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Are Humans Good for Goats? Assessing the Welfare of Goats Engaged in Human Interaction in a Care Farm Setting

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Unlike virtually all other modalities of human-animal interaction (HAI) or animal-assisted intervention (AAI), care farming allows animals an element of control over their environment and the opportunity to express their preferences. The animals can initiate or terminate human interaction by choosing to approach or retreat, the animals choose when to take a break, and they are free to explore their environment. Autonomy and the ability to express preferences is a key indicator of positive animal welfare in general (Stilwell, 2016; Mattiello et al, 2019) but especially relevant for promoting animal welfare in human animal interactions.

This randomized control trial investigated the longitudinal behavioral changes of goats residing in a therapeutic care farm setting who engage in human interactions. My hypothesis is goats engaged in reoccurring, semi-structured human interaction will display an increase in positive welfare over time. This would demonstrate that care farming can both be good for human health and improve animal welfare.

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First Advisor

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Animal, animal welfare, animal behavior, animal science

**Are Humans Good for Goats? Assessing the Welfare of Goats Engaged in Human
Animal Interaction in a Care Farm Setting**

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Master of Science in Animal Welfare and Behavior Program, University of Pennsylvania
VCSN 653: Capstone Project
Advisor: Jenni Punt & Tom Parsons
November 21, 2022

Dedication:

My research is dedicated to my wife Kelly for her consistent encouragement to follow my dreams, blaze my own path, and bring along as many animals that will follow. And to my son Jonah, who gives me hope that the next generation will learn better and do better by all animals and in all ways.

Acknowledgment:

I would like to acknowledge the humans and goats who made this project possible. The faculty and students of the AWB program at UPenn Vet for igniting my passion for farm animal welfare.

I would like to acknowledge Shawn Hayden for agreeing to let me conduct my research and being such a champion of this work. Josh, Andy, Geoff, and Chris, without your assistance this project would not have happened. Deepest thanks to each of you for volunteering your time and talents. You inspire me.

And finally, Autumn, Buckaroo, Ferdinand, Isabell, Lucky, Slaughter and all of the animals of Evergreen Grove. May you continue to always be happy, safe, healthy, and at peace.

Abstract

Despite the lack of representation in the research, therapeutic care farming may provide an optimal approach to human animal interaction, endorsing positive animal welfare and, as Fine & Mackintosh (cited Fine et al., 2019) urge, promoting and protecting the welfare of animals at a comparable level to human outcomes.

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Introduction

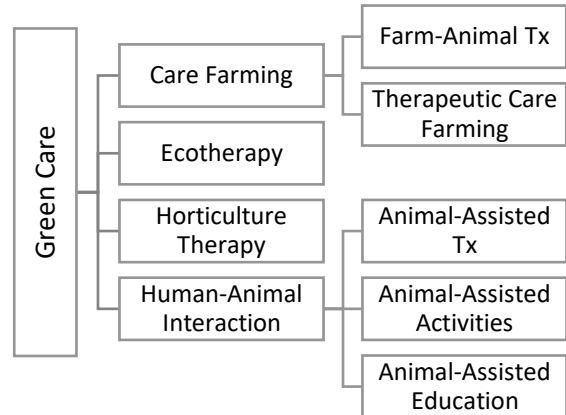
Our relationships with animals, and how we define them, are complex. Human-Animal Interaction (HAI) refers to, “any manner of relationship or interaction between a person and a non-human animal” (O’Haire, 2022). More specifically, Animal-Assisted Intervention (AAI) defines the human-animal relationship for the purpose of providing a therapeutic benefit to humans. AAI has further been categorized into Animal-Assisted Therapy, Animal-Assisted Activities, and Animal-Assisted Education. For over 50 years, AAI has been applied across the fields of medicine and behavioral healthcare to promote physical healing, developmental rehabilitation, and emotional well-being (Fine, 2019).

The AAI field of research, which predominately focuses on human outcomes, has been critiqued for its lack of scientific rigor, questioning its efficacy for humans. Within the last ten years there has also been emerging criticism that AAI research has neglected to study the inherent risks to animals and their welfare (Ng et al., 2015; Brodie et al., 2002), thus contributing to the lack of precise, empirically evaluated AAI guidelines which promote positive animal welfare (Serpell et al., 2010). And while the field of AAI continues to expand, in terms of the animals used, human conditions treated, and research methodologies applied, there is a glaring omission in the United States framework.

