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Rewarding research

Can positive reinforcement lead to better results in animal behavior modification? Faculty and students are studying miniature horses to find out.

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Construction on artificial turf field to begin soon, thanks to donors. Page 23

Rewarding research:



Can positive reinforcement lead to better results in animal behavior modification? Faculty and students are studying miniature horses to find out.

By Natasha Waibel

It all began with a casual conversation in the faculty suite in the Mars Center for Science and Technology.

Biology Faculty Associate Shari Ackerman-Morris was telling Associate Professor of Psychology Kathleen Morgan about the miniature horses that she was training with her daughter's 4-H group. A longtime horse rider and licensed riding instructor, Ackerman-Morris was interested in applying all-positive reinforcement methods to train these pint-size horses which, at less than three feet tall, can still be very strong.

"It's not uncommon for these little guys to really pull the kids around," she observes. "I was interested in exploring other ways for kids and ponies to work together."

A five-member team of faculty members and students began researching those ways this summer. What they discover could have important implications far beyond the horse-training world. For pet owners and trainers of other animals, their success with all-positive reinforcement techniques could mean less stressful and better working partnerships between pets and owners, and better-trained pets in less time. And their current work could lead to a new applied behavior analysis research team at Wheaton, which would be yet another opportunity for students to get real-world experience related to their classroom coursework.

Both in the real world and in the world of training, there are different consequences of

behavior. Some of those consequences are desirable (for example, getting dessert after cleaning your plate, or getting your roommate to stop nagging you after you pick up your clothes), and some are less so (such as getting a verbal reprimand after being rude to another, or losing the privilege of borrowing your friend's car after you dent the fender).

Any consequence that increases the likelihood of a behavior occurring again is called a reinforcement. The goal of giving you dessert after you cleaned your plate is to get plate-cleaning behavior to increase in frequency. This kind of reinforcement—adding something pleasant after the behavior you would like to increase occurs—is called positive reinforcement. A good and effective positive reinforcer can be anything that the person or animal being reinforced values—a word of praise, a pat on the head, a special treat.

But behavior can also be reinforced by



Kathryn Mason '14 (left) works with Shep on overcoming his fear of the Hula-Hoop. Above, research and training tools: a journal, Hula-Hoop, videorecorder, and cones.



Professor Kathleen Morgan passes a Hula-Hoop over Gold Dust during training session.

removing, or subtracting, an undesirable thing—such as stopping one’s nagging once the person you are nagging does what you want. Because this way of reinforcing (or increasing) a behavior involves taking something away, it is referred to as negative reinforcement. The undesirable stimulus used to increase a behavior is often subtle, such as gentle social or physical pressure (i.e., stepping close to a horse until it steps back), but is nonetheless effective in increasing the frequency of a behavior.

The horse world relies on both positive and negative reinforcement to aid in training. Part of the rationale behind using negative reinforcement in horse training is the sheer size and strength of the animal compared to the human. In addition, a growing field that calls itself “natural horsemanship” argues that most species-typical horse social interactions involve negative reinforcement.

“You have some particularly tasty grass that I would like. I step toward you—you step away. I get the grass. No one gets hurt,” Morgan says. In fact, one natural horsemanship

Is positive reinforcement less stressful than negative reinforcement when used to change behavior?

trainer that Ackerman-Morris consulted at the annual Equine Affaire in Springfield, Mass., told her that because horses were by nature “flight animals” (dealing with perceived danger by running away), negative reinforcement was the only technique that would really make sense to them.

Ackerman-Morris and Morgan were puzzled over this line of reasoning, however. They observed that birds were also flight animals but were not typically trained using negative reinforcement. And in the dog training world, many handlers have moved completely away from the use of negative reinforcement techniques to using only positive reinforcement.

So Morgan and Ackerman-Morris began wondering: Is it true that positive reinforcement is not as effective as negative rein-

forcement for equines? What if they could design a scientific study that showed it was possible to train miniature horses using all-positive reinforcement? Could this method of training work to obtain the behaviors that miniature-horse trainers want from their animals, and would it be less stressful for everyone—trainer and trainee—than using other methods?

