Proceedings of the National Conference
On Undergraduate Research (NCUR) 2018
University of Central Oklahoma
Edmond, Oklahoma
April 5-7, 2018

Reciprocal Effects of Relationships and Interactions Between Humans and Green Iguanas

Taylor M. Simmons
Psychology Department
Bethel College
North Newton, Kansas

Faculty Advisor: Dr. Dwight Krehbiel

Abstract

Human and animal bonds have proven to be beneficial for the physiological and psychological health of both parties. Most research on these issues has utilized common domestic animals. Modeling a study on previous research may yield similar findings in an unorthodox caretaker-to-animal relationship, such as that of the human and green iguana. Six participants were each paired to a juvenile green iguana for 4 weeks. They spent one hour in an animal care facility, which included 30 minutes of interaction and 30 minutes of rest. Perceived Stress Score (PSS), blood pressure, and heart rate were measured at the 0, 30, and 60-minute mark. Iguana behavioral data were collected in order to measure negative behaviors, such as tail whipping, gaping, and flinching. Composite measures of negative behavior decreased across trials (r=-0.29). Participant PSS often decreased after interactions with the iguana, but varied considerably across pairs. Overall, the change in PSS correlated with the total occurrences and standardized value of negative behaviors (r=0.38, r=0.26). These findings suggest that a broad range of human and animal relationships could be unique and mutually beneficial.

Keywords: HAR, HAB, HAI, AAI, AAT, PSS, Green iguana

1. Introduction

Research on human-animal relationships (HARs) began in the 1980s, and focused mainly on the agricultural consequences of HARs[5]. It has been demonstrated that characteristics of the stockperson accounted for differences in the relationship with the animal and could result in positive or negative impacts on their welfare and productivity[3,14]. Consequences of poor human-animal relationships resulted in lower reproductive rates in sows, silver foxes, and layer hens[4,9]. In addition, there has been evidence of stockperson qualities affecting milk production in cows and meet quality in veal calves[8,11].

Since its origin, research on HARs has expanded to include zoo contexts, health contexts, and, largely, animal-assisted therapy contexts. Studies have shown that perceived bonds between zookeepers and their animals improved the ease of the care of said animals, as well as made their employment experience overall more enjoyable[6]. Similar benefits were also experienced from the perspective of the animal, meaning they were more receptive to care and appeared to enjoy zookeeper contact, or at least were more content. Kathy Carlstead highlights the importance of studying keeper-animal relationships, and demonstrates this in her own research entitled, "A Comparative approach to the study of Keeper-Animal Relationships in the zoo". Carlstead's work revealed that keeper characteristics and behaviors, such as feeding time and visibility, correlated with animal characteristics, responses, and affinity to keeper. For example, keeper job satisfaction negatively correlated with animal fear of people, and keeper visibility is positively correlated with keeper affinity[1].

While reciprocity in HARs in widely demonstrated in many of the different facets of the literature, a large portion of the literature mainly focuses on the benefits of HARs to humans. A movement called "One Health" advocates for

the integration of human, animal, environmental, and ecosystem health[12]. It is based on the multitude of physiological health benefits experienced from interacting with animals, namely improvements in experiences of cardiovascular disease, cancer, and autism spectrum disorder[12]. Animal assisted therapies have also demonstrated improvements in social interaction, oxytocin, dopamine, and cortisol levels[2].

2. Methodology

2.1 Participants

There was a total of six human participants and six juvenile green iguanas in this study. The human participants were comprised of Bethel College students, and ranged in age from nineteen to twenty-three years old. Three of the participants were male, and three were female. The participants were recruited by advertising iguana interactions through email, word of mouth, and a STEM research course. Interested participants inquired about the interactions, and were chosen based on their ability to comfortably handle the green iguanas. While all participants had various animal and reptile exposure, potential participants who were unable to handle the iguanas were excluded from the study. The green iguanas were purchased simultaneously from a local pet store, and were not sexed. Data were excluded from one green iguana due to a human participant error in completing the required human-iguana interaction data through video recordings. The green iguanas were housed in the Animal Care Facility in the Krehbiel Science Center on the Bethel College campus. Each human participant was paired to one juvenile green iguana.

