3138/jvme.35.4.487

Barratt E. L., Davis N. J. (2015). Autonomous sensory meridian response (ASMR): A flow-like mental state. *PeerJ*, *3*, https://doi.org/10.7717/peerj.851.

Batson, C. D., Early, S., & Salvarani, G. (1997). Perspective taking: Imagining how another feels versus imaging how you would feel. *Personality and Social Psychology Bulletin*, *23*(7), 751–758. https://doi.org/10.1177/0146167297237008

Beetz, A., Uvnäs-Moberg, K., Julius, H., & Kotrschal, K. (2012). Psychosocial and psychophysiological effects of human-animal interactions: The possible role of oxytocin. *Frontiers in Psychology*, *3*, 234. https://doi.org/10.3389/fpsyg.2012.00234

Bishop, S. M., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., Shapiro, S, & Carmody, J. (2005). The Toronto Mindfulness Scale: Development and validation. *Journal of Clinical Psychology, 62*(12), 1445-1467. https://doi.org/10.1002/jclp.20326

Boyer, V. E., & Mundschenk, N. A. (2014). Using animal-assisted therapy to facilitate social communication: A pilot study. *Canadian Journal of Speech-Language Pathology & Audiology*, *38*(1). https://link.gale.com/apps/doc/A372693690/AONE?u=anon~7b9c14ac&sid=googleScholar&xid=c2f1c315

Brickel, C. M. (1982). Pet-facilitated psychotherapy: A theoretical explanation via attention shifts. *Psychological Reports, 50*(1), 71–74. https://doi.org/10.2466/pr0.1982.50.1.71

Brown, K. W., & Ryan, R. M. (2003). Mindful Attention Awareness Scale. *PsycTESTS.* https://doi-org.proxy006.nclive.org/10.1037/t04259-000

Cacioppo, J. T., Hippel, W., Ernst, J. M. (1997). Mapping cognitive structures and processes through verbal content: The thought listing technique. *Journal of Consulting and Clinical Psychology, 65*(6), 928-940.

Carmody, J., & Baer, R. A. (2009). How long does a mindfulness-based stress reduction program need to be? A review of class contact hours and effect sizes for psychological distress. *Journal of Clinical Psychology, 65*(6), 627–638. https://doi.org/10.1002/jclp.20555

Centers for Disease Control and Prevention. (2019). *About pets and people.* U.S. Department of Health and Human Services. https://www.cdc.gov/healthypets/health-benefits/index.html#:~:text=There%20are%20many%20health%20benefits,depression%20by%20giving%20us%20companionship.

Chandler, C. K. (2012). *Animal assisted therapy in counseling* (2nd ed.). Routledge. https://doi.org/10.4324/9780203832103

Chew, S.L. (2021). *The superpowers of the psychology major*. American Psychological Association. https://www.apa.org/ed/precollege/psychology-teacher-network/introductory-psychology/superpowers-psychology-major

Cordon, S. L., Brown, K. W., & Gibson, P. R. (2009). The role of mindfulness-based stress reduction on perceived stress: Preliminary evidence for the moderating role of attachment style. *Journal of Cognitive Psychotherapy, 23*(3), 258–569. https://doi.org/10.1891/0889-8391.23.3.258

Deckersbach, T., Hölzel, B. K., Eisner, L. R., Stange, J. P., Peckham, A. D., Dougherty, D. D., Rauch, S. L., Lazar, S. and Nierenberg, A. A. (2012). Mindfulness-based cognitive therapy for nonremitted patients with bipolar disorder. *CNS Neuroscience & Therapeutics, 18*, 133-141. https://doi.org/10.1111/j.1755-5949.2011.00236.x

Dedovic, K., Duchesne, A., Andrews, J., Engert, V., & Pruessner, J. C. (2009). The brain and the stress axis: the neural correlates of cortisol regulation in response to stress. *NeuroImage*, *47*(3), 864–871. https://doi.org/10.1016/j.neuroimage.2009.05.074

Ditzen, B., Neumann, I. D., Bodenmann, G., von Dawans, B., Turner, R. A., Ehlert, U., & Heinrichs, M. (2007). Effects of different kinds of couple interaction on cortisol and heart rate responses to stress in women. *Psychoneuroendocrinology, 32*(5), 565–574. https://doi.org/10.1016/j.psyneuen.2007.03.011

Edney A. T. (1995). Companion animals and human health: an overview. *Journal of the Royal Society of Medicine*, *88*(12), 704–708.