Stress in animals is a topic that Morgan has studied for the better part of her professional career. “Often we just think of the big events that cause stress in animals’ lives—like a visit from the vet. But plenty of routine events in the lives of horses are probably also somewhat stressful,” Morgan says, “such as traveling in a trailer or going to a horse show. Training is probably another routine experience that can be stressful.” Morgan’s research has tended to focus on quantifying stress in animals and finding ways to reduce it.

Is positive reinforcement less stressful than negative reinforcement when used to change behavior? On the surface, it might

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Kathryn Mason '14, psychology major

them as if getting a carrot for doing something the human would like you to do would be less stressful than being made to feel tightly uncomfortable by a human pressing gently on your shoulder and then stopping when you move away.

But what if the horse begins to “worry” about whether it will be getting that carrot or not? What if it only takes a few trials in order for the horse to “figure it out” that moving away makes the human stop pressing its shoulder, and thus never experiences that pressure again? Why scientifically comparing the effects of positive and negative reinforcement training on miniature horses, Morgan and Ackerman-Morris hope to determine how each of these training methods affects an animal, and also to document the extent to which positive reinforcement can be used in lieu of negative reinforcement in the world of miniature horse training.

Finding the right horses (and student researchers)

Around the same time the idea for the study was taking shape, one of Morgan’s psychology students, Kathryn “Katy” Mason '14, was working at Winslow Farm Animal Sanctuary in Norton, Mass. All of the animals at the sanctuary, including a small group of miniature horses, live “at liberty,” meaning they are rarely haltered or handled, and many have limited experience with training. This unique background made the Winslow minis ideal candidates for all-positive reinforcement training, since they aren’t predisposed to act a certain way around trainers. After speaking with Morgan about the study, Mason came onboard as a student researcher.

The study’s control group is at Whispering Pines, a local farm in Foxboro, Mass., that owns miniature horses. The miniature horses at this farm are trained using a combination of positive and traditional negative reinforcement techniques. At both the farm and the sanctuary, the animals are well loved and well cared for. Thus, the primary differences



A brief history of clicker training

Although the science of clicker training was co-developed by Keller Breland, Marian Breland Bailey and Robert Bailey, the person responsible for bringing it into public consciousness and practice is widely considered to be Karen Pryor. In the 1960s, Pryor refined and improved positive reinforcement techniques through her work with dolphins. It wasn’t until the 1990s, however, that clicker training began catching on with dog trainers, and today it’s used by trainers of a wide variety of animals.

Clicker training involves the use of a clicker to “mark” the desired behavior and to help the animal form the association between what it did and getting a reward. Although this is the technique preferred by many practitioners, it is not

without critics, many of whom consider clicker training to be a kind of “bribing” because of its reliance on treats. In the Wheaton study, the animals have free access to other food, so the team does not consider their use of the technique to be in any way a “bribe.”

“If they had no other way of getting what they need, that would be one thing,” Morgan says. “But that is not true here. All I am saying to them is, ‘Hey, you don’t have to step into this Hula-Hoop if you don’t want to. But if you do, there might be some Cheerios in it for you.’”

She notes that the improper use of positive reinforcement with food can lead to biting by animals. An interested pet owner may wish to consult a professional trainer before employing the technique.

between the two are in the horses’ experiences with training, which makes them ideal for comparison in this study.

To round out the research team, Morgan recruited psychobiology major Alexandra Lund '13, a co-captain of the Wheaton Equestrian Team who’d previously worked with Morgan on a giraffe training study. In addition, psychobiology major Jessica Beckstrom '13, the other co-captain of the Equestrian Team and an experienced bird trainer at Worcester Ecotarium, also volunteered. Morgan, Lund, Ackerman-Morris, Mason and Beckstrom began working with the two groups of miniature horses in June, with funding from a Mars student-faculty research grant.

A tale of two farms

Forest and Shep are two of the resident miniature horses at the animal sanctuary. A study

in contrast, Forest was born at the sanctuary and is an outgoing mini with a penchant for biting. Shep is a “rescued” mini who was abused in her former home and is now skittish and wary of humans as a consequence.

When student researcher Mason began doing groundwork training with both horses in the spring, she encountered significant resistance. “I could barely put my hand out before Forest would try to bite it,” she says, “and I couldn’t get within ten feet of Shep.”

