The
PROCEEDINGS
of the Annual ABMA Conference

Hosted by
San Antonio Zoo
and
SeaWorld San Antonio

Board of Directors

Tricia Dees President

Scott Trauger President-Elect

Cathy Schlott Past President

Missy Lamar 1st VP

Kelly Elkins 2nd VP

Susie Ekard CFO

Christa Gaus Secretary

Darren Minier CFO

Christina Burgess Secretary-Elect

Alicia Sampson Director at Large

Justin Garner Director at Large

Traci Schneekloth Director at Large

Julie Grove Director at Large

Wouter Stellaard Director at Large

Angie Llanas Conference Committee Co-Chair

Christina Burgess Conference Committee Co-Chair

Table of Contents

ABMA Award List

President

The Animal Behavior Management Alliance presents this award to

Tricia Dees

In recognition of her distinguished service as President

2017-2018

First Vice President

The Animal Behavior Management Alliance presents this award to

Missy Lamar

In recognition of her distinguished service as 1st Vice-President

2017-2018

3 Years on the Board

The Animal Behavior Management Alliance presents this award to

Cathy Schlott

In recognition of her 3 years of exemplary service on the Board of Directors

2015-2018

3 Years on the Board

The Animal Behavior Management Alliance presents this award to

Christa Gaus

In recognition of her 3 years of exemplary service on the Board of Directors

2015-2018

3 Years on the Board

The Animal Behavior Management Alliance presents this award to

Darren Minier

In recognition of his 3 years of exemplary service on the Board of Directors

2015-2018

3 Years on the Board

The Animal Behavior Management Alliance presents this award to

Justin Garner

In recognition of his 3 years of exemplary service on the Board of Directors

2015-2018

3 Years on the Board

The Animal Behavior Management Alliance presents this award to

Kelly Elkins

In recognition of her 3 years of exemplary service on the Board of Directors

2015-2018

Conference Committee

The Animal Behavior Management Alliance presents this award to

Angie Llanas

In recognition of her generous support and contribution to the 18th Annual ABMA Conference

2018

The Animal Behavior Management Alliance presents this award to

Christina Burges

In recognition of her generous support and contribution to the 18th Annual ABMA

Conference

2018

Keynote Speaker:

The Animal Behavior Management Alliance presents this award to

Jim Breheny

In recognition of her contribution as a keynote speaker at the 18th Annual ABMA Conference

2018

Sponsors:

The Animal Behavior Management Alliance presents this award to the

San Antonio Zoo

In recognition of their generous support and contribution to the 18th Annual ABMA Conference

2018

The Animal Behavior Management Alliance presents this award to the

Sea World San Antonio

In recognition of their generous support and contribution to the 18th Annual ABMA Conference

2018

Judges

Animal Behavior Management Alliance

In appreciation of your contribution to the 18th Annual ABMA Conference

Susan Gerros-Aquarium of the Pacific

Russel Harris- Houston Zoo

Sandy Jabas– The Mirage

Julie Grove– Maryland Zoo Baltimore

Antonio Ramirez– Busch Gardens

The Animal Behavior Management Alliance

Engage Award– In recognition of the best article submitted for the year from the quarterly ABMA magazine ENGAGE

"In a Word, Captivity Kills" by Mark Simmons

The Animal Behavior Management Alliance

Sharing the Knowledge Award: Recognizes achievements in behavior management education to enhavce the knowledge of professionals and/or the public to the benefit of animals in human care

"Open Barn Doors in a New Direction" by Katie Stevens

The Animal Behavior Management Alliance

Animal Welfare Advancement Award- Recognizes achievements that enhance animal welfare through specific environmental enrichment/conditioning techniques or programs.

"The Quarantine Experience" by Nicki Boyd

The Animal Behavior Management Alliance

Behavior Management Innovation Award: Recognizes outstanding application of novel, unusual, original behavior management techniques.

"Allowing Choice and Control Over Diet For Our Polar Bears at Kansas City Zoo." by Andrea O'Daniels

The Animal Behavior Management Alliance

Behavior Management Achievement Award– Recognizes an outstanding achievement in the application of behavior management techniques.

"The Flight Plan: Giving Rescured Macaw's a Choice" by Emily Yunker

The Animal Behavior Management Alliance

Poster Presentation Award– Recognizes the best poster tha represents an achievement in any behavior management technique, animal welfare, enhancement of knowledge, or any contribution into the field.

"Evaluating Enrichment to Assess a Species Specific Enrichment Program" by Allison Kao

The Animal Behavior Management Alliance

The Impact Award– Chosen by the conference delegates, this recognizes the presentation, panel workshop, or event that impacted them the most from the whole conference.

Thad Lacinak-Precision Behavior

BMF SCHOLARSHIP WINNER

She's Going the Distance- Training a Polar Bear for Conservation-based Research Projects at the San Diego Zoo

Becky Wolf[1], [1]San Diego Zoo

Training has been used for years to assist with the husbandry needs of many zoo animals. From shifting to injections and more, positive reinforcement training is an important part of the daily routine for many of the animals in our care. At the San Diego Zoo, keepers were asked to participate in a research project to assist the US Geological Survey to compare the energetic costs of different polar bear behaviors, which will ultimately inform conservationists about the impacts of climate change on wild polar bears. Over the course of 6 months, keepers were able to train "Tatqiq", a 17-year old female polar bear, to voluntarily participate in blood draws, collection of 10-minute resting oxygen consumption rates while inside a metabolic test space, and walking on a motorized treadmill. The data that was collected is vital to helping researchers in their study on polar bear body functions and will hopefully prove valuable to helping save wild polar bears.

Polar bears in the wild are facing very challenging times. Their reliance on sea ice to catch prey makes them extremely vulnerable to the effects of climate change and the loss of the sea ice. Their remote habitat also makes them challenging to study effectively. Zoos can provide bears that are much easier to study in a controlled environment.

Materials

Tatqiq, a 17-year old polar bear, has participated in multiple research projects throughout her life at the San Diego Zoo. She is one of 3 polar bears that calls the San Diego Zoo home (along with her brother "Kalluk" and an older female "Chinook"). She was chosen to be the participant in multiple research projects over the years based on her willingness to actively participate in training sessions, her personality, and overall calm demeanor.

Multiple research studies have been done with the polar bears at the San Diego Zoo, starting in 2005 with a project to study polar bear hearing sensitivity. One of the first projects Tatqiq participated was in 2014. Researchers hoping to better understand the energetic costs of different polar bear behaviors first needed to collect baseline data on what those different activities look like from data collected from an accelerometer collar. Tatqiq was trained to voluntarily wear the collar at the zoo, allowing for collection of this important baseline information.

Methods

In late 2015, a new challenge was proposed to the polar bear staff- can we train Tatqiq to not only walk on a motorized treadmill but also to lay resting in a metabolic test space, as well as to cooperate for voluntary blood draws before and after the data collection periods. Challenge accepted. The treadmill was installed in August 2016 with data collection occurring over the course of several days during 2 separate sessions in February and April of 2017.

Initially, keepers loaded the treadmill with lots of treats (in anticipation of a hesitant bear), with the plan of just

opening the door and allowing her free access to the treadmill for about an hour or so each morning. Tatqiq surprised everyone and walked right inside with no hesitation the first time she was given access to it.

Once she was comfortable with just being inside the treadmill, keepers began cueing her to come inside the treadmill. She was only given the opportunity to come inside during training sessions, by having a keeper open the rear door of the treadmill and cueing her with "in", followed by the door being opened. Once she was responding to the door opening and going inside, she was called to the front and fed reinforcers via a small hole in the front panel of the treadmill.

The next step was getting Tatqiq used to having the door closed behind her. A second keeper was stationed near the rear of the treadmill, where the sliding door was, and Tatqiq was reinforced for staying inside the treadmill. Occasionally, she would become wary of people standing behind her where she couldn't see them. In these instances, the second keeper would move a bit closer to the front of the treadmill, where Tatqiq was able to see them and the session would continue with them slowly moving further back towards the door.

Next, she was cued to lay down inside the treadmill and lay there for continuous reinforcers at a consistent rate, with the goal of having her lay inside the enclosed treadmill for 10 minutes. Keepers initially started with feeding her at intervals of every 5 seconds, then moved up to 15 seconds and by the time data was collected, reinforcement was offered every 30 seconds. Reinforcers varied, but included chicken baby food, lard, beef heart, canned dog food and peanut butter.

The next step was closing the door behind Tatqiq. She was cued that the door was closing with the verbal cue "door", with the knowledge that should Tatqiq attempt to back out of the treadmill, the door was immediately opened all the way, allowing her to exit. This proved vital, as Tatqiq was somewhat hesitant at being totally enclosed inside the treadmill and in the early stages of training would often stand up to leave immediately after she heard the door closing. Small approximations were made to allow her to become comfortable at her own pace, with first just closing the door a few inches, then halfway, and then eventually all the way closed. Once she realized she had control of when the door opened, Tatqiq quickly became comfortable lying in the treadmill for 10 minutes with the door closed.

At this point, USGS researchers came to the zoo for resting rate data collection. Over the course of 2 days, 6 successful resting oxygen use rate collection sessions were conducted. Despite some new machinery added for the actual data collection, Tatqiq participated calmly each time, only attempting to back out of the treadmill once and even though the door was opened, it did not affect the data collection.

The next challenge for Tatqiq and the staff was to walk on the moving treadmill. This proved to be the most challenging part of the study for Tatqiq. Early stages of training had her bolting back out of the treadmill as soon as it was turned on the slightest bit. Keepers tried working with her both standing on the treadmill and then turning it on (resulting in her backing out almost immediately) and having it barely turned on and attempting to get her to come onto the already moving treadmill. Attempting to get her to come onto the moving treadmill was much less successful from the beginning and was quickly abandoned.

Keepers were able to successfully work Tatqiq through her discomfort with the moving treadmill by offering her different types of reinforcement and immediately turning it off as soon as she started backing out. Sessions were started with her laying calmly in the treadmill. She was then cued to "stand" using a verbal and hand cue (a second, higher feeding hole was added to accommodate the different feeding heights needed for both portions of the study. It was quickly discovered that the lower feeding hole made it difficult for Tatqiq to walk and eat her reinforcer, which often cause her to stop walking to lower her head to eat). Once she was standing, keepers cued her that the treadmill was turning on with the verbal "walk" and the treadmill was turned on to the absolute slowest speed, remembering to turn it off as soon as she started backing out. It should be noted that the door was not closed at any point in the early stages of the walking training.

Training continued with keepers very slowly building up Tatqiq's confidence with the moving treadmill. Some days she would walk for several minutes without attempting to back out, while other days she would not cooperate at all and would immediately balk as soon as the treadmill was turned on. To really get over the hump of having her stay within the moving

treadmill, reinforcement was offered at a continuous basis. Once Tatqiq was more confident, keeper slowly decreased the frequency of reinforcement, starting with every 5 seconds and increasing in 5 second intervals to approximately every 30 seconds. Different liquids were also offered out of syringes, allowing her to eat for slightly longer periods of time and keep her a bit more occupied.

Once Tatqiq was walking on the treadmill while it was at its lowest speed, keepers slowly increased the speed at small increments. Sessions began with her entering the treadmill when cued, then it was turned on to its slowest speed. Keepers would then turn up the speed a small amount at a time each time Tatqiq was bridged with the verbal "good". Speed increments were determined by predetermined marks on the speed dial.