Roughly 760 years prior to the advent of AAI with Boris Levinson and his dog, Jingles, was the practice of Green Care (Galardi et al., 2021). Broadly, Green Care encompasses many different approaches which utilizes an intentional relationship with the natural environment, including animals, as a framework for interventions to improve or promote human health, recovery, and rehabilitation (Sempik et al., 2010). The earliest history of Green Care principles being applied for therapeutic purposes was in the treatment of ‘mentally distressed pilgrims’ in the 13th century at Geel in Flanders where a therapeutic community was established and farming was the main client activity (Berget et al., 2010). Other Green Care modalities can include horticulture therapy, care farming, ecotherapy, and AAI, among others (Berget & Braastad, 2011). What unifies these disparate interventions is the ethos that humans benefit from exposure to and meaningful

interactions with the natural environment and animals. In contrast to the United States framework which anchors AAI under HAI, a more comprehensive and historically accurate representation would center around Green Care.

Applying a Green Care philosophy can enhance contemporary practices of HAI by encouraging animal interactions within the natural environment and creates an exciting opportunity to expand other promising practices, such as care farming, in the United States. Care farming is an agriculture-based therapeutic intervention for the treatment or intervention of physical and behavioral health conditions (Hassink et al., 2014). The model is more established and integrated in health care and social services in Western European countries where most care farming occurs on production farms (Haubenhofner et al., 2010). Given the role of industrialized agriculture in the United States and the diminishing presence of family farms, a 'therapeutic' care farm may be a more relevant U.S. framework where livestock live in a sanctuary setting as opposed to a production facility.



Despite the lack of representation in the research, therapeutic care farming may provide an optimal approach to human animal interaction, endorsing positive animal welfare and, as Fine & Mackintosh (cited Fine et al., 2019) urge, promoting and protecting the welfare of animals at a comparable level to human outcomes.

Animal Welfare Concerns:

The current literature on AAI animal welfare concerns can be organized into three key areas: training, environment, and animal autonomy. Depending on the AAI task, some animals are subjected to prolonged training which may cause exhaustion and lead to distress (Zarim, 2006). Alternatively, other animals are not adequately trained and may experience stress when expected to perform an uncertain task (Ng et al., 2015). Another animal welfare consideration while being trained for and working in AAI is the use of equipment. Is the equipment animal friendly and safe? Are potential risks for physical injury or harm recognized and minimized? Are animals gradually introduced to equipment in a manner that reduces fear or stress?

AAI animals frequently encounter novel environments such as hospitals, schools, or courtrooms which are unpredictable, often crowded, loud, and may have noxious odors all of which can increase the animal's distress. Care and attention must be given to the animal's work schedule allowing for breaks away from clients and the opportunity to go to the bathroom and drink water. Animals may become fatigued and stressed from performing tasks and, if leashed, harnessed, or otherwise restrained, they are not able to disengage with the client(s). If forced to continue interacting beyond their level of comfort or in an unpleasant interaction, the animal may develop learned helplessness, greatly compromising their welfare and health.

Applying the domains of environment, training, and autonomy to therapeutic care farming highlights some of the inherent animal welfare advantages of this specific form of Green Care. In therapeutic care farm settings animals live in natural or semi-natural

environments with open access to pasture, efficient foraging, and the benefits of the natural elements while also having access to barns or stables for protection from predation and harsh environmental conditions. The animals have the opportunity to display natural species-specific behaviors and interact with conspecifics as well as other species. The animals in a care farm setting are traditionally not trained to perform any specific tasks and the use of equipment is uncommon. The majority of human interactions are either related to animal care such as, feeding, grooming, and cleaning or for the purposes of animal enrichment, including play. Play is recognized as an indicator of positive welfare in animals (Mattiello et al, 2019) and as a measure of their affective or emotional state (Held & Spinka, 2011; Verbeek & Lee, 2017). The absence of play can also be a measure of poor welfare since animals do not engage in play if their overall fitness is compromised or if they perceive an event or situation as harmful. Animals engaged in care farming avoid the stress of transportation, unfamiliar conditions, and novel environments.