Using a clicker training technique that she learned as a dog trainer, Mason would wait until the horses performed a desired behavior (in Forest’s case, *not* biting her hand), then mark the behavior with the clicker and treat the horses to a handful of Cheerios.

“The clicker works like a bridge,” explains Mason. “It connects the good behavior to the Cheerio reward, creating an association



Kathleen Morgan,
associate
professor of
psychology



Shari Ackerman-Morris,
faculty
associate in
biology



Alexandra Lund '13,
psychobiology
major



Kathryn Mason '14,
psychology
major

in the animal's mind." So far, the technique has proven highly effective with the sanctuary minis. A few weeks into clicker training, Forest's biting had dramatically decreased, and Shep had become more willing to approach humans.

Now a few months into the process, Forest is beginning to learn several behaviors typically used in miniature horse show "trail" competitions. His tricks include standing quietly by a human's side, "heeling" beside a walking human, backing up, jumping over small items, and turning 360 degrees while keeping his back legs inside a Hula-Hoop. All of this is done with Forest "at liberty;" i.e., without requiring him to wear a halter or lead line.

Shep has come a long way, too. She's learned to stand squarely in front of Mason and no longer takes off at the sight of the Hula-Hoop—major progress for a horse that used to bolt at almost anything, including the sound of the clicker.

A few towns over at Whispering Pines, the training for an upcoming show is in progress. The 4-H kids working with the minis at this farm include Ackerman-Morris's daughter Jessica and the farm owner's children, Jyla and Chelsea Sulham. The girls have been working with the Whispering Pines minis for just over 18 months; prior to that, the horses had no show training but were regularly handled. These minis have been trained to jump, complete a trail course, and most recently, to pull a cart.

Nine-year-old Jyla's mini horse Pumpkin is striving to be the "boss mare" at the farm, and Pumpkin can also be bossy with research team members. For instance, Pumpkin has a tendency to continually bump the researchers with her nose, looking for loose Cheerios. But it is clear that Pumpkin and Jyla have a special bond. Pumpkin will follow Jyla anywhere, even over jumps.

Bookie, shown by Ackerman-Morris's daughter Jessica, is another of the control farm minis competing with Pumpkin for head-mare status. Like Pumpkin, Bookie has attitude, which makes her a good show horse, but also makes training her a challenge. Like Pumpkin and Jyla, though, Jessica and Bookie have a special bond, and Bookie will perform tasks for Jess that she won't do for others.

"It is clear that these minis have a good working relationship with the child who is their primary trainer," Morgan says. "We just want to know if we can make that relationship even better."

The kids training the control minis use lead lines and halters to handle their animals and conventional training that includes both positive and negative reinforcement. Research team members observe these train-

ing sessions and also conduct some of their own, comparing the two techniques in terms of how many training sessions it takes to get the desired behavior, and how both humans and animals respond to each technique.

Because those responses can be tough to catch in real time, Morgan and her fellow researchers film their training sessions so they can analyze them later. "We really want to see the sequence of events—what the humans do and what the horses do in response," says Morgan. "Then we can compare in more detail the behavioral effects of using positive versus negative reinforcement."

The science of stress

To compare the impact of the two training techniques on the animals, the team is using several measures of stress. One measure is the amount of cortisol (a primary stress hormone) that ends up in the animals' saliva. Using cotton swabs, the researchers collect regular samples from the horses as they are being trained and compare those cortisol levels to baseline samples collected before training begins.

Another way the researchers are measuring stress is by monitoring the miniature horses' heart rates during training with specially designed equine heart-rate monitors. Together with the cortisol results and analysis of behavioral stress indicators (such as head tossing and tightening of the mouth), the team hypothesizes that positive reinforcement training will produce reduced physiological and behavioral measures of stress compared to the combined training, and improve the minis' overall willingness to work for a trainer.

Strategy plus serendipity

Given instinctual equine behavior, certain maneuvers common in the "trail" class for miniature horses have proven particularly tough to train using only positive reinforcement.

From pit pony to show horse

Miniature horses were first introduced to the United States in the 19th century and used as draft horses in coal mines up until 1950. Known as "pit ponies," they were ideally suited for hauling carts in the underground mining tunnels because of their small size and substantial strength.