Once she was staying on the moving treadmill for several minutes, keepers were able to close the door behind her. Because she seemed slightly more aware/reactive to the door closing, keepers initially only closed the door halfway and moved onto closing it completely when she was walking for several minutes without attempting to leave the treadmill. Keepers continued to immediately turn off the treadmill and opened the door anytime she attempted to leave the treadmill. It took about 3 months, but eventually Tatqiq would walk on the enclosed treadmill for approximately 10 minutes.

Completely separate from the treadmill portion of the study, researchers also needed Tatqiq to allow for voluntary blood draws before and after the treadmill sessions, to allow them to compare blood chemistry values before and after energy usage.

The zoo's polar bear area already had a blood sleeve available and keepers planned to train her for blood collection from both front feet. Tatqiq was asked to lay down at the mesh with the sleeve just off to the side. Keepers were able to prompt her to put her paw into the sleeve by touching her foot with the end of a target stick and reinforcing her for moving the foot close to or into the sleeve. A verbal and hand cue were both used ("paw" and a closed fist next to the sleeve respectively). If the paw was not far enough into the sleeve, keepers simply re-cued her until she would move her paw further into the sleeve.

Next, a second trainer and the cue "touch" was introduced. This cue was used for not only having keepers/vet techs touching the top of her paw for the actual blood draw, but was also used when keepers would touch her with the clippers to shave the hair off the top of her paw. An area approximately 3 inches by 4 inches was shaved to facilitate finding the vein. From this point on, 2 keepers (or 1 keeper and a vet tech) were always present, since a minimum of 2 people were necessary for an actual blood draw. 1 vet tech was dedicated to this training project and was typically present 4-5 days per week. Initially, she just came down to offer Tatqiq treats and would be present for, but not participate in, the training sessions. Once she was reliably presenting her paw and allowing the keepers to touch it, the vet tech replaced the second keeper.

Keepers initially desensitized Tatqiq to the presence/sound of the clippers by simply placing them next the blood sleeve where she could easily see them throughout the training session. When Tatqiq did not react to them being present, keepers were able to pick them up and slowly move them towards her paw while they were on. When she did not react again, keepers kept them turned off and touched the top of her foot when she was cued for "touch". Next, the clippers were turned upside down and touched to the top of her paw to allow her to become used to the feeling of the clippers being on without actually shaving her fur. The final step was when actual clipping occurred (again with little to no reaction from Tatqiq).

Once the area was shaved, keepers began putting pressure on the paw and using a blunt needle along the area where the vein was to simulate a needle stick. Tatqiq was a champ and showed no reaction to this step as well and was quickly on her way to attempting an actual blood draw.

When an actual needle stick was attempted, Tatqiq immediately reacted and pulled her paw out of the blood sleeve. During the same session, she complied right away with presenting her paw, but no additional stick was attempted. Only 2

sticks were allowed per paw, per day. Our first successful blood draw occurred on Jan. 11, 2017, approximately 2 months after training began.

Results

Data collection occurred in 2 sessions, one to collect resting oxygen usage and one to collect active walking oxygen usage. Collection occurred 2 months apart. Even with some last minute additions in terms of equipment and small additions to what researchers hoped to collect, Tatqiq was a rock star, participating in a total of 6 sessions over 2 days for each data collection period. Once the data was evaluated, researchers discovered that polar bears use much more energy when compared to other large animals their size. They also comparatively use more energy just walking around, which with the loss of sea ice, is something they are now spending more and more time doing in the wild.

The data collected during this study is invaluable to assisting researching in evaluating the energetic needs of wild polar bears and shows how well zoos can work with researchers to help animals in the wild. Tatqiq, Chinook and Kalluk are ready to tackle their next challenge in helping their wild cousins by participating in a photo study this spring. This new study will hopefully allow researchers to turn 2D pictures of bears into 3D models to better estimate factors such as a bear's weight and overall body condition.

Tells and Tails: The Way Our Giraffe Herd Helps Us, As Trainers, Decide What Our Next Approximations Are

Amy Schilz, Jason Bredahl, Diana Cartier, Kayla Ringuette

Cheyenne Mountain Zoo

So often in training, we hear the phrase "select for the behaviors you want to see, ignore the behaviors you don't want to see." This procedure has been standard for many training programs. We should definitely be paying attention to what we want the animals to do and select for those behaviors. However, if you're ignoring unwanted behaviors, you may be missing critical information that guides what you should do next. What if those "unwanted" behaviors are communicating discomfort, something like… "Hey, slow down, I'm not ready for that step!" but the trainers persist? In our giraffe training program, we've found that when we ignored some of these small, "unwanted" behaviors, the result has been escalation of those behaviors, or even increased aggression.

This paper will run through the way we developed a more effective way to work with our giraffe herd during their individual training sessions. By adjusting our approximations based on what each of the giraffe's behaviors is telling us, we have created scenarios where each of their behaviors produces desirable outcomes for them. The giraffes can control whether or not we touch them, poke them, brush or pick their hooves, etc. In most cases, the giraffes cue the trainers to cue the behaviors! Once we started paying attention to their smaller, overt behaviors ('tells', ex: a tail swish), we could move forward much faster, sometimes by taking steps backwards. The end result has been solid behaviors (blood draws, hoof work, injections, x-rays) built from more trusting relationships.

When we're looking at behavior, we look for anything an animal does that can be measured. We can measure how many times a monkey's hand goes up to scratch its head per hour, how many times a bear walks back and forth along a fence each day, or how many times a cat blinks per minute. All of these are examples of behavior; they can be measured over time.

Additionally, behaviors that we can observe have a purpose, i.e., to produce outcomes of value. We don't always know what the purpose (the desired outcome) is, or why certain behaviors happen the way they do. We do know, though, that behaviors that maintain or increase produce reinforcing outcomes, in one way or another.

When we (Cheyenne Mountain Zoo giraffe trainers) started working with our giraffe herd, we first looked carefully at all the behaviors we could observe. While there are probably an infinite number of behaviors that giraffe perform, there are some behaviors that are easier to observe than others. We all know giraffe run, kick, stomp, bend down to drink, and spar with their cohorts. However, we found that there are other behaviors that are less noticeable, such as flicking ears, flaring nostrils, swishing tails, widening eyes, and twitching skin. It's these smaller, harder to detect behaviors that we've found come in handy when we are trying to work with the giraffe during training sessions.

At Cheyenne Mountain Zoo (CMZ), we started calling these smaller behaviors "tells" because the term reminded us of humans playing poker. Poker players look for the smallest behavior they can see in their opponents that, if interpreted correctly, might give them an edge up in their game. For example, if they notice an eye twitch in their opponent, and that opponent then lays

down a royal flush, the person observing might fold if they notice that same eye twitch on the next hand. Similarly, we trainers look for tells in our giraffes, as it can help give us an edge up in training successful behaviors.

If one of our giraffe twitches an ear, for example, we might want to think about why that ear is twitching. If every behavior serves a purpose, what purpose might that ear twitch have? Is it to get rid of a fly, or try to hear better, or to remove our hand from their environment? If we start to see that the ear flap happens every time our hand comes near the ear, it's a pattern that we should pay attention to. Does the ear flap get bigger the closer our hand gets? Does it get smaller if our hand goes away? If so, is the ear flap the giraffe's way of removing our hand from their proximity? Does it mean they're uncomfortable?

We've found that if we can observe smaller behaviors, or "tells", it gives us more information on what the giraffe is or isn't comfortable with. Each of these small behaviors also has a purpose; the giraffe perform them to get a desirable outcome. Once we realized this, we really started paying attention to those tells! We started to gather information each individual giraffe; we noted what each giraffes' observable behaviors were when we thought they were uncomfortable or trying to remove something from their environment. We discussed them as a team and made note of them during training sessions.

We took that information in, then figured out how we could apply it to our overall training program. We learned that if a giraffe shows discomfort at our hands coming close, we can reinforce their tell by removing our hands. The giraffes essentially condition us to remove whatever aversive we are applying (hands, in that case) by exhibiting their tell behavior. We then base our successive approximations off of that information. If there are no tells, we infer that the giraffe is comfortable at that step, and we move forward in our approximations. If the giraffe is showing tells, we infer that we have to take some steps back. We then have to figure out a way to train the goal behavior using a positive reinforcement strategy moving forward.

Once the giraffe realized they had control over our approximations by using their tells, we essentially formed a communication system that worked well for both the trainers and the giraffe. What we did, basically, was allow the giraffe to train *us,* too! The giraffe's body language actually became a LANGUAGE; we had built a system in which they had previous experience where their behaviors of showing comfort or discomfort affected our choices on approximations.

Once we started to figure out that we could have full on "conversations" with our giraffe herd; our training was no longer a monologue where we essentially told them Do this behavior to earn treats." Instead, we waited for *them* to tell *us* what steps to take by "listening" to their body language. Equally, we used bridges and reinforcers to communicate with the them, too, on what we *did* want to see from them. By giving them ways to express whether or not they were ok with our approximations, we had found a way to give them a voice during training sessions. We gave them choices over whether or not they wanted our hands close, or a door to open, or to put their foot on a block, which then gave them control over their interactions with us. This happens to be a great training strategy, considering that control is now recognized as a primary reinforcer! Once our giraffe herd learned that they could control how close we got to them, whether or not doors opened or closed, and or not we were going to touch them, they started to trust us. If they said "no" using some of their tells, we would back off in our training steps. Once we backed off, they became more comfortable with taking steps forward; they knew they could tell us whenever they wanted us to stop.

That revelation really changed the way we used the operant teaching quadrants. For example, during our hoof trimming sessions, our giraffe can control whether or not we knife out their foot. If we cue "knife" and start knifing out the hoof, the giraffe can swish their tail if they're they want the knife removed. This tail swish tells the trainer "take the knife off my foot", and the trainer does. The knife is, at that moment in time, an aversive. The giraffe removes the knife from its environment by tail swishing. See functional assessment below:

Antecedent: Knife scrapes foot
Behavior: Tail swishes
Consequence: Knife comes off foot
Prediction = Tail will swish more to escape the knife – Negative Reinforcement (R-)

We use the information that the giraffe just gave us to back up in our training approximations. The giraffe performed a behavior that let us know it was uncomfortable, and it used an escape strategy to get the knife out if its environment. We then know that we have to take a smaller step and make the knife less aversive. We try a different strategy, like knifing with less pressure, or knifing out a spot without painful bacteria, and reinforce the giraffe staying still with a high value item. See functional assessment:

Antecedent: Knife scrapes foot with less pressure in a different spot
Behavior: Tail stays still
Consequence: Keeper gives cracker
Prediction= Tail will continue to stay still to get crackers – Positive Reinforcement (R+)

We use this information to guide us in our training steps, as well. As long as the tail stays *still*, we start to raise the criteria for the giraffe. We might start with applying increased pressure to the knife with each approximation or move to an area that looks a little more sensitive. We pair harder approximations with a higher value reinforcer to make faster progress.

By using an animal's tells as a guide during your approximations, you provide more opportunities for them to have control over their environment. Both scenarios listed out above are reinforcing to the animal, meaning that the behavior in both scenarios will increase or maintain in strength. The tail swish rmoves an aversive stimulus from the environment, so we would expect the tail to swish again if we knifed in the same spot with the same pressure. However, we can use competing reinforcers like crackers, browse, or lettuce to increase or maintain the behavior of the tail staying still. We, as trainers, hope that the positive reinforcement strategy wins the competition between the use of positive and negative reinforcers. For our giraffe herd, "still" behavior (once they are in the correct position) earn them the highest rate of positive reinforcement.