Ein, N., Li, L., & Vickers, K. (2018). The effect of pet therapy on the physiological and subjective stress response: A meta-analysis. *Stress and Health. 34*(4), 477-489. https://doi.org/10.1002/smi.2812

Fisher, R. P., & Craik, F. I. M. (1977). Interaction between encoding and retrieval operations in cued recall. *Journal of Experimental Psychology: Human Learning and Memory, 3*(6), 701–711. https://doi.org/10.1037/0278-7393.3.6.701

Friedmann, E., & Son, H. (2009). The human–companion animal bond: How humans benefit. *Veterinary Clinics of North America: Small Animal Practice, 39*, 293–326. http://dx.doi.org/10.1016/j.cvsm.2008.10 .015

Friedmann, E., Katcher, A. H., Thomas, S. A., Lynch, J. J., & Messent, P. R. (1983). Social interaction and blood pressure. Influence of animal companions. *The Journal of Nervous and Mental Disease*, *171*(8), 461–465. https://doi.org/10.1097/00005053-198308000-00002

Gan, R., Zhang, L., & Chen, S. (2022). The effects of body scan meditation: A systematic review and meta-analysis. *Applied Psychology: Health and Well-Being*. 1-19. Advance online publication. https://doi-org.proxy006.nclive.org/10.1111/aphw.12366

Ghawadra, S. F., Abdullah, K. L., Choo, W. Y., Phang, C. K. (2019), Mindfulness-based stress reduction for psychological distress among nurses: A systematic review. *Journal of Clinical Nursing, 28*, 3747– 3758. https://doi.org/10.1111/jocn.14987

Halm, M. (2008). The healing power of the human-animal connection. *American Journal of Critical Care: an Official Publication, American Association of Critical-Care Nurses, 17*(4), 373-376.

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, *44*(2), 227–239. https://doi-org.proxy006.nclive.org/10.1348/014466505X29657

Jones, H. D., & Hart, C. L. (2020). Black cat bias: Prevalence and predictors. *Psychological Reports*, *123*(4), 1198–1206. https://doi.org/10.1177/0033294119844982

Kabat-Zinn, J., Massion, A. O., Kristeller, J., Peterson, L. G., Fletcher, K. E., Pbert, L., Lenderking, W. R., & Santorelli, S. F. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *The American Journal of Psychiatry*, *149*(7), 936–943. https://doi.org/10.1176/ajp.149.7.936

Khoury, B., Lecomte, T., Fortin, G., Masse, M., Therien, P., Bouchard, V., Chapleau, M. A., Paquin, K., Hofmann, S. G. (2013). Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review, 33*(6), 763–771. https://doi.org/10.1016/j.cpr.2013.05.005

Kogan, L. R., Schoenfeld-Tacher, R., Hellyer, P. W. (2013). Cats in animal shelters: Exploring the common perception that black cats take longer to adopt. *The Open Veterinary Science Journal, 9*(7), 18-22. https://doi.org/10.2174/1874318820130718001

Koster R., Seow, T. X., Dolan, R. J., Düzel, E. (2016). Stimulus novelty energizes actions in the absence of explicit reward. *PLOS ONE, 11*(7), https://doi.org/10.1371/journal.pone.0159120

Lovibond, P. F., & Lovibond, S. H. (1995a). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy, 33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-u

Lovibond, S. H. & Lovibond, P. F. (1995b). *Manual for the Depression Anxiety Stress Scales*. (2nd. Ed.) Sydney: Psychology Foundation.

Marshall, C. (2014). Cat videos on YouTube: 2 million uploads, 25 billion views. *ReelSEO*. Retrieved from ReelSEO: The videomarketer's guide website: http:// www.reelseo.com/2-million-cat-videos-youtube/.

McConnell, A. R., Brown, C. M., Shoda, T. M., Stayton, L. E., & Martin, C. E. (2011). Friends with benefits: On the positive consequences of pet ownership. *Journal of Personality and Social Psychology, 101*(6), 1239–1252. https://doi.org/10.1037/a0024506

McNicholas, J., & Collis, G. M. (2000). Dogs as catalysts for social interactions: Robustness of the effect. *British Journal of Psychology, 91*(1), 61–70. https://doi.org/10.1348/000712600161673

Morelli, S. A., Sacchet, M. D., & Zaki, J. (2015). Common and distinct neural correlates of personal and vicarious reward: A quantitative meta-analysis. *NeuroImage*, *112*, 244–253. https://doi.org/10.1016/j.neuroimage.2014.12.056

Myrick, J. G. (2015), Emotion regulation, procrastination, and watching cat videos online: Who watches Internet cats, why, and to what effect? *Computers in Human Behavior*, *52*, 168-176, https://doi.org/10.1016/j.chb.2015.06.001.