2.2 Procedure

Participants were instructed to meet with their assigned iguana three times a week for a total of 30 minutes. This analysis covers the initial four weeks of this schedule. An additional 30-minute period consisted of rest without the iguana in order to serve as a control, thus employing a within subjects design. This allowed for the individual analyses of the unique bonds. In order to control for order effects, the participants were split into two groups. Group 1 experienced the experimental condition first, interacting, followed by the control condition, resting. Group 2 experienced the control condition first, followed by the experimental condition. For each group, surveys were completed at the 0, 30, and 60-minute mark. Questions on the survey asked participants to report their blood pressure and heart rate, as well as included a modified version of the 10- item Perceived Stress Scale (PSS). In addition to these measurements, the surveys included questions regarding participants perception of potential bonding between themselves and their iguana, information regarding the iguana and habitat (such as temperature and humidity in the Animal Care Facility), and any additional information they felt necessary to report. Throughout the bonding condition, participants were given a list of suggested bonding activities that included petting, verbally soothing, hand feeding, and removing stuck shed from the iguana. During the first and last 2.5 minutes of the bonding session, the participants used a provided video camera to record themselves and the iguana interacting. During the rest period, the participants were instructed to stay in the same location, but separated from the iguanas, in order to keep a consistent climate between the two conditions. While the rest period was general, they were informed of prohibited activities, such as inviting friends and listening to music.

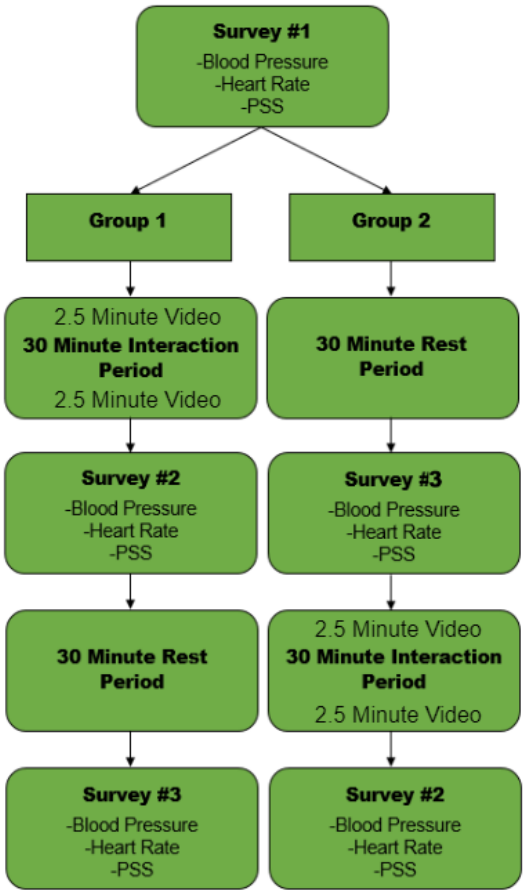

Figure 1. Procedure Outline

2.3 Instruments

Participants utilized an independently operated blood pressure and heart rate wrist cuff. A modified 10- item Perceived Stress Scale (PSS) was administered using a Google Forms survey. The survey included a section in which to submit blood pressure and heart rate information. A video camera was provided to the participants in order to record videos of their interactions with the iguanas. Negative iguana behavior (tail whipping, gaping, and flinching) was measured through the program JWatcher based on these videos provided by the participants. Statistical analyses were completed using R, Rcmdr, and RStudio[10].