The giraffe are welcome to signal to us when they want to take a step back in approximations. Each giraffe has its own unique way of communicating, so we try to watch all of the behaviors each animal does in order to catch the correct tell. Some of our giraffe flare their nostrils, while others twitch the skin on their sides. What we have found is that unwanted, undesirable behaviors increase when we ignore their tells. A tail swish turns into a stomp, a stomp turns into a kick. The kick is effective in removing the trainer's hands, so that's where the giraffe will start the next time you try to repeat that same approximation. If we ignore the smaller tells, they learn that the smaller behaviors don't get them the consequences they want, so they will escalate in aggression.

We have found it much safer for our staff to work around the giraffe if we train with tells in mind. We would much rather stop a training session and re-evaluate when we see flared nostrils than have one of our staff get hurt because we pushed the giraffe's session until it kicked. We have found that having trainers who listen to tells gives the giraffes a way to tell us no, and we fully believe that each of them has the right to say no when they're uncomfortable.

We learned this approach of reinforcing tells through trial and error, and we had a few misses along the way. We had a couple of giraffe who we would touch before they were ready, or knife swipe on a piece of the foot that was painful. When we were newly starting out, we hadn't thought about reinforcing tells, so we would just repeat the approximation. As we would now predict, ignoring tells resulted in the giraffe's escalating their aggressive behavior. They would stomp when our hands got near their foot, which was the result of inadvertent reinforcement!

In order to go back in approximations, we had to re-evaluate the way we wanted this giraffe to say "stop". When we didn't listen to any of the giraffe's tells, those behaviors had disappeared from its repertoire, given these conditions (extinction). We then discussed how we would want this giraffe to "kindly" tell us to stop and started to train for the behaviors we *did* want to see.

For example, one of our giraffe, Msichana, would flick her fetlock out if she wanted our hands off her foot. We discussed what we wanted her to do instead and decided that we'd like her to take her foot off the block calmly towards the floor. We needed to

teach her a tell; we needed to give her a way to say "no" that we were all comfortable with. We worked with Mischana to establish that behavior by reinforcing her every time she took her foot back calmly. Most of our giraffe take their foot back on a 'release' cue, and we hold them to the criteria of keeping their foot on the block until the release cue is given. With Msichana, though, we decided that she could take her foot back any time she wanted, and she would still be given a reinforcer as long as there was not a flick of the fetlock when she took her foot down. We started to see her offer this behavior whenever she was uncomfortable, and we continued to reinforce it with a small piece of lettuce or cracker. If she kept her foot up, she earned a high rate of high value reinforcers. If she flicked her fetlock, we removed our hands. We saw her figure out that if she was uncomfortable, she could remove her foot from the block to remove our hands, *and* she'd get a cracker if she did it without the fetlock flick. She now has a way to tell us no, and it's less aggressive than her previous methods. This is an example of the matching law: given a choice between two behaviors we tend to do the one that produces the most, or most valued, reinforcers.

We also started to learn how to tell if each giraffe was ready for a training session. At first, we had a hard time distinguishing if giraffes were just chewing, or in "giraffe land", or if they were paying attention to us at all. We were just cuing whenever we were ready, but we noticed that the giraffes would sometimes be startled by the touch of a hand, even though we had cued it. We decided we needed to figure out when to give our cues, and how to tell if they were giving us "I'm ready, you can start, or keep going" signals. What we have found to work is presenting a target stick for them to put their nose on. This shows us that they are engaged in the session, and they're ready for cues. If they remove their nose from the target, then we stop what we are doing and wait for them to reset. Once they are finished doing whatever they decided to do, they would bring their head back to the target stick and we would keep going.

Through this process, we also learned that one of the first things a giraffe will do if it's uncomfortable during foot work is take its foot off the block. In order to take it's foot off the block, it lifts its head up to move its foot. So, we started to predict if the head went off the target stick, that meant the foot might go off the block next. We used that as a way for the giraffe to signal to the trainer that they might need a bit of a break during foot work, so if we see their heads come off the target stick, we stop knifing out their foot. If they come back to the target stick, we resume the session. If they don't, then we give the release cue to give them a break.

In conclusion, we really believe that training can and should be a two-way information flow between the animal and the trainer. So often in training, we hear the phrase "Focus on what the animal is doing right. Select for the behaviors you want to see, ignore the behaviors you don't want to see." We think that you should definitely select for the behaviors you do want to see and put a lot of reinforcement history on those behaviors! However, we also think that by paying more attention to the behaviors we don't want to see and figuring out what function they serve for the learner, then providing that function, we can greatly improve the dialogue between us and the animals in our care.

We'd like to thank our team here at Cheyenne Mountain Zoo for supporting us through all of our training challenges. Everyone here at the zoo has helped us with our herd in one way or another, and we are very appreciative of their collective pursuit of our zoo's mission. We would also like to thank Dr. Susan Friedman, who has helped us learn about training animals by giving them power over their environment. We have learned a lot from her, and in such a variety of ways! She's provided our zoo's staff with opportunities to grow in our skills through lectures, L.L.A classes, answering questions and brainstorming over phone calls, editing papers, and also by standing alongside us while we work with our animals.

Enriching Palms:
How Enrichment Lead To The Breeding Of Palm Cockatoos (Probosciger aterrimus)

Angela Martell
Aviculturist

Animal Care Specialists give enrichment to captive animals for many reasons. A variety of enrichment, from food to environmental, can help meet the ultimate goal to have both physically and mentally healthy animals, in a comfortable and stress free environment. Enrichment, combined with the proper set up, can also have the added benefit of encouraging breeding behaviors and to the successful breeding of notoriously difficult species in captivity , like Palm Cockatoos. With the implementation of species specific enrichment and behavioral observations, San Antonio Zoo had their first successful breeding of Palm Cockatoos in 2017.

Natural History

Palm Cockatoos (Probosciger aterrimus) are the largest species of cockatoos. They are native to New Guinea, Aru Islands, and Cape York Peninsula. Their habitat is generally in rainforest and lowland areas. Palm Cockatoos are unique among cockatoos in several ways. Their nests consists of a platform of twigs inside a previously hollowed out large tree they find. They also are highly specialized feeders with low birth frequency. Palm Cockatoos are one of the few birds who use a form of tool use to perform a behavior called drumming. Palm Cockatoos construct “drumsticks” from branches from surrounding trees. This drumming is thought to be part of courtship and helps attract a mate. Foot stomping and tapping with their beaks are also other forms of drumming used.

Goal

By 2009, none of these or any other breeding behaviors had been seen from a pair of Palm Cockatoos. This pair had been at the San Antonio Zoo since 1998. A plan was needed to find out if the reason there wasn’t any breeding behavior had anything to do with anything husbandry related. With the ever growing importance of enrichment as an integral part of husbandry, this plan would also help to show just how important enrichment is.

Challenge #1 and #2

A few types of enrichment, mostly manipulative, were given to the Palm Cockatoos. With the Texas heat, sprinklers were used as both enrichment and to prevent overheating. Also, during this time , aggression was seen and heard on a fairly regular basis from this pair. Not unusual for parrots, but this could lead to more injuries.

Challenge #3 and #4

The pair were very interested in what the keepers were doing. Sometimes this was almost encouraged to have some "playtime" with the birds. This can shift the focus off their mate and onto their keeper instead.

Challenge #5

In 2009, the Palm Cockatoos were housed in an area called the Parrot House. This was a building with wraparound exhibits with a different parrot species in each exhibit. The main area was outside in public view with an inside area they could access. This access area also was part of the keepers' service area. With all the activity, especially inside, the Palm Cockatoos were always distracted and came inside to see all the activity going on in the service area. The pair was housed together in the larger exhibit with a large hanging nest box. There was room for the pair to get away from each other if needed. But, was it enough?

Methods: Increase Amount of Enrichment

Browse

A variety of browse was offered to the pair. More bamboo, which is easily available throughout the zoo, was put in the exhibit. One eucalyptus tree that grows off exhibit became another source of browse for the Palm Cockatoos. Various sizes of branches were cut from the eucalyptus tree. The process included partially climbing the tree and carrying all the cuttings down to the Parrot House (about a ten minute walk). The bark from the eucalyptus tree was also collected to be used to encourage more chewing. Various sticks were included to splinter and possibly drum with. Both the bamboo and eucalyptus were set up high near the nest box to try to also encourage interest in their box.

Showers

Some sprinklers at the Parrot House worked better than others. It became easier for keepers to use a handheld water hose to give the birds their showers. This also gave the keepers some time to observe the birds' behavior while the hose was in use. The Palm Cockatoos were a main focus during these observations due to their pair aggression. These handheld showers were done more often, while the exhibit sprinklers were used less often. The pair was given a choice in whether or not to partake in the shower.

Breakthrough

One morning, both the male and female Palm Cockatoos were enjoying their shower. After about eight minutes, the male went over to the female and began a to feed her. This was a step to strengthen a pair bond. This pair had not been seen doing this before. Both the showers and the browse were increased. Daily observations were added. It was also decided to take advantage of an empty exhibit next to the Palm Cockatoos. They would have access to this empty cage, in addition to their own to allow more space for the pair. Another nest box was put up for choice. Observations showed increasing breeding behaviors, from drumming to courtship behavior (wings spread, crest up, red cheek patch, and high pitched vocals). The pair bond was strengthened.

It was hypothesized that the size of the water droplets from the water hose was more the size of rain droplets.

The fights had lessened to almost nonexistent. There was still the problem of the distraction of the keeper activity in back. A piece of plywood was cut and fitted onto the keeper access door to their back area. This became a visual barrier as not to distract the pair.

Setback

Due to the growth of the zoo, a large carousel and restaurant was to be put in the center of the zoo. This left no room for the Parrot House. This meant the Palm Cockatoos would have to be moved. In 2012, the pair were moved to the ARK. It is a similar set up as the Parrot House without an inside back area for the outside exhibits where the Palm Cockatoos would be set up. This also meant new keepers. Any playtime was still discouraged and the same browse schedule remained in effect. The handheld showers lessened until they weren't being done due to time constraints of the keepers. Some behaviors remained, but to a much lesser extent. Then in late 2016, the ARK became available again to the previous keeper. It was time to get the previous routine back going with a few diet changes.

Observations

The shower with a handheld hose was brought back. It occurred less often than before, due to the demands of the keeper's routine in this area. The pair bond was previously strengthened, so the pair aggression problem was not a concern like before. Plenty of browse and sticks were offered, along with hanging wood chew toys. A large stump with openings on top was introduced to give a choice. In mid-January, a pile of splintered wood pieces began showing up in the corner of the exhibit after sticks were put in for enrichment. Nothing else significant happened until February, when the male flew up to the original nest box and was seen going inside for the first time. The female soon followed. Any behaviors observed were noted.

Sample Observations (The ARK)

February 9th 2017- Pair pulling a disappearing act. Female in most of the AM (1.0 out). Male inside right before noon (0.1 out). Female back in around 1:30 (1.0 out).

February 22nd 2017- Female out for short time in the am. Minor aggression toward male. Went back inside nest box for majority of day.