Any situation where an unknown or unfamiliar human enters an animal's environment and attempts to interact with them may cause distress for the animal. This highlights the critical distinction between care farming and other forms of AAI: the animals' ability to express preferences and exercise control over their experience. Unlike virtually all other modalities of HAI or AAI, care farming allows animals an element of control over their environment. They can initiate or terminate human interaction by choosing to approach or retreat, take breaks, and explore their environment. Autonomy and the ability to express preferences is a key indicator of positive animal welfare in general (Stillwell, 2016; Mattiello et al, 2019) but especially relevant for promoting animal welfare in human interactions. Verbeek and Lee (2017) expanded on this notion by applying Appraisal Theory, essentially emotional responses are influenced by assessing the stimulus of the situation and the greater the control in a situation the more positive the response.

As the emphasis on promoting and protecting the animal welfare in HAI/AAI expands, care farming may illuminate the path forward. Therapeutic care farming should be recognized and researched within the United States and made accessible as a viable HAI framework with clear protocols for the protection of human health and promotion of positive animal welfare.

Goat Welfare in Care Farming

Despite their highly social nature (Briefer, Tettamanti, & McElligott, 2014; Zobel et al (2018), cognitive abilities and long-term memory (Briefer & McElligott, 2013), and ability to develop strong bonds with humans (Anderson et al 2004, cited in Miranda-de La Lama, 2010), goat welfare and emotions are seldom studied.

Welfare is the physical and emotional state of an animal in response to their environment (Broom, 1991). Traditionally, animal welfare assessments have focused on either resource-based measures, such as space per animal, quality of feed, or access to veterinary care, or animal-based indicators such as lameness, BCS, or coat quality (Appleby et al, 2018). The AWIN Welfare Assessment Protocol for Goats expressly states that animal-based measures provide a more accurate welfare assessment. Along with good feeding, good housing, and good health; appropriate behavior is an AWIN animal-based welfare principal that is perhaps most germane to assessing the welfare of animals engaged in HAI. The specific welfare criteria for appropriate behavior include: expression of social behavior, expression of other behavior, good human-animal relationship, and positive emotional state. Unlike typical physiological indicators for assessing welfare, such

as heart rate, oxytocin, or cortisol, behavioral indicators are easily observable which is vital for welfare assessments in care farming.

The purpose of this study is to assess the welfare of goats residing in a therapeutic care farm and engaged in semi-structured, re-occurring human interactions to determine if the interaction has a positive impact. The therapeutic care farm is a livestock rescue with an onsite residential treatment program for adult men with substance use and co-occurring disorders. My hypothesis is goats engaged in reoccurring, semi-structured human interaction will display an increase in positive welfare over time.

This study was conducted at Evergreen Grove in Gardner, MA. The program is an 18 bed, residential facility for dually diagnosed men (18+) and is located on a 16-acre farm surrounded by another 100 acres of forest. In addition to care farming, the men participate in structured group therapy, individual therapy, recovery coaching, case management services, and medication for psychiatric or withdrawal management if clinically indicated. The average length of stay is six months. Prior experience with animals is not a prerequisite for acceptance into the program and most men have no prior experience, education, or training with farm animals. Interaction with the animals is contingent upon resident's adherence to their treatment plan and their ability to participate with the animals in a safe and effective manner.

The program utilizes a phased system where interactions and care of the animals increases as men progress in their treatment and achieve clinical goals. The experience with the animals must be earned and is a privilege that can be lost.

The Orientation Phase allows no direct animal contact. During this phase residents observe all animals on the farm, especially the goats as their paddock is located directly behind the house. Residents acclimate to the clinical components of the program, learn house and farm rules, and begin case management. Phase 1 allows minimal animal interaction and focuses primarily on cleaning stalls, filling waters, and feeding. Residents are instructed in hygiene practices to reduce the risk of zoonotic disease as well as biohazards to protect the animals' health. In Phase 2 residents are tasked with duties in care farming in addition to the chores of Phase 1. The men work alongside staff to provide care for the farm animals, including: goats, horses, donkeys, sheep, alpaca, pigs, ducks, chickens, and geese. Activities include grooming, brushing, hoof trimming, leading horses to the paddock, and offering species specific enrichment. Men are also allowed to spend one-on-one time with the animals in the barn or in the paddock. Upon successful completion of treatment some residents have been hired as animal care staff and assist the barn manager in the care of the animals and training residents.