3. Results

3.1 Human Results

The following boxplots examine the change is PSS after the interaction (Figure 2) and after rest (Figure 3). The majority of the plots in Figure 2 indicate a decrease in perceived stress after interaction, while the plots in Figure 3 do not indicate a change. Overall, the median PSS before interaction is 13.5, which decreases to 12.5 after the interaction. After rest, the median PSS is 13. These values are out of a possible 40.

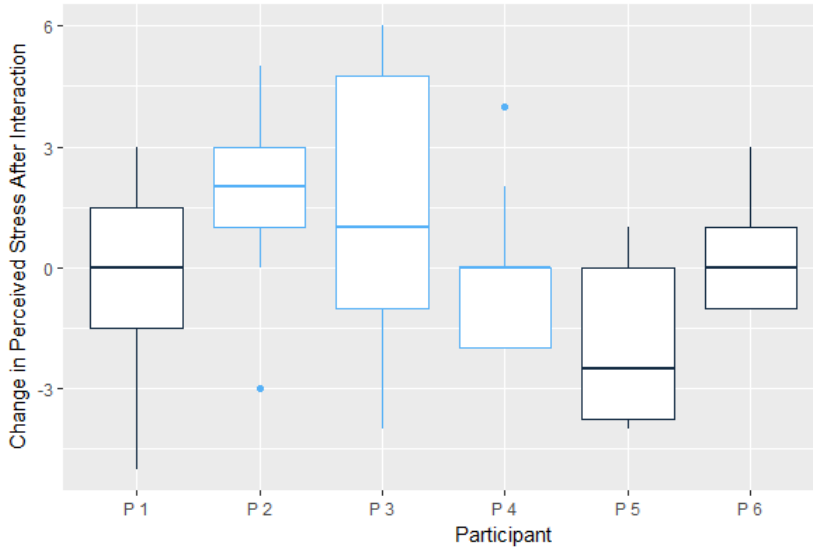

Figure 2. Boxplot comparing the change in PSS score after 30-minute interaction period between Group 1 (black) and Group 2 (blue) for each human participant.

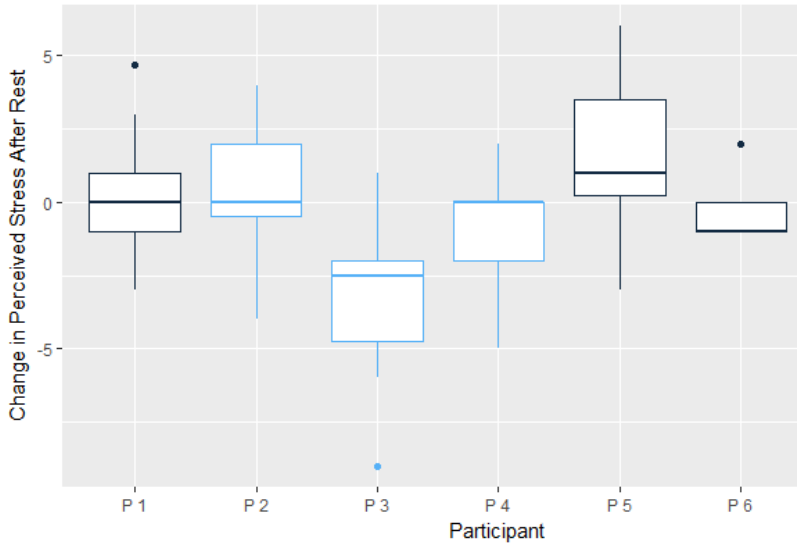

Figure 3. Boxplot comparing change in PSS score after 30-minute control period between Group 1 (black) and Group 2 (blue) for each human participant.

Figures 4 and 5 explore the changes in systolic blood pressure before and after interaction. Overall, the median systolic BP before interaction is 130.55 mmHg, which falls to 127.50 mmHg after interaction. The median systolic BP after rest increases slightly to 128.75 mmHg.