March 7th 2017- Nest box checked. No egg seen. Pair spending majority of time out of nest box. More sticks and browse put in exhibit. Pair immediately chewing sticks. Male was seen taking sticks up to the top of the nest box splintering sticks and dropping them inside. Some drumming with sticks seen on perching.

Milestone

An egg was found on April 4th 2017. On April 19th, the egg was found on the ground. The candling results were early death, which meant it was fertile! On May 5th there was another egg. This time it was pulled to the Incubation Room where it was candled and found to be fertile! There was some aggression observed by the male toward the female, but this quickly resolved itself. Several days later the egg candling result was again early death. The Palms took a short break after this until mid-July. On August 10th, another egg was found. Again, the egg was pulled and candled. Yet again, it was fertile. On September 3rd 2017, our first successful Palm Cockatoo hatch!

Conclusion

With the increase and variety of enrichment, any possible contributing factors to the pair aggression were fixed. With less fighting, due to being distracted by the showers, the pair were more calm and comfortable. With less "playtime" from keepers and any other keeper related distractions taken out of the equation, the pair were able to focus on each other and strengthen their bond. All of these factors, along with age and the right setup, brought on breeding behavior.

With the changing attitudes toward enrichment for captive animals, enrichment is now seen as an integral part of husbandry. No longer just fun and games to keep the animal active, it can also be seen as an important factor to help trigger biological behaviors or cure aggressive behaviors that all benefits an animal's welfare.

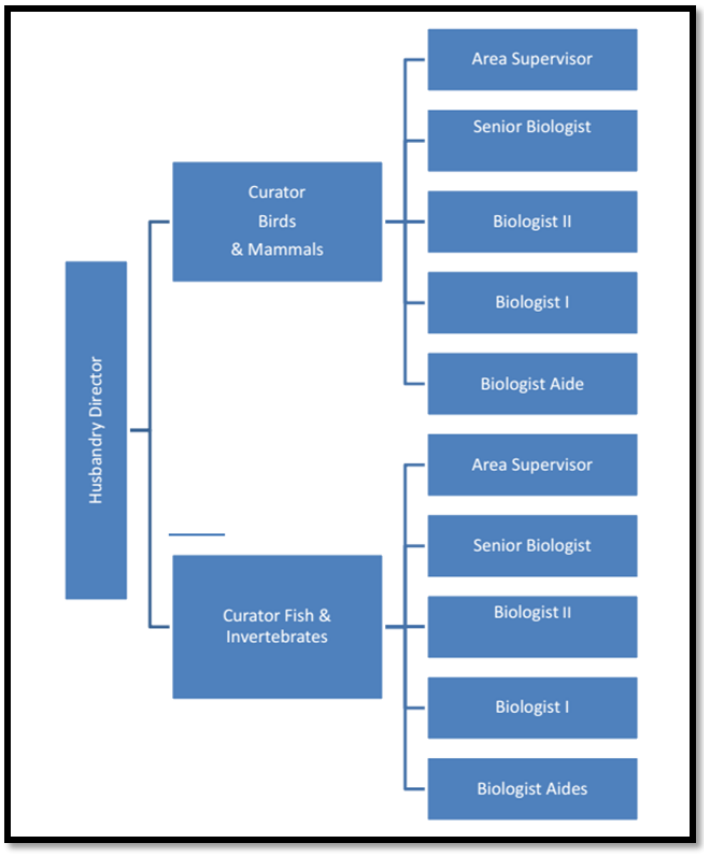
Husbandry Staff Care Manual
How the Adventure Aquarium Leadership Team Developed a Successful Mentor Program

Ann-Marie Bisagno
Adventure Aquarium

Adventure Aquarium houses, 464 species of 15,042 individual animals, with a husbandry staff of 39. We realized the care of the animal staff is just as important as taking care of the animals, and sometimes more difficult. As part of Adventure Aquariums commitment to constantly improve in all areas of the business, including employee satisfaction, we frequently solicit employee feedback by formal and informal ways. As a result of this feedback the husbandry leadership realized that we needed to take steps to improve moral and communication, so we developed a mentor program. As the program evolved over a period of 5 years we found it to be beneficial to the team in many ways. It gave the staff the opportunity to learn new skills by becoming mentors to their peers. It enabled them to keep track of their yearly goals with support along the way to achieve them. Animal care benefited by keeping up on training goals and improving communication between trainers. Staff development improved by expanding the program to include the next level biologists. The mentor program proved to be an important tool to address communication and performance issues on a peer to peer basis. This paper will discuss the methods used and the evolution of the bird and mammal mentor program. It will describe how it helped staff and leaders to improve communication, animal care and staff development.

How It Began

In order to understand the structure of the department here is a brief description of how the husbandry department is organized. The husbandry team consists of two areas: Bird and Mammal, (B&M), which takes care of the obvious plus reptiles; Fish and Invertebrates, (F&I), which takes care of everything else. (Fig. 1)

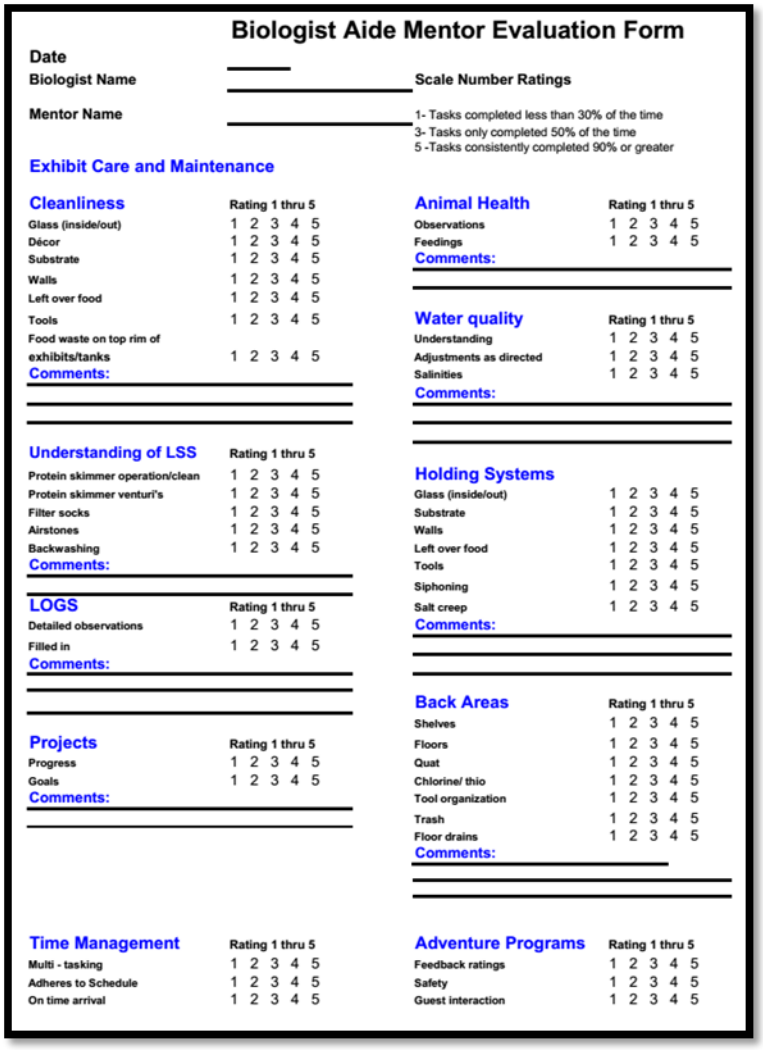


(Fig. 1 Organizational Chart.)

Every year the aquarium conducts an employee survey. There are questions pertaining to all aspects of the operation, but the area that inspired us to create a mentor program was how the staff viewed their leaders. Our scores suffered in areas like "Do you think your leaders care about you as a person?" and "Do you have the tools and information to do your job?" There were also other questions that pertain to how the leaders are relating to the staff. These questions were given to reflect each leader, so it was individualized enough that we decided we needed to do something to improve our relationship with the staff. Our goal for this program was to improve communication, track animal training goals, create an environment of open and honest communication, create a more cohesive team and improve relationships with leaders

First Steps

The F&I team, started a program of their own, but used it to mostly to keep track of goals and rate the staffs' performance according to their needs. We adopted their form, but soon found out we needed to use something very different. (Fig 2)



Biologist Aide Mentor Evaluation Form

Date

Biologist Name _____

Mentor Name _____

Scale Number Ratings

1- Tasks completed less than 30% of the time
3- Tasks only completed 50% of the time
5 -Tasks consistently completed 90% or greater

Exhibit Care and Maintenance

Cleanliness — Rating 1 thru 5

Glass (inside/out)	1 2 3 4 5
Décor	1 2 3 4 5
Substrate	1 2 3 4 5
Walls	1 2 3 4 5
Left over food	1 2 3 4 5
Tools	1 2 3 4 5
Food waste on top rim of exhibits/tanks	1 2 3 4 5

Comments:

Understanding of LSS — Rating 1 thru 5

Protein skimmer operation/clean	1 2 3 4 5
Protein skimmer venturi's	1 2 3 4 5
Filter socks	1 2 3 4 5
Airstones	1 2 3 4 5
Backwashing	1 2 3 4 5

Comments:

LOGS — Rating 1 thru 5

Detailed observations	1 2 3 4 5
Filled in	1 2 3 4 5

Comments:

Projects — Rating 1 thru 5

Progress	1 2 3 4 5
Goals	1 2 3 4 5

Comments:

Time Management — Rating 1 thru 5

Multi - tasking	1 2 3 4 5
Adheres to Schedule	1 2 3 4 5
On time arrival	1 2 3 4 5

Animal Health — Rating 1 thru 5

Observations	1 2 3 4 5
Feedings	1 2 3 4 5

Comments:

Water quality — Rating 1 thru 5

Understanding	1 2 3 4 5
Adjustments as directed	1 2 3 4 5
Salinities	1 2 3 4 5

Comments:

Holding Systems

Glass (inside/out)	1 2 3 4 5
Substrate	1 2 3 4 5
Walls	1 2 3 4 5
Left over food	1 2 3 4 5
Tools	1 2 3 4 5
Siphoning	1 2 3 4 5
Salt creep	1 2 3 4 5

Comments:

Back Areas — Rating 1 thru 5

Shelves	1 2 3 4 5
Floors	1 2 3 4 5
Quat	1 2 3 4 5
Chlorine/ thio	1 2 3 4 5
Tool organization	1 2 3 4 5
Trash	1 2 3 4 5
Floor drains	1 2 3 4 5

Comments:

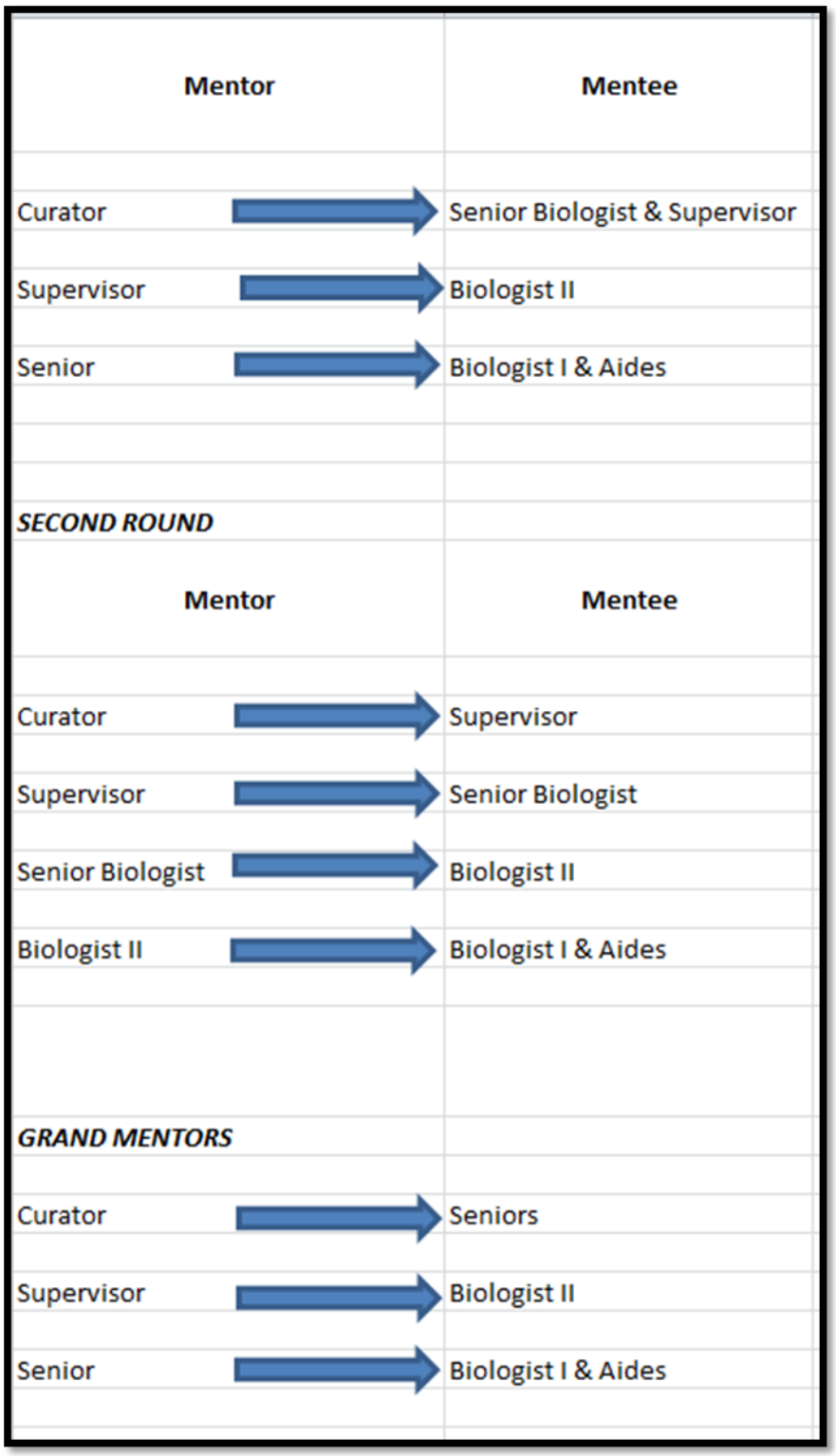
Adventure Programs — Rating 1 thru 5

Feedback ratings	1 2 3 4 5
Safety	1 2 3 4 5
Guest interaction	1 2 3 4 5

(Fig. 2. Rating Form.)

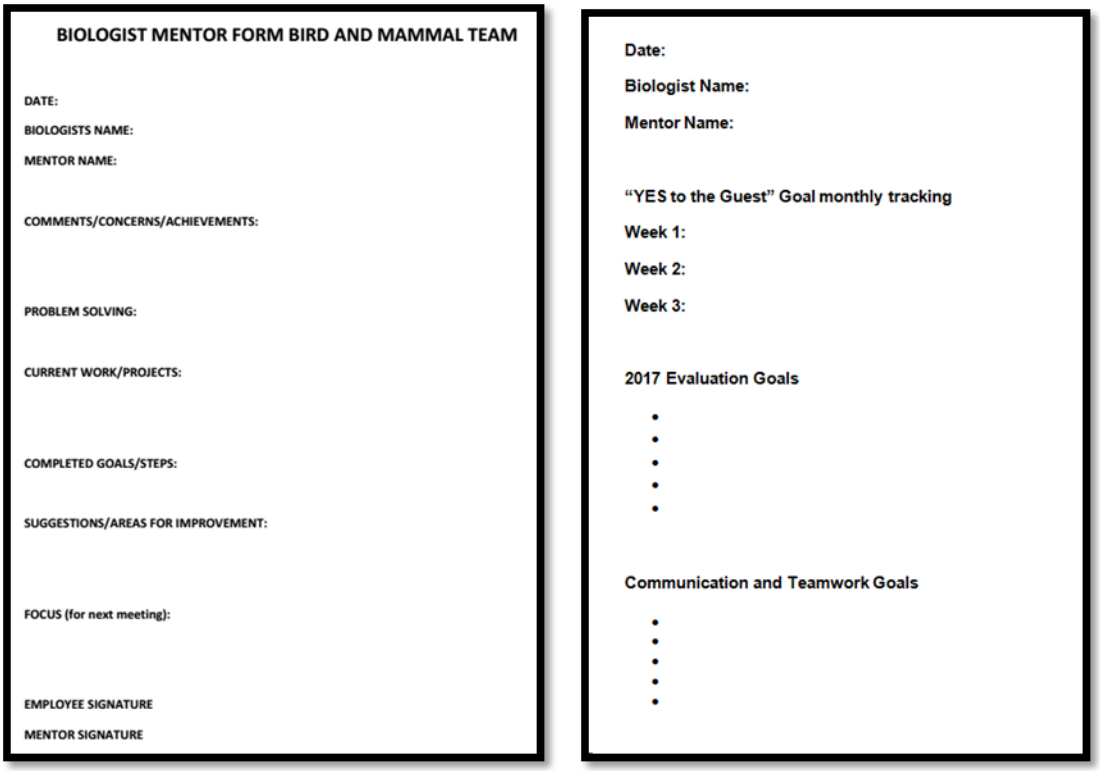
Instead of assigning scores the B&M team decided to focus more on relationship building and getting into the deeper conversations of communication. While we still tracked goal progress, we found it more useful to concentrate on effective communication both interpersonal and departmental.

The first year we started by having the curator mentor the senior biologists & supervisor, the supervisor mentor the biologist II's, and the seniors mentored the Bio I's and aides. (Fig. 3)



(Fig. 3. Mentor Assignments)

We met with our mentees on a monthly basis to discuss goals, projects and communication. This provided some structure to hold us all accountable to hold these meetings; otherwise our daily routine would get in the way. As we had more meetings it reinforced the need for better communication and how we needed to look at each individual to tailor our communication to fit their personalities. For example, one staff member might need a lot of detail when given a task, while the other person just needs the basics to be able to run with it. We were able to coach people through any issue that would prevent them from accomplishing goals. For example, the person that needs every little detail would end up not accomplishing a task because they were too nervous to make a mistake. We could coach this person through it to try to alleviate the anxiety of not doing something perfect the first time. Realizing that each staff member requires different approaches to communication and goal achievement was important in developing the program and improving our communication with the staff. Each form was different for each team of mentors (Fig.4).



BIOLOGIST MENTOR FORM BIRD AND MAMMAL TEAM

DATE:

BIOLOGISTS NAME:

MENTOR NAME:

COMMENTS/CONCERNS/ACHIEVEMENTS:

PROBLEM SOLVING:

CURRENT WORK/PROJECTS:

COMPLETED GOALS/STEPS:

SUGGESTIONS/AREAS FOR IMPROVEMENT:

FOCUS (for next meeting):

EMPLOYEE SIGNATURE

MENTOR SIGNATURE

Date:

Biologist Name:

Mentor Name:

"YES to the Guest" Goal monthly tracking

Week 1:

Week 2:

Week 3:

2017 Evaluation Goals

-
-
-
-
-

Communication and Teamwork Goals

-
-
-
-
-

(Fig.4. Individualized Coaching Form.)

We wanted to make sure each person was comfortable with their style of mentoring. It was important to bring the mentees into the process to not only help them but help the leaders. It was imperative that we made these meetings a safe space to speak openly and honestly about any issue.After each meeting the mentee kept their form and a copy was saved on the computer in a file that all leaders could access at any time. If there were any major team issues they were brought up at the weekly team leaders meeting. We would discuss how to deal with the issue, weather to have the staff speak to each other directly, or for us to step in and mediate.

The Evolution

As we continued the program it evolved to include the biologist II's as mentors. So now the structure changed. Now the Curator mentored the Supervisor, Supervisor mentored the seniors, seniors mentored the II's, and the Bio II's mentored the Bio I's and Aides (Fig. 3). This proved to be the best thing we did to the program. It allowed the Bio II's to have some added responsibility and to build their leadership skills. It also gave them some insight on what it's like to lead staff and work through problems.

We also included the grand mentors in meetings on a quarterly basis. The grand mentors are the seniors, the supervisor, and the curator, (Fig.3). By doing this, it created consistency in expectations from leader to leader. After one year of including the Bio II's as mentors, we switched their mentees. This caused quite a stir. We did not anticipate the intense bonds the mentor/mentee teams would create. I should have known this because I was a bit sad to lose the Bio II's when we made the first change. We felt it was very important to rotate mentor/mentee teams on a yearly basis to give each staff member an opportunity to get to know each other at that deeper level.

Results

Many positive things came from starting this program. By having so many meetings it forced the staff to get to know each other at a deeper level. It improved communication between staff members; they would be better informed as to changes in animal care or training progress with new staff. It kept the staff on track with training goals; we were able to accomplish complex behaviors, such as voluntary blood draw on one of our hippos. It helped the leaders become more informed of any issues and allowed us to react much quicker to resolve conflicts. It empowered the staff to think of solutions to interpersonal problems and implement solutions to resolve them much quicker and without the involvement of the supervisor or curator. End of year evaluations went much quicker and smoother; goals were discussed at the meetings so there were no surprises at the end of the year if they were not accomplished. Staff development was improved by providing them the opportunity to mentor their peers; they were able use their previous experiences to coach staff that may be new to the field.

Conclusion

We have found this program to be a complete success. We have never had a group of staff members that have been so cohesive, successful in accomplishing goals and moving the department forward. While it can be challenging to fit in all of the meetings, it is worth the extra effort. The key to the program is managers need to be fully committed to the program and give the staff the time to have meetings. We found the staff to be protective of the program and they do not want it to end…ever.

Realizing that taking care of the staff is just as important as the animals will result in better animal care and staff development.

Training an Amur Leopard in a Natural Prey Drag Behavior

Basia Dann
Cheyenne Mountain Zoo

Animal ambassadors at zoos are a key component of inspiring conservation action. Training natural behaviors as part of training demonstrations is a way that keepers and animal ambassadors can introduce guests to the amazing abilities of species that guests are unlikely to see in the wild. One of the most impressive behaviors leopards exhibit in the wild is dragging a heavy prey item to a safe spot for caching. This paper describes in detail the training of an Amur Leopard in a natural prey drag behavior. Keepers trained 0.1 Amur Leopard "Anya" to drag a firehose toy up the side of a mountain as a part of a natural behavior show. Leopards in general have been considered a species that is difficult to train due to their "high energy" and tendency toward "aggressive" behaviors. Throughout the training, keepers learned several valuable lessons illustrated in this paper. Keepers worked through many obstacles including the pairing of an inexperienced trainer with an inexperienced cat, learning how to encourage a cat to place a foreign object in their mouth, and learning how to get a super food motivated cat to walk away from where the food was. This behavior in completion has led to many valuable benefits including ease in training other behaviors, an expenditure of energy that reduces stereotypic behavior and the inspiration of countless guests to care about a highly endangered species. This behavior and the application of it as a conservation message is truly history in the making.