Once pulled out of the mines, pit ponies started to be bred for a more refined look, evolving from a stocky, quarter-horse type to a thinner, Arab variety. In 1978, the American Miniature Horse Association was founded to encourage the breeding and exhibiting of miniature horses. Today the association registers nearly 185,000 minis and has more than 11,000 members. Competitive miniature-horse showing has become increasingly popular in recent years, with more than 250 association-sponsored shows annually occurring throughout the U.S. and Canada.

“There are many effective methods of animal training out there—what we hope to show is the value and impact of one method not presently in common use among horse trainers.”

Jessica Beckstrom '13, psychobiology major

“The natural way that horses interact with each other and with humans is by moving away from an approach, not toward it,” says Morgan. “There is one behavior that requires the pony to step crablike along a rail, sideways. It’s called a side pass, and looks like it sounds—the pony crosses its legs under its body as it steps to the side rather than forward or back. Typically, this behavior is obtained by gently pressing a horse’s shoulder and hip until it steps to the side. The behavior is negatively reinforced by removing the physical pressure once the pony takes the step that the trainer wants. Eventually, the trainer can fade this to nothing more than holding out a hand and the horse steps away.

“We’ve been working on the side pass with the sanctuary minis by trying to train them to actually move their shoulders and hips toward our hand—in other words, to move to us rather than away from us. That’s not something they naturally do. At the control farm, we can take advantage of the minis’ natural tendency to move away from an approaching hand, but at the sanctuary, we have to figure out how to do it without using physical pressure or negative reinforcement.”

Despite the constant strategizing, re-strategizing and analyzing that all five researchers do as part of the training process, major breakthroughs sometimes happen serendipitously. Take, for example, the way they cracked the code for getting the miniature horses at the sanctuary to back up. Mason was working with Forest when she rolled her hand back to avoid getting bitten. In response, Forest stepped backward. Then Beckstrom found a YouTube video of an animal trainer in California showing a similar way to positively reinforce backing up in horses. The team has since refined the original hand-rolling technique and has used it to successfully train several of the other miniature horses to walk backward without the use of social or physical pressure.



An alert Shep checks out the Hula-Hoop.

Getting the word out

The study plan as it stands now is to continue working with both groups of horses into the fall and for Morgan, Ackerman-Morris, Lund, Mason and Beckstrom to submit an abstract of their initial findings to the New England Psychological Association, with the hopes of presenting (and drumming up interest) at the association’s annual meeting in October. From there, the team will develop a comprehensive report of findings for submission to the *Journal of Applied Animal Welfare Science*, *Applied Animal Behaviour Science*, or *Animal Welfare*.

Exactly when the miniature-horse training will end is still to be determined. For her own part, Morgan would like to continue working with the Winslow Farm horses until one or more of them is able to complete a traditional miniature horse trail competition course—an accomplishment that could, as colleague Ackerman-Morris points out, take some time.

“The timetable depends on how strict we’re going to be,” says Ackerman-Morris. “Will it be a course that the horses have worked on and know well? Or will we teach them individual elements and then put them together in new and unique ways? We haven’t decided yet what our test will be.”

One thing that Ackerman-Morris and Morgan do know, however, is that they’d like to continue this type of research at Wheaton indefinitely. “I want to develop a more-or-less permanent applied behavior analysis research team that would work both

on and off campus to study how these training techniques can improve animal behavior and well-being,” says Morgan.

The development of such a team would provide steady opportunities for students interested in animal behavior to gain real-world research experience—experience that both Lund and Mason recognize as priceless.

“I’ve done smaller research projects in class but never anything to the degree of this project,” says Mason. “I plan to continue on to graduate school after Wheaton, and I have no doubt that the skills and knowledge I’ve gained through this research will have a positive impact on my future success.”

The nonhierarchical nature of research at Wheaton is also key, explains Lund. “The college emphasizes a small class size, which allows you to form great relationships with both your professors and fellow students. This research project is an extension of that. Morgan and Ackerman-Morris have definitely made me, Jessica and Katy feel like equal partners throughout the process.”

“There are many effective methods of animal training out there—what we hope to show is the value and impact of one method not presently in common use among horse trainers,” says Beckstrom. “Who knows? Maybe we can start a bit of a revolution among horse handlers.”

Natasha Waibel is a writer who lives in Boston.