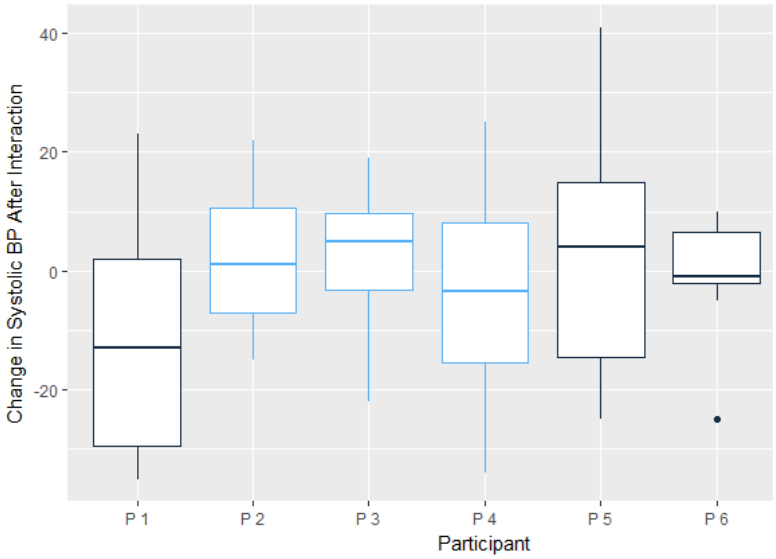

Figure 4. Boxplot comparing change in systolic blood pressure after 30-minute interaction period between Group 1 (black) and Group 2 (blue) for each human participant.

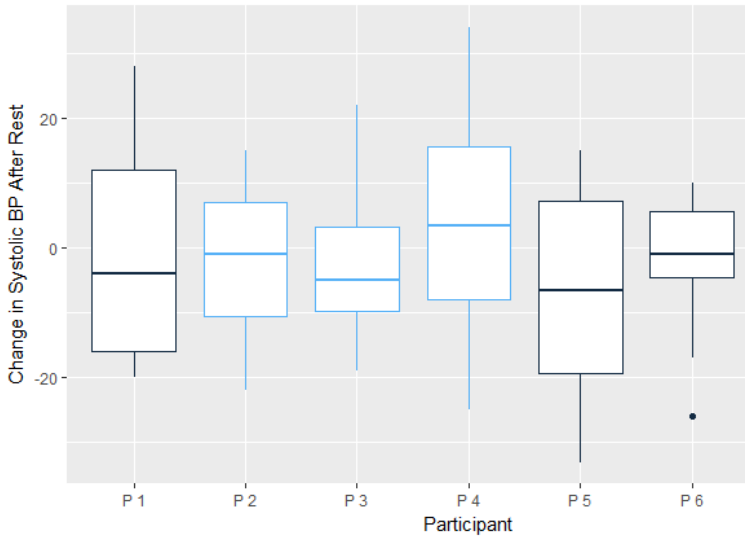

Figure 5. Boxplot comparing change in systolic blood pressure after 30-minute rest period between Group 1 (black) and Group 2 (blue) for each human participant.

Figures 6 and 7 explore the same relationships demonstrated above, yet examine them as an average across all participants. While this particular research topic and design lends itself to the exploration of the individual relationships within each bond, it can be beneficial to view the averaged data.

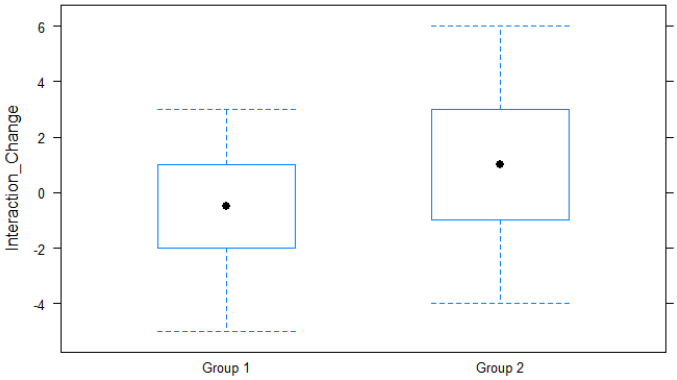

Figure 6. Boxplot comparing averaged change in PSS score after 30-minute interaction period between Group 1 and Group 2.