Introduction

Cheyenne Mountain Zoo's (CMZ) mission statement includes the effort to "connect people with wildlife and wild places through experiences that inspire action." As an institution, CMZ has worked hard to incorporate natural behavior shows that create those experiences that inspire action. Natural behavior shows give guests the opportunity to see an animal demonstrating its natural adaptations up close and personal and not on a television screen. These shows include behaviors like a gibbon brachiating across their exhibit, a grizzly bear getting in a good back scratch on a tree, and a mountain goat scaling the side of a building. Each of these shows is paired with a powerful conservation message, helped along by the awe inspired guests as they see animals do the things they were built for.

Amur Leopards (*panthera pardus orientalis*) are one of the most endangered species of cats. With an estimated 60 individuals surviving in the Russian far east, it is a species that is in desperate need of help. Zoos have been an integral part in the species' survival by participating in breeding programs through the SSP and by introducing guests across the globe to the magnificent animals. At CMZ, keepers in the Asian Highlands section aimed to create a natural behavior show to connect our guests to the rare leopard. In the creation of this show, keepers trained 0.1 Amur Leopard, "Anya", to drag a firehose toy up and through the exhibit as a demonstration of a leopard's natural strength and ability.

Leopards as a species have frequently been labeled as "aggressive" and "too high-energy". These labels can become self-fulfilling prophecies, creating unnecessary barriers to training such complex behaviors. Through the extensive training with Steve Martin (Founder of Natural Encounters Inc.) and Susan Friedman (Department of Psychology, Utah State University, Behavior-

works.org), Cheyenne Mountain Zoo has worked hard to shut down these labels. If keepers continued to believe these preconceived notions, the prey drag behavior would never have been a possibility. The benefits of the behavior were extensive as well. Keepers observed that after training the drag, many of the behaviors that garner the labels "aggressive" and "too high-energy" for leopards were no longer seen from Anya.

The training of this behavior turned in to a yearlong process in which a new trainer learned about the science of behavior. Trainer and leopard worked through many challenges such as finding the best motivation, building the proper antecedent environment, and adapting the behavior to best accomplish the goal of wowing guests at the show. Though it had its challenges, this behavior has led to many benefits and continue to impact the guests that visit the zoo, the trainer who taught the behavior, and the welfare of Anya.

What the behavior looks like

After several changes and adaptations for the most impressive behavior, the goal behavior looked like this:

A firehose toy hung from a snap shackle at the top of the exhibit would be released by a tug on a cable from a guest watching the show. The firehose toy would plummet into the exhibit in front of the glass. This would act as a S^D for the Amur leopard to come racing from the top of the exhibit down to grab the firehose toy and drag it back up the 6m (20ft) mountainside to the top of the exhibit (Fig. 8) where she would receive reinforcement.

Why this behavior?

When the concept of a natural behavior show featuring Amur Leopards was first discussed, keepers brainstormed what behaviors and abilities could best display the characteristics that make leopards unique. Over the years, the zoo had always done enrichment demonstrations with our Amur leopards but never a show with trained behaviors. In most enrichment demonstrations, items such as a cardboard box stuffed with meat or a phonebook soaked with goat's milk were huge hits. The leopards would often grab their enrichment from the front and drag it into their den space to munch away at it. This sparked the idea to show off a leopard's natural ability to drag their prey up into a tree for caching. This behavior is very rarely exhibited by any other big cat. Therefore, it displayed something that was entirely unique about leopard behavior.

Although this behavior is impressive in its own right, it is a goal of CMZ keepers to create what we call "defining moments". These are simple, quick interactions that directly connect guests to our animals. These can be moments like holding up a target stick for an animal during a training session, or even just spending a few seconds checking out a moose antler. We have found that if we can incorporate these moments of direct interaction into our shows, it increases the impact. Thus, the idea was formed that a guest would be the one to cue the behavior by dropping a prey item into the exhibit via a wire attached to a snap-shackle holding up the item. The zoo has worked closely with Steve Martin of Natural Behaviors Inc. and he always recommends to start big and end bigger, and this behavior would definitely prove to be big.

Why this cat?

Amur Leopard, Anya was chosen to learn the prey drag behavior due to her energy level and to wear her out a little. At the time, Anya was 2 years old and was fairly new to Cheyenne Mountain Zoo. In her time at the zoo, Anya had exhibited several different high-energy behaviors. She was known for jumping off the adjacent walls of her den repeatedly when a keeper would approach and do high energy, tight pacing, near the end of the day when it came time to shift inside. Anya did not have a prior formal history of

positive reinforcement training before she started learning this behavior. She came with unique challenges for a high value positive reinforcer as she only liked her regular diet meat and chicken.

As new to training as Anya was, the primary trainer on the behavior was also fairly new to positive reinforcement training. This was the first chained behavior that this trainer had ever attempted to train. The benefit of working at Cheyenne Mountain Zoo was the limitless support in the form of training mentors and managers that helped by watching training sessions and talking down the behavior afterwards.

What is our set up?

The training took place in four different settings.

Training began in an off-exhibit den space inside the leopard building (Fig. 1). This space had many advantages. It was quiet, with fewer distractions than the outdoor yard, it had a bench that Anya would often spend time on, a feed chute for quick delivery of reinforcers, and multiple adjacent spaces to easily shift the leopard to other areas to reset the environment. The goal in this space was to place the prey item in front of the training door so Anya would drag it up onto the bench at the back of the den.

The second space that training took place was at the training door in the exhibit yard (Fig.2). This exhibit includes a den built into the terrain that Anya could pull the prey item into. This was also a good spot for guests to witness the behavior as the den space is very visible through the guest viewing glass. The goal initially was to place the prey item in front of the window and have the leopard drag the prey in front of the window into the den off to the side, a distance of about 3 m (9 ft).

The hallway transfer chute was the next place utilized for training (Fig. 3). Here, Anya would be able to pick up the firehose from one end and practice dragging it the length of the hallway. This setup allowed for one keeper to be at one end of the hallway and another keeper to be at the other end. One keeper would cue the behavior while the other keeper would reinforce when Anya reached their position.

The final training space was the north side of the exhibit yard (Fig. 4). The keeper who would cue and reinforce the behavior sat at the training door at the top of the exhibit. Another keeper could be added as a prompt along the flexi-mesh just down the hill from the primary trainer. The snap-shackle that would drop the prey into the exhibit was positioned at the south end of the viewing windows. The release cable ran through the top of the mesh onto the public side where a guest could release the prey.

The prey item took many forms over the course of the training. At first it started out as a small, .9 kg (2 lb) woven firehose chain (Fig 5). At one point, we added on a smaller width of firehose to the top with a knot in it (Fig. 6). The final result was a 9kg (20 lb) firehose chain toy (Fig. 7)

Biggest Challenges- Challenge 1

A unique challenge that keepers encountered right off the bat was trying to figure out how to encourage Anya to place a foreign object in her mouth. Keepers started out by trying to train approximations of picking up the firehose toy. Keepers would bridge and reinforce when she looked at the toy and then when she would interact with the toy by putting her face up to it or sniffing it. After several weeks, keepers were getting nowhere. No matter what, Anya would not put her mouth on the firehose toy. Even when meat was put on the toy, she would just lick it off and then abandon the toy. So the question remained: how to encourage Anya to pick up the toy in the first place. In Anya's time at the zoo, keepers had only ever observed her pick up objects like cardboard or paper

enrichment that she could tear up. It was clear that keepers needed to establish some reinforcement history of picking up things that weren't food or something to shred.

Next came the brainstorming process of what antecedents would best set Anya up for success. Antecedents are the stimuli, events and conditions that precede a behavior and set the occasion for the behavior to occur (Friedman, 2009). In thinking about proper antecedent arrangement, keepers thought about what antecedents were present in the environment when Anya chose to display the caching behavior. In the past, keepers had seen Anya pick up her bones on weekly bone day and carry them up to the bench in her den to chew on them. A plan followed in which a completely cleaned off bone would get firehose wrapped around it and dropped down the feed chute. Unfortunately, this set up proved too difficult to gather the proper materials. The next idea stemmed from another item that keepers often saw Anya cache: meat cannoli's (cardboard tubes with meat stuffed inside).The new plan was to wrap pvc tubes in cardboard tubes and drop them down the feed chute to encourage the caching behavior. Eventually, keepers would remove the cardboard tubes and wrap firehose around the pvc piece. Unfortunately, this approach garnered no results. Anya would just rip the cardboard off the pvc and then disengage.

Solution to Challenge 1

Just as there were no other options, the answer came to us. Upon spending some time with Anya tong feeding her, keepers had an epiphany. No matter if it was food or cardboard or something else entirely being offered through the mesh with tongs, Anya would immediately put it in her mouth. This made sense because her history with tongs coming through the mesh was typically when the tongs had meat on the end of them. What if we handed the firehose toy to her through the mesh using tongs? This turned out to be the winning approach. When keepers handed the toy to Anya through the mesh using tongs, she immediately bit down on the fire-hose.

We also wanted to create the dragging behavior that would be the end product. We took the firehose toy and connected a long, unwoven, thinner piece of firehose to the toy. Keepers then started anew. Approximations were as follows:

Keeper hands firehose to Anya and when she bites down, keeper reinforces.
Keeper hands firehose to Anya and when she bites down and pulls back, keeper reinforces.
Keeper hands firehose to Anya and when she pulls firehose tight against the mesh, keeper reinforces.
Firehose toy is placed in exhibit, keepers use tongs through the mesh to hand firehose to Anya. When she bites it, keeper bridges and reinforces.
Firehose toy is loose in exhibit, keepers bridge and reinforce when Anya picks it up

Finally, after placing the firehose in the den and giving Anya access to it, Anya picked up the toy and pulled it up onto the bench in the den.

Biggest Challenges- Challenge 2

The next step in our process was to generalize the behavior to the outdoor exhibit. This space offered a different set up with unique challenges. The training space for the yard near the den was very small (Fig.2) and where Anya would drag her prey was not easily seen by guests on the other side of the glass. Therefore, in order to give the guests a better view of the behavior, keepers decided to place the firehose toy further out in the exhibit, in front of the window.

The decision to place the firehose toy in front of the window presented several issues. First, the firehose toy's location was behind Anya and thus out of sight when the she was watching the trainer for the cue. Because the trainer and the bucket of food were in front of her, we had difficulty getting her to turn around and notice the toy. We found that this was caused by two things. First, Anya's interactions with keepers had switched over to being almost solely in training sessions for this behavior. Thus, Anya was incredibly excited to see keepers. This looked like unwavering eye contact, tight pacing in front of keepers, and leaping against walls or other surfaces when keepers made even the slightest movement. Also, because Anya recognized the training bucket, she would often stare at the training bucket and not engage enough for keepers to give a visual cue. Keepers finally worked through this by waiting out the pacing, but the amount of time it took proved too long to incorporate the behavior into the show. Keepers also worried that instead of just reinforcing the behavior, they were also accidentally reinforcing the long period of tight pacing before the behavior.