The farm staff includes a Barn Manager responsible for overseeing the daily care of all the animals and training residents in animal care. The Therapeutic Farm Coordinator assists in training residents and supervises interactions with the animals. The clinical staff includes licensed mental health providers, case managers, recovery coaches, and a nurse practitioner.

Animals, Design, & Methods

Animals

The herd chosen for this study included 18 mixed breed goats, group housed with three alpaca, two sheep, and one potbelly pig. Table 1 provides the detailed information

on each goat including: breed, gender, age, length of stay (LOS), horn status, and prior history of abuse and/or neglect.

The herd has a 120sq.ft. barn stall with year-round free access to a grassy 2100sq.ft. fenced paddock which is completely visible from the resident's house. The paddock has climbing structures with hiding spaces and scratching posts. There is ad libitum water and grain; hay is provided twice daily. Shavings are provided in the stall as bedding for the goats and the potbelly pig. The three alpaca and two sheep sleep in adjacent stalls to the goats. All of the animals have annual veterinary care (vaccinations, deworming) and have access to emergency care as needed.

Table 1: Goat Index

Name	Breed	Gender	Age	Horned	Prior History	LOS
Autumn*	Nubian	Female	4	Polled	Neither	4 yrs
Beatrice	Dwarf	Female	5	Yes	Neither	2 yrs
Ben	Dwarf	Male Castrated	7	No	Neither	5 yrs
Bernie	Nubian	Male Castrated	4	Polled	Neither	less than yr
Buckaroo*	Pygmy	Male Castrated	4	Yes	Neither	less than yr
Dags	Pygmy	Male Castrated	unk	Yes	Neither	less than yr
Ez (baby)	Pygmy	Female	3	No	Neither	3 yrs
Ferdinand*	Dwarf	Male Castrated	4	No	Neglect	4 yrs
Isabell*	Pygmy	Female	4	Yes	Neither	less than yr
Lilly	Pygmy	Female	2	Yes	Neither	2 yrs
Lucky*	Dwarf	Male Castrated	4	Polled	Neither	3 yrs
Lyra	Pygmy	Female	2	Yes	Neither	3 yrs
Roxy	Nubian	Female	4	Polled	Neither	3-4 yrs
Sarah	Pygmy	Female	4	No	Neither	3 yrs
Slaughter*	Nubian	Male Castrated	4	Polled	Neglect	less than yr
Travis	Alpine	Male Castrated	2	Yes	Neither	4 yrs
Winter	Nubian	Female	4	Polled	Neither	4 yrs
Yagi	Pygmy	Female	4	Yes	Neither	2 yrs

*Indicates goats in experimental group

Study Design

A temporary study pen (20x20) was constructed within the 2100sq.ft. fenced paddock. The gate to the study pen was left open for all goats to investigate and become familiar with prior to the study starting. During the experiment, goats were able to maintain visual contact with the herd. Sony HDR-CX440 Handycam HD digital cameras were attached to posts at opposite angles of the study pen and recorded goats entering the pen and for the duration of the human contact.

Two goats were excluded from the study: one was under medical treatment for dermatitis and the other had been hand raised at the farm and was biased towards seeking out human interactions. Of the remaining goats, six were randomly selected from a feed bucket for the experimental group. Three clients volunteered to be the handlers. All three had been at the program for three-months, two were in their 50's and one was in his 30's. One handler had previously been at the program and was familiar with the goats, the other

two handlers had only known the goats approximately three months. Handlers were provided new buckets, brushes, curry combs, and soft combs.

Each handler was randomly assigned two specific goats for the duration of the experiment. There was no assigned order to which goats the handlers interacted with but they were only to interact with their assigned goats. Prior to the start of the study, the handlers participated in a brief training on the study protocol.

Semi-structured HAI Study Protocol

1. Goats brought into study pen by handlers on a loose lead.
2. Gate to study pen is closed.
3. Each station had a bucket with brushes and combs.
4. Handlers begin at their station (three corners of the pen).
5. Timer starts: 2-minutes Approach Window - Assigned goat given 2-minutes to approach their handler.
6. After 2-minutes: if goat did not approach, handler may approach goat.
7. 15-minute Contact Window:
 - a. Using hands, handlers rub or scratch body, head (between horns).
 - b. Using brush or comb, brush cervical to sacral regions (neck, back, rump) and sides.
8. At any point if the goat walks away the contact ends; humans are not to follow or re-engage with the goat.
9. If goat re-approaches, handler may resume brushing, scratching, or rubbing.
10. Time called at 17 minutes.
11. Handlers return to stations with bucket and brushes.
12. Timer starts: Assigned goat 2 given 2-minutes to approach their handler.
13. Protocol repeats.
14. Time called at 17 minutes.