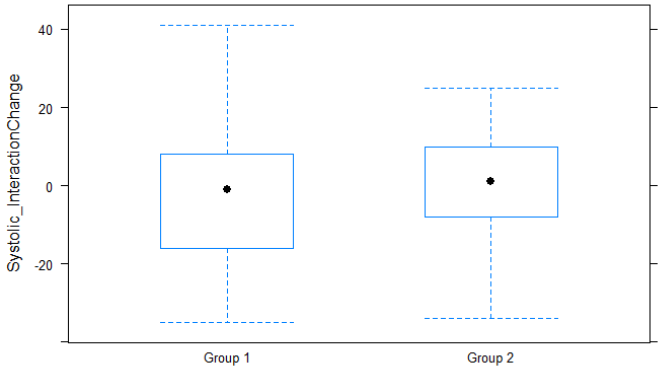

Figure 7. Boxplot comparing averaged change in systolic blood pressure after 30-minute interaction period between Group 1 and Group 2.

3.2 Green Iguana Results

A weak negative relationship was found between the trials as they progress and two different values of negative iguana behavior. The first measure, demonstrated in figure 8, is the standardized score of negative iguana behavior. In regard to this value, the individual differences between iguanas are taken into account, as the different iguanas have different response tendencies. Each of the three behaviors, tail whipping, gaping, and flinching, is standardized and then combined to create the total standardized value. This value has a negative relationship with time, $r(39) = -0.29$, $p = 0.07$. The second value, demonstrated in figure 9, is the sum of all three behaviors, with each behavior weighted equally, and also has a negative relationship with time, $r(39) = -0.31$, $p = 0.05$.

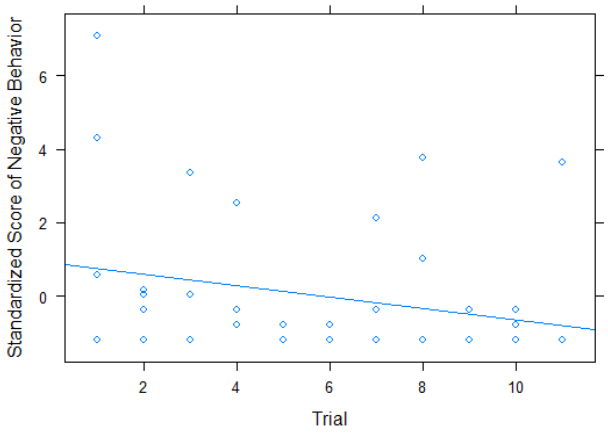

Figure 8. Scatterplot representing decline in the standardized value of negative iguana behavior over time.

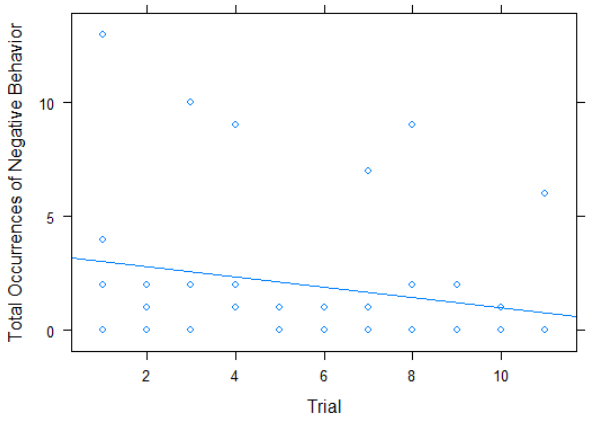

Figure 9. Scatterplot representing decline in the total sum of negative iguana behavior over time.