Solution to Challenge 2

A new plan for the behavior was created. This new plan not only made the behavior more easily seen by guests, but it also made it easier for keepers to prompt Anya to walk away from where the food was. This new plan added a new element to the behavior as well: a climb up the side of the mountain, instead of just a leap into a den. The new goal was that keepers would place the firehose toy down at the front of the exhibit and Anya would run out to grab it and haul it back up the mountainside to keepers.

Keepers started anew in the shift hallway. This allowed for one keeper to sit at one end of the hallway near where the firehose was placed to cue the behavior and another keeper at the other end of the hallway to reinforce once Anya had dragged the firehose the length of the hallway. The next step was to increase the distance that Anya would drag the toy. Because the hallway connected to the yard, keepers gradually decreased the amount of hallway Anya would need to walk through and increased the amount of yard ground she would need to cover. The approximations were as follows:

Keepers place firehose on upper outdoor veranda, cue behavior, Anya drags firehose to other keeper further in hallway and is reinforced.

Keepers place firehose on lower outdoor veranda, Anya drags firehose to next keeper and is reinforced.

Keepers place firehose further into yard next to where a keeper can stand, Anya drags firehose to keeper at top of exhibit and is reinforced.

We knew that at some point we would need Anya to walk past the keeper and go grab the firehose toy from in front of the window. It became necessary for us to fade out the middle keeper. These were the approximations for fading out the middle keeper:

Keeper at top of exhibit cues behavior, Anya runs down to other keeper who calls out to her as a prompt, gets a small meatball reinforcer and is cued again. She then runs away from keeper to pre-baited (i.e. diet meatball or chunk of chicken) firehose and then drags firehose up to keeper at top of exhibit for higher value and magnitude reinforcer.

Keeper at top of exhibit cues behavior, Anya runs down to other keeper and is cued again. She then runs away from keeper to pre-baited firehose and then drags firehose up to keeper at top of exhibit for higher value and magnitude reinforcer.

Keeper at top of exhibit cues behavior, Anya runs down to pre-baited spot where second keeper had previously stood. Then Anya runs to pre-baited firehose and then drags firehose up to keeper at top of exhibit for higher value and magnitude reinforcer.

Fade out two baits.

This approach combined two different methods of training a behavior, shaping and chaining. Chaining was used initially. Keepers chained together the A-to-B behavior of Anya running from one keeper to another with the behavior of picking up the firehose toy and with the behavior of climbing back up to the top of the exhibit. In earlier stages, the chaining of picking up the toy and carrying it to a keeper's location had already been completed and the prompts had been faded out. Keepers were thus able to add on a new element to the chain and quickly fade out the prompts. Shaping a longer drag, once the chain had been completed, was helpful for a number of reasons. Shaping is defined as "the procedure of reinforcing a graduated sequence of subtle changes toward the final behavior, starting with the closest response the bird already does" (Friedman, 2006). Anya was building history bringing the firehose toy to the keeper at the top of the exhibit (the closest response) and the firehose was being moved further away from that keeper and thus closer to the final behavior.

Biggest Challenges- Challenge 3

In positive reinforcement training, there are several ways that you can vary the reinforcer in order to increase the value of the reinforcer. Steve Martin (2015) details how "warming a peanut may increase the effectiveness of the reinforcer for some parrots, and feeding a frozen peanut may decrease the effectiveness of the reinforcer for some parrots". This modification of the primary reinforcer would prove to be the turning point for reinforcing the behavior. Martin (2015) also talks about how "animals build skill and behavioral fluency through practice. Some behaviors require more effort than others and are therefore more difficult for the animal to learn and perform". It was clear through Anya's behavior that dragging the firehose toy up the mountain was a difficult behavior to perform. Even after dragging the toy a short distance, Anya's breathing would become heavier. She would pant, open mouthed and be less willing to do other behaviors after completing the drag. She would often wander off to a water dish or a shady area in the exhibit to rest in the middle of the behavior or after just one repetition. We were at a full stop. Keepers had placed the firehose toy on a rock just halfway down the mountain and Anya just wouldn't drag the toy from any further distance.

In the wild, when a leopard drags a prey item twice their weight up a tree, the reinforcer for that behavior is that the leopard then gets to gorge itself on that prey item. We were offering Anya only the portion of diet meat we had set aside for the training session and we were asking her to do multiple repetitions with this available meat. In effect, she was dragging this heavy prey item up the side of the hill for less than 0.9 kg (2 lbs) of food for each repetition. We needed to make sure that the outcome was worth the effort.

Solution to Challenge 3

The first change made was to only ask for the behavior once or twice a day. This meant that only one session a day and sometimes only one repetition occurred. Initially, this helped. The behavior required so much energy that when one repetition was completed it often wasn't worth it for Anya to take on the next approximation.

Finding the right reinforcer for the job proved to be a challenge. Anya is unique and represents the concept of "the study of one" (Friedman, 2018) in that she rejected most of our ideas for higher value reinforcers. Anya rejected pork, steak, fish, goat's milk, and whipped cream. We decided to try to vary the magnitude of the reinforcer and would deliver her entire diet, 1.13kg (2.5lbs) upon completion of the behavior. However, Anya would still not drag the toy any further. Jeremy Dillon, Cheyenne Mountain Zoo's Animal Behavior Manager, came up with the winning suggestion. Dillon noted that when we were delivering the reinforcer to Anya in the form of her diet, not only was the meat something that she would get regardless of whether she completed the behavior, but it was delivered too slowly. We settled on delivering an entire half of a chicken to Anya upon completion. In the event that we did not have half of a chicken, she would receive several frozen chicken breasts. When Anya was dragging the toy up the hill, a second keeper would pre-load the chicken in the shift hallway so that when she completed the behavior, the door

to the hallway would open and a giant pile of chicken would be waiting. After this epiphany, the following approximations moved along quickly. Anya would go closer and closer towards the window and the snap/shackle to pick up the toy until we had a complete behavior in just four short sessions.

Incorporating guests

Once the behavior was solid, it was time to start adding in the guest component. Cheyenne Mountain Zoo's Vision states "Every Kid. Every Time. Goosebumps! Every kid, of any age, will have an experience for a lifetime with every visit". The goal of this behavior had been to add in guest interaction. One lucky guest would be chosen from the audience to tug on the snap-shackle wire and release the prey item for Anya to run down and drag up the hill. Steve Martin (2012) talks about his intention when putting on shows by saying "Rather than impart knowledge, my goals are now to inspire caring and conservation action. What the audience members know about Red-tailed Hawks is less important to me than how they feel about Red-tailed Hawks". This behavior allowed for us to both impart knowledge and inspire awe in our guests. When guests got to trigger the full drag behavior, they often walked away with goosebumps, amazed by Anya's natural ability.

The final approximation to incorporate guests was fairly easy. Keeper at the top of the exhibit would cue the behavior, guest at the front of exhibit would be invited to drop the toy into the yard, Anya would grab the toy and drag it to the top for a reinforcer.

Benefits of the Behavior

Apart from inspiring guests into conservation action, this behavior had numerous far-reaching benefits. Steve Martin talks a lot about improving animal welfare through training. He says that through training "we create an environment where captive animals have opportunities to experience choices, make decisions, and experience the consequence of their actions" (Martin, 1997). This behavior gave Anya the opportunity to "earn" a living, as Martin puts it, in a very similar way that leopards work hard to survive in the wild. It allowed for Anya to make the same choices and decisions that a wild leopard would be making.

The biggest benefit of this behavior was that keepers saw a decrease in the stereotypic behavior of pacing at the top of the exhibit. After the energy expenditure of completing this behavior, Anya would often go find a perch out in the yard and rest there for the rest of the day. This not only looked better for guest perception, but it also made shifting inside at night easier for keepers, as Anya often didn't have the energy to do the tight pacing she normally did at shifting time.

Another benefit was that Anya started utilizing more of the exhibit. While learning the behavior, Anya decided that on her approach to the firehose toy, she would stop at several places in the exhibit and scent mark. This was initially infuriating but keepers realized that they should be embracing the behavior. Asking Anya to drag the firehose up the hill was increasing more than one single natural behavior to interpret for guests. It was encouraging her to interact with her yard in many ways. The drag behavior also encouraged Anya to spend more time at the front of her exhibit. Whenever keepers walk by the exhibit, Anya hides around the corner by the window and then springs out to follow keepers toward the release site for the firehose. Whether this new behavior is due to the history with the drag behavior or the relationship built with keepers through training, is tough to tell, but she uses the front of the exhibit more often, creating opportunities for even more guests to see her up close and personal.

Finally, through the trusting relationship built between keeper and animal, new behaviors were learned much more quickly. Steve Martin (2016) predicts this by saying "Animals once labeled 'slow, obstinate, aggressive, un-trainable' and more, now respond quickly to cues presented by trainers who have changed their behavior and maybe their lives through clear communication, antecedent arrangement and reinforcing consequences". Anya is now trained for a "calm" behavior where she holds still in front of a keeper, an injection behavior, an open-mouth behavior, an "up" behavior, and is working on voluntary blood draw. With a history of positive reinforcement through the drag behavior, these new behaviors came quickly and smoothly, benefitting both keepers and Anya.

Conclusion

Amur Leopards are often given the labels "aggressive" and "too-high energy" and complex training is often avoided. Through training this behavior, both the lives of keepers and the life of 0.1 leopard "Anya" were improved. The behavior helped to decrease other behaviors that give leopards these labels. Keepers were also able to inspire countless guests by creating a special interaction with a leopard. Both the trainer and the leopard were enriched by giving valuable opportunities to problem-solve together and a trusting relationship between the two brought about ease in training new behaviors. So, the question is, what behavior can you train that will shut down labels and enrich the lives of the animals in your care? The possibilities are endless.

References

Cheyenne Mountain Zoo (2018). Mission & Vision. Retrieved 10 March 2018, from http://www.cmzoo.org/index.php/about-the-zoo/zoo-facts/mission-vision/

Friedman, S. G. (2009). *Behavior Fundamentals: Filling the Behavior-Change Toolbox*. Journal of Applied Companion Animal Behavior, 3(1), 36-40.

Friedman, S. G. (n.d.). *Shaping New Behaviors*. In Http://www.behaviorworks.org/files/articles/Shaping New Behaviors.pdf. (Good Bird ™ Magazine, 2-1, (2006), 16-18).

Martin, S. (2012). Connecting With Our Audience. Retrieved from http://naturalencounters.com/site/wp-content/uploads/2015/11/ConnectingWithOurAudience.pdf

Martin, S. (2016). *Improving Animal Welfare Through Training*. Retrieved from http://naturalencounters.com/resources/papers-and-presentations/

Martin, S. (1997). *Training: A Critical Component Of Enrichment Programs*. Retrieved from http://naturalencounters.com/site/wp-content/uploads/2015/11/Training_A_Critical_Component_of_Enrichment_Program-Steve_Martin.pdf

Martin, S. (2015). *What's The Motivation*? Retrieved from http://naturalencounters.com/site/wp-content/uploads/2015/11/WhatsTheMotivation.pdf

Building a New Culture by Approximations: Innovative Training Concepts for Zoo Knoxville's Elephants

Rebecca Wyatt

Elephant Lead Keeper

Zoo Knoxville

Zoo Knoxville's elephant care team redefined its behavior management program and is reshaping the culture in which the caregivers and elephants work together. The focus of the behavior program has shifted from a goal orientation to a process orientation. This has enabled caregivers to better customize behavior programs for each individual elephant. The "study of one" philosophy (Friedman & Haug, 2010) allows for innovative approaches, such as two-way communication between trainer and elephant, elephant choice in how the training progresses, and individual trainer responses tailored to the unique needs of each elephant. Utilization of these strategies has increased trust between the elephant and trainer, which has improved the trainer's ability to work on the more vulnerable husbandry behaviors. These behaviors include blood draw, radiographs and ultrasounds. The shift in culture has also generated a more confident elephant team. As a result, the wellness of the elephants has improved markedly. A basic tenet of Zoo Knoxville's mission is to help draw the connection between animals and guests in order to promote a stronger commitment to conservation. This connection is accomplished when zoo guests can observe elephants eagerly participating in training sessions. Beyond encouraging a sense of wonder in the guests, the positive relationship between trainer and elephant allows guests to experience physiologically, emotionally and behaviorally healthy elephants. This can inspire guests to further support zoos and the conservation initiatives they support.