Methods

Data was collected from April 4, 2022 – April 20, 2022. The semi-structured HAI was conducted on Monday, Wednesday, and Friday for weeks 2 through 4. The semi-structured human interactions were conducted and recorded during the same time each day to account for circadian rhythm as well as the treatment program's schedule. Each day of data collection followed the same format. First, an initial 2-minutes 'Approach Window' followed by a 15-minute 'Contact Window' for a total 17-minute study period per goat and handler pair.

Continuous recording and instantaneous (15-second) interval-focal sampling was utilized to study the goats' behavior during the semi-structured human interaction. An ethogram and time-budget identified 13 behaviors to be measured: approaching, exploring (investigating), grazing, grooming, HAI, headbutting, leaning, nudging, playing, standing, and walking. Latency to approach in the first two-minutes was also measured. The recordings were reviewed and data was coded in the Behavioral Observation Research Interactive Software (BORIS).

Results

In order to determine if human interaction has a positive impact on goat welfare, we conducted a randomized control trial to investigate longitudinal changes in 13 key

behaviors. The study was a within-subjects design conducted three days a week for three consecutive weeks for a total of nine observations days.

The goats were assigned to a human handler for a semi-structured basic grooming sequence. Each handler and goat pair remained consistent over the nine-day study and each pair had a 17-minute test period. The first 2-minute, approach window, measured if the goat initiated human interaction by approaching their handler. The following 15-minutes, contact window, measured observed behaviors while goats were engaged with their handlers. If during the contact window the goat walked away, the human was instructed not to follow the goat or try to re-engage, only the goat could re-initiate or re-approach the human.

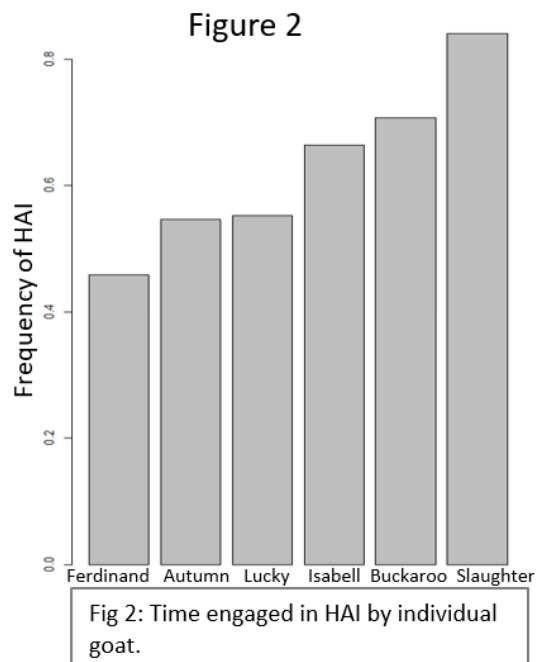
Our results show three important findings. Goats displayed individual preference towards human interaction. Over time the goats' preferences towards interaction changed. Over time the goats' repertoire of expressed behaviors increased, especially among goats with less preference for human interaction.

Individual Preferences Towards Human Interaction:

The goats displayed individual preferences towards human interaction as measured by their latency to approach and duration of interaction with their handler. Figure 1 illustrates the cumulative changes in latency to approach for the herd over the 9-days of data collection. The x-axis identifies the week and day of the study. On the first day (Wk1:D1) none of the six goats approached their handler within the 2-minute approach window. Day 2 (Wk1:D2) two goats (33.33%) approached their handler within or at the 2-minute period. By Day 3 week one, 50% of the herd approached their handler within or at the 2-minute approach window and this pattern remained or continued to increase each day of the study until the last day when only two goats, or 33.33% approached within the two-minute approach window.

Overall, the time goats spent engaged with humans ranged from 45% - 84% of their total time while in the study pen. Whether goats initiated the contact within the first 2-minutes also correlated to how long they remained engaged with their handler. The goats with a stronger preference for human interaction were more likely to initiate contact during the 2-minute approach window and they were more likely to remain engaged with their handler during the 15-minute contact window.