Figures 10 and 11 represent the same relationships explored in figures 8 and 9, respectively. These figures represent the data for each iguana separately. In terms of the total value of negative behavior, the correlation coefficients are the following: Iguana 1: r = -0.54, Iguana 2: r = -0.33, Iguana 4: NA, Iguana 5: r = -0.64, Iguana 6: r = -0.80. When looking at the standardized value of negative iguana behavior, the correlation coefficients are the following: Iguana 1: r = -0.51, Iguana 2: r = -0.07, Iguana 4: NA, Iguana 5: r = -0.76, Iguana 6: r = -0.60.

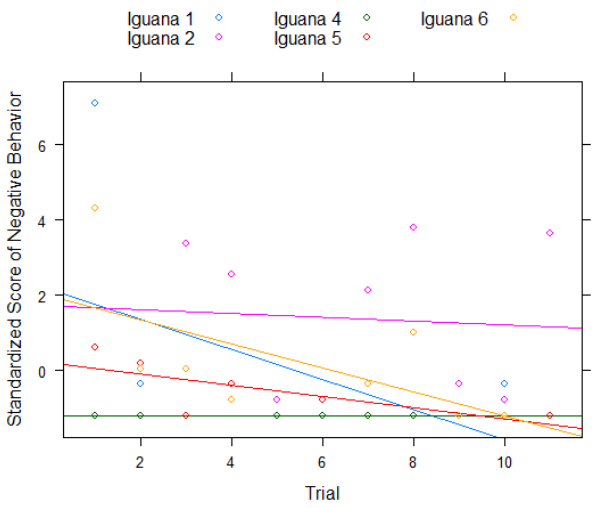

Figure 10: Scatterplot representing decline in the standardized value of negative iguana behavior over time by each iguana.

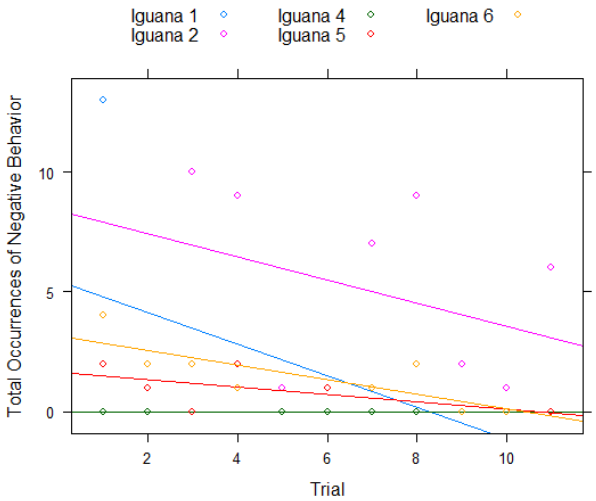

Figure 11: Scatterplot representing decline in the total sum of negative iguana behavior over time by each iguana.

3.3 Reciprocal Results

Figures 12 and 13 represent the relationship between human PSS data and iguana behavioral data, both the standardized and total sum value. There was a weak positive relationship between the change in PSS score after interaction and the standardized value of negative iguana behavior, as well as between the total sum of negative iguana behavior ($r(39) = 0.22$, $p = 0.16$; $r(39) = 0.35$, $p = 0.03$).