Nagengast, S., Baun, M., Megel, M., & Leibowitz, J. (1997). The effects of the presence of a companion animal on physiological arousal and behavioral distress in children during a physical examination. *Journal of Pediatric Nursing, 12* (6), 323-30. https://doi.org/10.1016/s0882-5963(97)80058-9

Niazi, A. K., & Niazi, S. K. (2011). Mindfulness-based stress reduction: a non-pharmacological approach for chronic illnesses. *North American Journal of Medical Sciences*, *3*(1), 20–23. https://doi.org/10.4297/najms.2011.320.

Nilsson, H., & Kazemi, A. (2016). Reconciling and thematizing definitions of mindfulness: The Big Five of mindfulness. *Review of General Psychology, 20*(2), 183–193. https://doi-org.proxy006.nclive.org/10.1037/gpr0000074.

Nittono, H., Fukushima M., Yano A., Moriya H. (2012). The power of *kawaii*: Viewing cute images promotes a careful behavior and narrows attentional focus. *PLOS ONE, 7*(9), https://doi.org/10.1371/journal.pone.0046362

Ollila, E. (2016). Differences between dogs and cats: Learn what makes each one special. *Hills.* Retrieved on May 16, 2022 from https://www.hillspet.com/pet-care/resources/differences-between-cats-and-

dogs#:~:text=Dogs%20tend%20to%20work%20together,and%20a%20clean%20litter%20box.

Osman, A., Lamis, D. A., Bagge, C. L., Freedenthal, S., & Barnes, S. M. (2015). The Mindful Attention Awareness Scale: Further examination of dimensionality, reliability, and concurrent validity estimates. *Journal of Personality Assessment, 98*(2), 189–199. https://doi.org/10.1080/00223891.2015.1095761

Pendry, P., & Vandagriff, J. L. (2019). Animal visitation program (AVP) reduces cortisol levels of university students: A randomized controlled trial. *AERA Open*. https://doi.org/10.1177/2332858419852592

Rault, J., Waiblinger, S., Boivin, X., & Hemsworth, P. (2020). The power of a positive human-animal relationship for animal welfare. *Frontiers in Veterinary Science, 7.* https://doi.org/10.3389/fvets.2020.590867

Rodriguez, K. E., Herzog, H., & Gee, N. R. (2021). Variability in human-animal interaction research. *Frontiers in Veterinary Science*, *7*. https://doi.org/10.3389/fvets.2020.619600

Rhys Davids, T. W. (1881). *Buddhist sutras*. Oxford, United Kingdom: *Clarendon Press.*

Selva J. (2020, January 9). *Mindfulness meditation videos, exercises, books and courses. Positive psychology*. https://positivepsychology.com/mindfulness-meditation/

Serpell J. A. (2000). Animal companions and human well-being: A historical exploration of the value of human-animal relationships. *Handbook on Animal-Assisted Therapy: Theoretical Foundations and Guidelines for Practice*. 3–17.

Shea, C. (2018). A brief history of mindfulness in the USA and its impact on our lives. *Psych Central*. https://psychcentral.com/lib/a-brief-history-of-mindfulness-in-the-usa-and-its-impact-on-our-lives/

Shiloh, S., Sorek, G., & Terkel, J. (2003). Reduction of state-anxiety by petting animals in a controlled laboratory experiment. *Anxiety, Stress & Coping: An International Journal, 16*(4), 387–395. https://doi.org/10.1080/1061580031000091582

Siegel, J. M. (1993). Companion animals: In sickness and in health. *Journal of Social Issues, 49*, 157–167. http://dx.doi.org/10.1111/j.1540- 4560.1993.tb00915.x

Spielberger, C.D. (1966). *Anxiety and behavior*. Academic Press, New York.

Spielberger C.D. (1972). *Anxiety: Current trends in research*. London: Academic Press

Spielberger, C.D., Gorsuch, R.L. and Lushene, R.L. (1970). *State-trait anxiety manual.* Consulting Psychological Press, Palo Alto, CA.

Stern, R. A., Arruda, J. E., Hooper, C. R., Wolfner, G. D., & Morey, C. E. (1997). Visual analogue mood scales to measure internal mood state in neurologically impaired patients: Description and initial validity evidence. *Aphasiology, 11*(1), 59–71. https://doi.org/10.1080/02687039708248455

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*(6), 643–662. https://doi.org/10.1037/h0054651

Thrasher, A. M. (2016). *Changes in physiological indicators of stress while interacting with therapy dogs* (Order No. 10168765). Available from ProQuest Central. (1826874875).