Figure 2 illustrates the frequency of human interaction by each goat over the duration of the study. The x-axis lists the goats by name and the y-axis is the frequency with which they sought out human interaction. There is a significant difference ($p < 0.001$) between some of the goats but not all. Some displayed a stronger preference for



human interaction, choosing to spend more time with their handler than engaging in other behaviors such as grazing, investigating, or playing. Goats with a stronger preference for human interaction were more likely to approach within the 2-minutes and generally stayed engaged longer with their handler. They were 12 times more likely to engage their handler than goats that did not initiate contact within the first 2-minutes. The goats that handlers approached after the 2-minutes were called spent, on average, 16% less of their time with their handlers.

Change in Human Interaction Over Time

Across the entire cohort, the amount of time the goats spent engaged with humans increased 50%, on average, over the duration of the nine days ($p < 0.001$). This indicates that even the goats with less preference for human interaction, those less likely to initiate contact with their handler within the 2-minute approach window, over time chose to interact more with their handlers. The increase in human interaction was associated with an increase in goats' latency to approach during the approach window and also an increase in re-approaching handlers during the contact window.

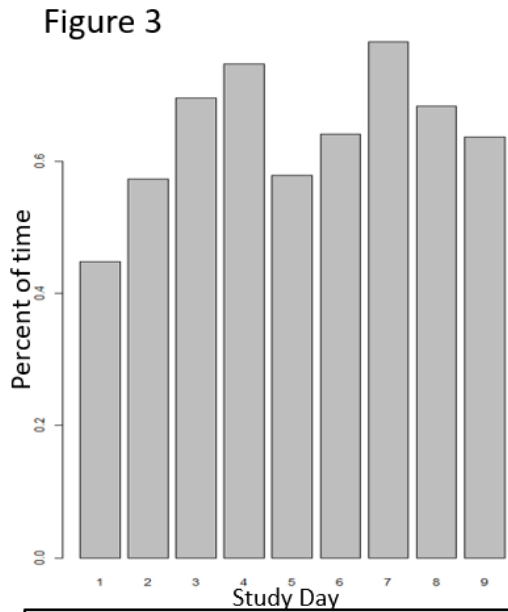


Fig 3: Cumulative time engaged with humans.

Figure 3 illustrates the cumulative changes in the duration of time spent engaged in human interaction over the nine days. The x-axis lists each of the nine data collection days and the y-axis is the percent of cumulative time goats spent engaged in human interaction.

The re-approach behavior defines two different scenarios. First, it describes a goat during their observation window that initiated contact with their handler, engaged, walked away from their handler, engaged in a new behavior, and then ended that behavior and re-approached the handler. The second describes when a goat is not in their observation window, that is they are in the study pen but not the focus, and they approach a handler attempting to engage in human interaction.



Photo 1: Autumn & Slaughter

These re-approach behaviors are captured in the following photos. In photo one, Autumn has inserted herself between her handler and Slaughter after the completion of her grooming session during her observation period. In photo two, Buckaroo is re-approaching his handler after the completion of his grooming session.



Photo 2: Buckaroo & Ferdinand



Photo 3: Buckaroo & Ferdinand

During the study, some goats developed a new behavior and would approach any handler interaction. Photo three captures Buckaroo approaching a handler not assigned to him while that handler grooms Isabell.

Repertoire of expressed behaviors

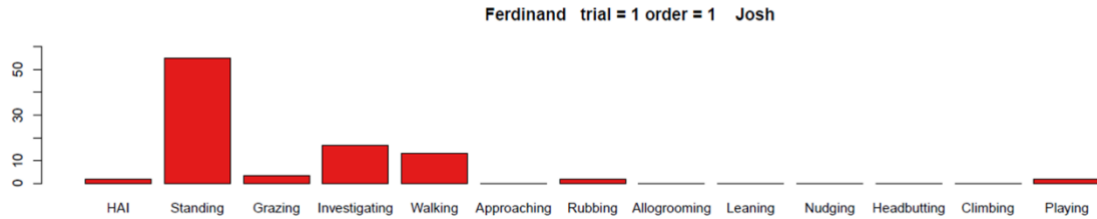
Three behaviors were observed and measured to determine if human interaction was a positive experience for goats: latency to approach and the duration and frequency of human-goat interaction. If the goat experienced the human interaction to be positive, they would approach their handler faster and remain engaged in the interaction longer than other free choice behaviors.