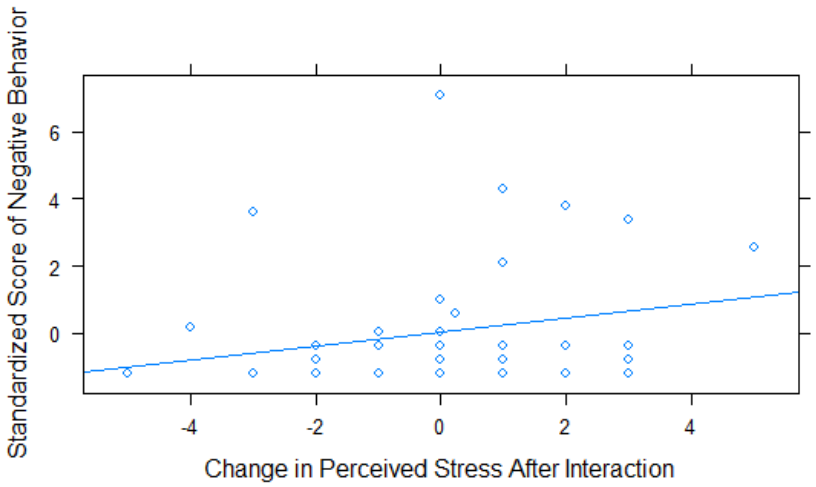

Figure 12: Scatterplot representing the relationship between the standardized score of negative iguana behavior and change in PSS score after interaction.

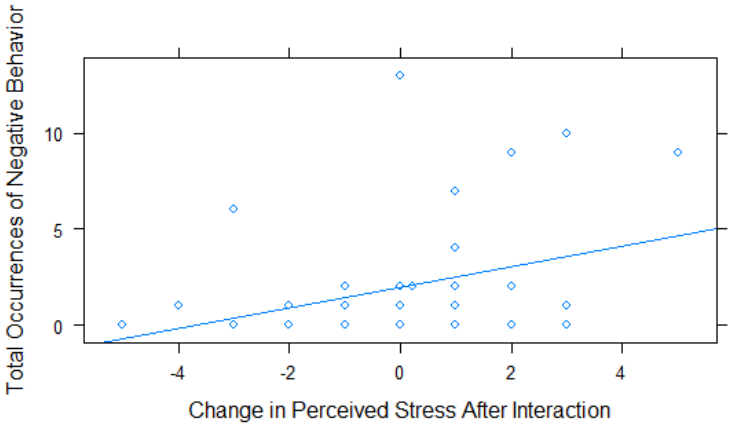

Figure 13: Scatterplot representing the relationship between the sum of negative iguana behaviors and change in PSS score after interaction.

4. Discussion

4.1 Human

Human physiological and psychological indicators of stress, as measured by systolic blood pressure and the Perceived Stress Scale, showed some variability in response to interactions with iguanas. It appears that in most cases, participants experience a greater decrease in perceived stress after interacting with the iguana, as opposed to after resting. There are, however, some major exceptions, such as Participant 2. This participant actually has a tendency to increase their levels of perceived stress after iguana interactions. However, all participants, with the exception of Participant 3, show virtually no change in perceived stress after the control period.

In regard to systolic blood pressure, there is a very similar, yet more striking trend. In this case, it is clear that the majority of time, for all participants, there is a decrease in systolic blood pressure after iguana interaction. In terms of the control period, the differences are more centered around no change at all. These results suggest a beneficial component of interacting specifically with iguanas as pets, in addition to the other instances of beneficial human-animal interactions that have been demonstrated in the literature.

4.2 Iguana

Both values of negative iguana behavior decreased over time, meaning as they interacted more with their assigned human, they became better behaved, from a human perspective, and exhibited less signs of distress. These iguanas could have begun to benefit from the human interactions, similar to the way humans receive benefits from interacting with them. When considering how this data breaks down for each individual iguana, it becomes apparent that Iguana 4 did not demonstrate any form of negative behavior throughout the entirety of the study. The correlations excluding Iguana 4 are much more striking than when this lack of negative behavior is included. However, this would shrink the sample size even further. Iguana 4 may be an outlier, but a larger sample size would be needed to realistically consider the data for exclusion.

This study only examines a lack of negative behavior, as opposed to an addition of positive attributes. The argument could be made that diminishments of negative responses in response to human interaction is not equivalent to receiving benefits. Future research could examine iguana fecal glucocorticoid response, as demonstrated in a 2012 study by Kalliokoski et. al, as well as include a control group with no human interaction as a comparison[7].