Tobin, M.B., Lacey, H.J., Meyer, L. and Mortimer, P.S. (1993). The psychological morbidity of breast cancer-related arm swelling. *Psychological Morbidity of Lymphoedema Cancer, 72,* 3248-3252. https://doi.org/10.1002/1097-0142(19931201)72:11<3248::AID-CNCR2820721119>3.0.CO;2-Z

Turner, D. C., Rieger, G., & Gygax, L. (2003). Spouses and cats and their effects on human mood. *Anthrozoös, 16*(3), 213–228. https://doi.org/10.2752/089279303786992143

Velde, B.P., Cipriani, J. and Fisher, G. (2005), Resident and therapist views of animal-assisted therapy: Implications for occupational therapy practice. *Australian Occupational Therapy Journal, 52*, 43-50. https://doi.org/10.1111/j.1440-1630.2004.00442.x

Verspeek, J., Behringer, V., Laméris, D., Murtagh, R., Salas, M., Staes, N., Deschner, T., Stevens, J. (2021). Time-lag of urinary and salivary cortisol response after a psychological stressor in bonobos (Pan paniscus). *Scientific Reports. 11*. https://doi.org/10.1038/s41598-021-87163-5.

Waal, F. B. M. (2010). The age of empathy: Nature's lessons for a kinder society. *Toronto: Emblem Editions*.

Wilson, C. C. (1991). The pet as an anxiolytic intervention. *Journal of Nervous and Mental Disease, 179*(8), 482–489. https://doi.org/10.1097/00005053-199108000-00006

Young, M. S. (1985). The evolution of domestic pets and companion animals. *Veterinary Clinics of North America: Small Animal Practice, 15*(2), 297–309. https://doi.org/10.1016/s0195-5616(85)50302-2

Zhuang, K., Bi, M., Li, Y., Xia, Y., Guo, X., Chen, Q., Du, X., Wang, K., Wei, D., Yin, H., & Qiu, J. (2017). A distinction between two instruments measuring dispositional mindfulness and the correlations between those measurements and the neuroanatomical structure. *Scientific Reports, 7*(1). https://doi.org/10.1038/s41598-017-06599-w

Table 1

Means, SD's, Range, and Correlation Coefficients (N = 156) for Dependent Measures

	M	*SD*	Range	Difference in Stress	MAAS Sum Score	VAMS Negative Sum Score	VAMS Positive Sum Score	Attitude Towards Cats
Difference in Stress	6.96	5.66	[-9, 21]	-				
MAAS Sum Score	12.8	6.58	[5, 35]	.041	-			
VAMS Negative Sum Sore	14.4	6.20	[6, 34]	.051	.407**	-		
VAMS Positive Sum Score	6.46	2.65	[2, 13]	.030	-0.26*	-0.43**	-	
Attitude Towards Cats	5.08	1.90	[1, 7]	.139	-0.01	.075	-0.04	-