An outcome not anticipated was the observed increase in the frequency and duration of the other 12 behaviors in the absence of human contact. During the 17-minute observation window the frequency that goats engaged in standing, approaching, grazing, investigating, walking, rubbing, grooming, leaning, nudging, headbutting, climbing, and playing were measured. There was an observed increase in the diversity of expressed behaviors for all

goats across the nine-day study but was most notable among the goats with less preference for human interaction.

In day one of the study (Figure 4), Ferdinand spent more than 50% of his time standing, antidotally this was usually by the study pen door, with only brief moments

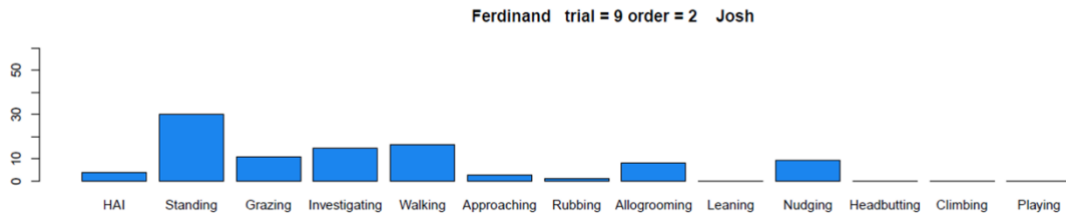
Fig. 4



engaged in other behaviors, mainly investigating or walking around.

Figure 5 illustrates Ferdinand's diverse repertoire of expressed behaviors on day nine. He spent only 30% of his time standing and continued to spend less than 10% of his time engaged in human interaction but he greatly increased the diversity and duration of time spent engaged in other behaviors, including approaching his handler to initiate human interaction.

Fig. 5



This diverse repertoire of behaviors suggests that the freedom to choose, if and for how long, to interact with a human promotes positive welfare as expressed in an increase in engagement with their environment and the rest of the herd and an increase in approach behaviors.

Discussion

This study demonstrations three significant findings. Goats display individual preference in the amount of time spent engaged in human interaction and over time their preferences can change. Finally, the goat's repertoire of expressed behaviors increased, especially among goats with less preference for human interaction.

In the current study, a mixed herd of goats living on a therapeutic care farm, when compared with free choices, chose to initiate interactions with humans 45% - 84% of the time. They were able to express their preferences in choosing to interact with humans and for how long. The goats with a stronger preference for human interaction engaged longer

and, overall, there was a 50% increase in the amount of time the goats engaged in human interaction over the nine-day study. It should be noted that the handlers were familiar to the goats and outcomes could be impacted if replicated with unfamiliar humans.

A less frequently researched but increasingly referenced measure of animal welfare is affective state, or an animal's experience of pleasant or unpleasant emotions (Fraser, 2008). The field of HAI has the responsibility to further research how various forms of AAI can impact animal welfare in general and specifically investigate which modalities promote pleasant emotions and avoid inflicting negative ones. A specific way the field of HAI can promote positive emotions in animals is by providing positive human interactions (Miller et al, 2022). In this study, the unexpected finding was the development of a new behavior where goats would seek out any handler or re-initiate with their handler multiple times. In the current study, even goats with shorter durations of human interaction demonstrated an increase in a diverse repertoire of behaviors which indicates positive welfare and a positive affective state. Additional research should be conducted to measure if such voluntary behaviors reflect a pleasant emotion.

Conclusion

There is a relevant discussion in the HAI/AAI field that animal welfare should be a central focus and efforts should be made to reduce stress on animals and enhance positive welfare (Hediger et al, 2019). Applying a Green Care philosophy can inform this discussion by encouraging animal interactions within the natural environment and creates an exciting opportunity to expand other promising practices of human animal interaction, such as care farming.

Care farming may naturally provide a therapeutic intervention which allows animals to display their natural behaviors. Further, the animals have the opportunity to express their preferences in the human interactions and maintain control in their environment.

Perhaps in no other field of research is a One Welfare framework more relevant. The interconnectedness of humans, animals, and environments is made apparent in care farming and the welfare of one cannot be separated from the wellbeing and welfare of the other. The health and welfare of the animal improves the health of the human.

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