Another question asks whether these results are due to maturation or habituation to human interaction. In an unpublished follow up, this same sample of green iguanas is exposed to stranger humans, and directly compared to their behavior with their bonded human. If the iguanas were to have improved behavior with their bonded human than a stranger human, it would indicate a bonded relationship as opposed to a generalized positive response to humans or evidence of habituation. However, this follow up study was inconclusive, and therefore more research is needed.

4.3 Reciprocal

Human perceived stress data and iguana behavioral data correlate, advocating for the reciprocal aspect of these relationships. This is true for both the standardized and non-standardized values of iguana behavior. Therefore, it is likely true that both parties play a role in the success of the relationship. This aspect also provides some insight to some of the variation in human results. For example, Participant 2 experienced often experienced an increase in perceived stress after interacting with their iguana (figure 2). However, it is clearly demonstrated in figures 10 and 11 that Iguana 2 exhibited higher rates of negative behavior.

4.4 Limitations and Future Research

It is important to consider some of the major limitations in regard to this work. First, a small sample size renders the typical inferential statistics relatively inappropriate, and limits definitive conclusions that can be drawn. However, this research persists in demonstrating some plausible relationships that are certainly worth exploring further.

In addition to exploring this topic with a larger sample size, it could be beneficial to also increase the length and frequency of interaction periods, as well as increase the longevity of the study. Following these relationships through the different developmental stages of the green iguana could also yield interesting results. It is also important to note that only a fraction of the interaction was scored for iguana behavior. Analyzing the entirety of the interaction could reveal a more accurate picture of the human-animal relationship.

As mentioned previously, examining the underlying hormonal mechanisms of both the humans and the iguanas could also be pursued. Human levels of oxytocin would be a physiological measure of bonding, and cortisol would indicate the levels of physiological, as opposed to perceived, stress in humans. In addition, this measurement of stress would explore an in-the-moment value of stress, while the Perceived Stress Scale is more generalized to the life experience of stress that the human feels.

Unfortunately, many of these could not be achieved by this study, as the materials, equipment, budget, and man power was not sufficient. Due to these deficits, the participants played a large role in the collection and transfer of their data to the researchers. This resulted in some missing data and inconsistent reporting that could also be rectified by a larger scale study.

5. Conclusion

There are still several plausible conclusions that may be drawn from this data. When mimicking a domesticated pet relationship with humans, green iguanas become more well behaved over time, or, in other words, exhibit less indicators of stress. In addition to the iguanas both becoming more pleasurable to hold, as well as the iguanas themselves appearing less stressed, humans may also receive physiological and psychological benefits from this interaction. However, it is clear from this research that each bond between human and iguana is unique in its own way in reference to the timeline and progression of the relationship, the benefits that both parties receive, and the baseline tendencies and temperaments of both parties.

A large take away from this research is the possibility that a broad range of human-animal relationships could be mutually beneficial, and that more research in this field is important and necessary. It appears that not only commonly domesticated animals can mimic these beneficial patterns. This could have important implications in terms of animal assisted therapies (AAT), as well as important ethical considerations for all animals and their relationships to humans. In terms of AAT, an iguana may be able to provide several benefits that a dog simply cannot, especially in consideration of common allergies, mobility issues, and differing preferences across individuals interested in AAT.

6. Acknowledgements

Acknowledgement and gratitude is extended to the participants of this study for the time dedicated. An additional thank you goes to Bethel College and the supportive psychology faculty, Dr. Paul Lewis and Dr. Rachel Messer, as well as specifically to Dr. Dwight Krehbiel, the faculty mentor supervising this research. Bethel not only provided the education and space necessary to complete this research, but also provided several internal grants to fund the research, including the URICA Grant, RICHE Grant, and Research Endowment. A final thank you goes to the colleagues at Bethel who assisted in the care of the iguanas, specifically Brianna Newport.

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