Note. *$p < 0.05$; **$p < 0.001$

Figure 1

Change in Stress across Video and Instruction Type

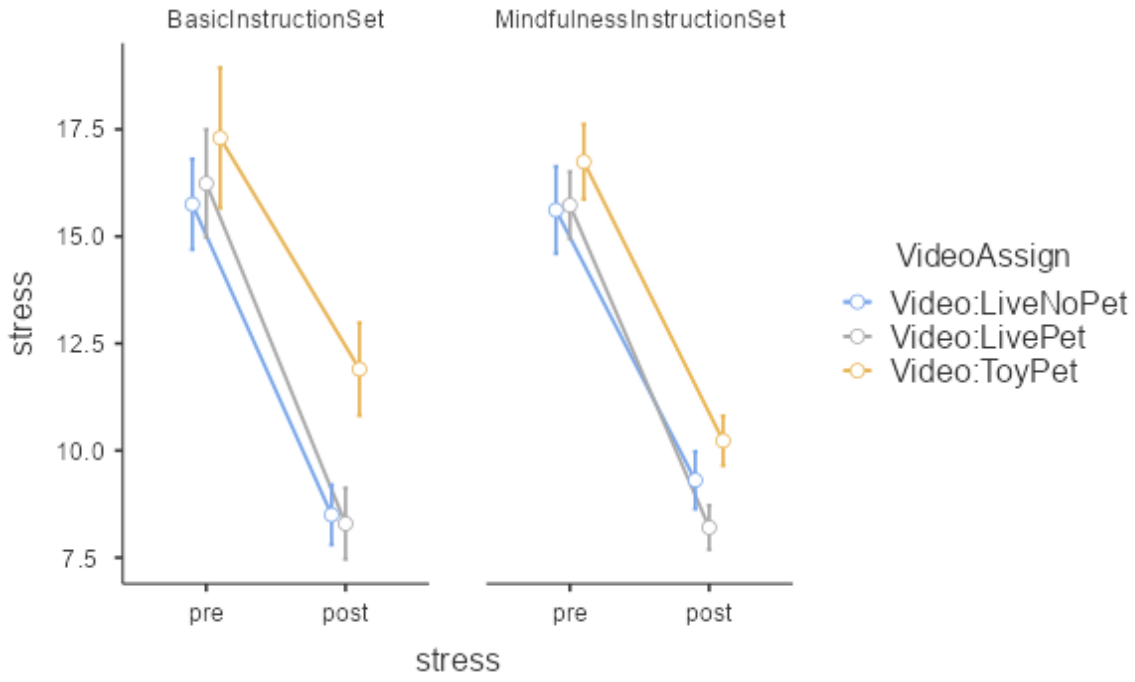

Figure 2

Still Frame from the Live Cat Being Pet Video

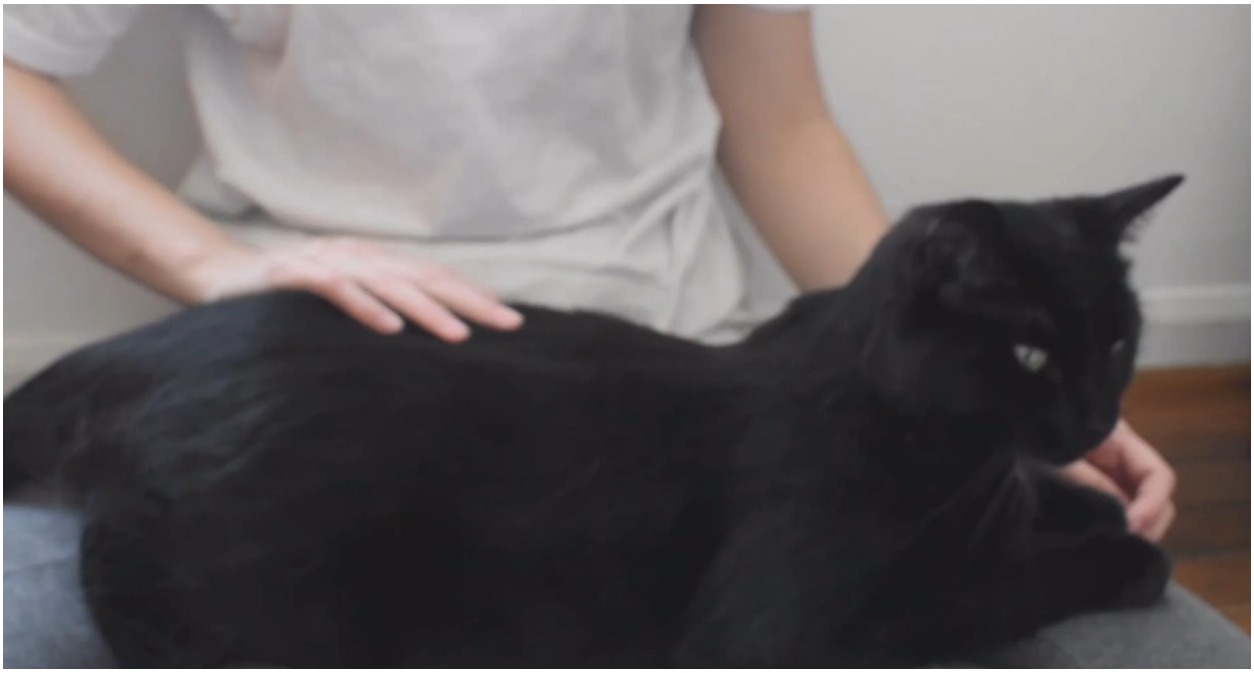

Figure 3

Still Frame from the Live Cat Not Being Pet Video

Figure 4

Still Frame from the Toy Cat Being Pet Video

Vita

Savannah Lee was born in 1997 in Tampa, Florida where she stayed until attending the University of Florida in 2015. She graduated May 2019 with her Bachelor of Science in Psychology. Taking a gap year, she worked at PetSmart as a member of the leadership team. The following fall of 2020, she enrolled at Appalachian State University to study Experimental Psychology, and in August of 2022 she was awarded the Master of Arts degree. In July of 2022, Savannah began work in industry at Gerson Lehrmen Group as a market researcher. Savannah now resides in Austin, Texas with her partner and two cats.