Introduction

At Zoo Knoxville's elephant program, we have worked to develop a culture with the elephants that gives the elephant as much control as possible by providing as many choices as possible throughout each day. The mindset has shifted from doing things *to* the elephant to working *with* the elephant (Roocroft, n.d.). Training has become a conversation between caregiver and elephant where one side is not dominant over the other but both species work cooperatively. Trust from the elephants is demonstrated by decreased aggression and allowing all of the elephant care team work with them as both a trainer and a technician. The trust that has been created through these actions has manifested itself into completing large husbandry milestones and a more peaceful barn atmosphere.

This culture shift did not happen overnight. It began with making every experience in the elephant's day a positive one, as well as maximizing their choice in a 24-hour period. A more positive atmosphere has been accomplished by decreasing the elephants' dependence on the caregivers. This allows more self-determination in their day. The elephant care team has accomplished this by providing more complex, time-consuming feeding strategies, altering the habitat features weekly, offering as much space as possible at all times, and ensuring a peaceful night's rest. The elephants' rest is maximized through carefully built sand mounds in several habitat and barn locations and strategically timed feedings to not interrupt peak sleeping times.

Similar efforts have been applied in our training procedures. Examples of this include the following: setting up clear antecedents that communicate to the elephant which training objective is occurring, only training with positive experiences and high rate of reinforcement and allowing self-determination throughout the session. Antecedent arrangement prior to training involves laying out all of the required materials for the session so the elephant can associate the materials with the type of husbandry. Location in the barn also plays a big role in helping the elephant understand in which type of session they are going to participate.

In addition, elephant staff has shifted to process-oriented training. Focusing on the process, instead of the end result, establishes a dialogue between trainer and elephant helping each other reach each new approximation. It also creates more patience in both the elephant and trainer to achieve these small approximations with big reinforcers. Over the course of several years, the elephant care team discovered the elephants want to stay in the session longer because frustration is reduced, and they are eager to achieve the next approximation. Through these simple steps, our training has reached a breakthrough to a high level of cooperation.

Two-Way Communication

The goal for each session is to create clear lines of communication. Each session begins with setting specific antecedents to indicate to the elephant that it is time to participate in the session. In each case, the antecedents become familiar and immediately inform the elephant about the behavior they will be working on before training begins. At this point, the elephant has the choice to come over and engage in the session. Often, the elephants will position themselves for the session without being cued. The trainer utilizes feedback from the elephant to ensure it has mastered the previous approximations. This is the type of dialogue that is strived for in each training session before starting on the next step and gives the elephant team confidence in each training task.

Each behavior looks different for each elephant which gives the trainer an opportunity to tailor each session to that elephant based on their comfort and confidence. For example, the bull elephant prefers to firmly place his foot in a ready position to receive his leg tether while one of our cows will rest her trunk calmly on the ground indicating she is ready to receive the tether. In most instances, modifications are made in training plans to work with the physical and emotional needs of each elephant.

A "trunk target" behavior has been implemented for several of the more advanced husbandry procedures. The trunk target behavior requires the elephant to hold a target in the tip of its trunk while resting the trunk on the ground. The purpose of the trunk target is twofold. First, it is an incompatible behavior that adds a measure of safety to a procedure while a technician approaches the body or head of an elephant. Second, the elephant care team has instituted the trunk target behavior as a direct line of communication for their comfort level and readiness for the next step in lengthy husbandry procedures. It is policy to wait for the elephants to cue their readiness for each step before progressing to the next step. This policy has strengthened the bonds of trust between trainer and elephant because the elephant will not be surprised by an approximation. This also gives the elephant total control over participation in the session.

Learning to Listen

Implementing the innovations has been a growing process for the elephant care team. They have learned the traditional philosophy of training where the trainer provides a cue and animal responds; however, without the appropriate counter-response, elephants could be placed in a time-out, become frustrated, abandon the session, and make little progress on the new, desired behavior. These results are all correlated with low rate of reinforcement and lack of communication. The culture that has been developed has required honing our observation skills. Recognizing the subtle readiness cues is imperative in understanding the comfort level of the elephant. Success is not determined by completion of the behavior, but the level of engagement in each session from the elephant and the positive progress made in any given repetition. Working with that understanding reduces the pressure on the elephant as well as the trainer – ultimately creating a more relaxing, productive atmosphere.

With the new processes in place, the elephant care team has had to become disciplined in "listening" to the elephant and not push beyond the animals' pace. The elephants have learned that trainers will "listen" to them. For example, if they choose to leave a session, the trainer will not force them to return. The trainer will also allow them to complete more repetitions at a lower approximation, as necessary, to improve the elephant's confidence at each step.

An excellent example of this involved one of the zoo's cows who kicked out during a rear leg blood draw. The trunk target behavior had been established to allow her to communicate to the trainer when she was ready, or not ready, for the procedure. She removed her trunk from the target several times but continued to place her trunk back to the target, signaling the trainer to continue. She placed her trunk nervously in her mouth then returned to the trunk target. She was attempting to communicate that she was not ready but was trying to work through the session. As trainers continued the procedure, she kicked out at the technician slightly, just enough to convey a message. The elephant care team reinforced the policy that if her trunk comes off the target, the next step will not happen in any circumstance. This restored control and safer lines of communication in her training sessions.

Conservation

The elephant training program at Zoo Knoxville may not directly impact conservation of elephants, but indirectly demonstrates important concepts to the nearly 500,000 visitors that pass through the Zoo's gates. The training philosophies that have been implemented allow visitors to see elephants engaging is species-specific behavior. This can occur through formal training

sessions where a trainer is present and can help visitors experience the behaviors of an elephant. It can also occur by providing self-learning opportunities for the elephant in the habitats, because they have been taught *how* to learn through the training program. Ideally, there would not be a need for elephants in human care; however, since they are, it is the responsibility of the elephant care team to help guests see physically and emotionally healthy elephants, which the training program greatly enhances. Guests who experience elephants in a positive way may be more inclined to make a personal connection with them and be more proactive in their efforts to help protect them in the wild.

References

A. Roocroft, personal communication, n.d.

Friedman, S.G. & Haug, L. (2010). From parrots to pigs to pythons: Principles and procedures of learning. In V.V. Tynes (Ed.), *Behavior of Exotic Pets* (pp. 191-205). Ames, IA, Wiley-Blackwell.

Growing Up Otter

Briana Cooper

Downtown Aquarium Denver

The Downtown Aquarium in Denver, Colorado acquired three female North American river otter pups. Due to their backgrounds, staff chose to train them as ambassador animals. This paper will discuss the various types of training sessions the otters participate in on a daily basis, including: off leash free contact in an enclosed space, off leash free contact in a semi-enclosed space, on leash walks in public and enclosed spaces, and one on one guest interactions (a.k.a. meet and greets). Training North American river otters as ambassador animals pose numerous challenges. The staff devised techniques for managing aggression, reducing competing reinforcers, guest safety, and keeping active otters stimulated. Some of the tactics used were the introduction of novel items, eliminating end of session predictors, training an end of session option, a priority of animal choice, environmental changes, and team meetings to promote trainer consistency. Today all three otters are participating in these sessions as ambassador animals. As they approach adulthood their social structure may change and their daily routines may be altered by moving them permanently to the exhibit, but the staff is ready to meet these challenges. These techniques and tactics were extended to other ambassador animals, so although this paper specifically discusses North American river otters, the concepts can be extrapolated to other species.

Introduction

The Downtown Aquarium Denver had an opportunity to raise, train, and present three female North American river otters as ambassador animals; a unique situation that most institutions have not attempted before. River otters are typically trained in protected contact situations; if free contact was desired, the recommendation was that only males should be used in this situation (AZA, 2009). With the arrival of three female pups in 2016, the Downtown Aquarium chose to try something new in the field. The first pup (Olive) arrived from Florida after being deemed unfit for release due to being imprinted on humans. The other two pups (Olivia and Emilia) were found orphaned in Alaska. They arrived with metabolic bone disease after a period of malnourishment. Both were underweight and very food aggressive. After four months of veterinary care and introductions the trio were housed together permanently. As the otters learned new behaviors, underwent training sessions, and familiarized themselves with the presentation areas, they exhibited challenging behaviors.

Aggression was the most common challenge trainers encountered. According to Konrad Lorenz, aggression is a normal behavior all animals exhibit to help them cope with their environment (Turner and Tompkins, 1990). This behavior, however, was one that trainers could not allow to be exhibited due to safety. The innate curiosity exhibited in the species, effective for animals that naturally hunt and socialize over large ranges, lead to lack of focus and motivation in the captive otters (Reed-Smith, 2008). Since trainers had no control over their natural history and fundamental behaviors, they had to create solutions that were in their repertoire of behavior management. These included changing the otter's daily routines, the introduction of reinforcement variety, and giving the otter's choice and control. The staff also had to challenge themselves to

become better trainers.

Training Session types

The otters have been trained to participate in four types of training sessions: off leash free contact in an enclosed space, off leash free contact in a semi-enclosed space, on leash walks in public and enclosed spaces, and one on one guest interactions, also known as "meet and greets" at the facility. The session types are both location and behavior specific.

Seven areas around the aquarium work as an off leash free contact session in an enclosed space. Each location is behind the scenes so the trainers can limit the number of individuals moving through the space. They are all used as spaces for training and socialization, with or without trainers present. As a result, they are typically the places where new behaviors are trained and new trainers begin interactions with the animals. Behaviors trained in these areas are defined as "basic". (Table 1).

Table

Basic Behaviors		
Behavior	*Criteria*	*Applicable Animal*
Calm Station	Watching trainer, focused, all paws on ground	All
Shape	Touch applicable shape with nose	All
Target	Touch target pole with nose	All
Finger Targets	Touch trainer's extended fingers with nose	All
Turns	Turns in direction indicated by cue	All
Rolls	Rolls in direction indicated by cue	All
Weave	Walks between trainers legs as they move	Olivia, Emilia
Throughs	Walk between trainer's legs	Olivia, Emilia
Point Follow	Follows trainer in indicated direction	All
Bang	Rolls onto back with entire abdomen exposed	All
Up	Stands on back legs	Olivia, Olive
Mark	Stands on elevated platform, holds until released	All
Crate	Goes into crate, turns around and allows trainer to close door	All

"Basic" as used here, refers to behaviors that are routine, have an established history of reinforcement, and are executed reliably by the animals.

The off leash, free contact in a semi-enclosed space is only available at one location in the aquarium and only two of the otters (Emilia and Olivia) participate in training sessions at this location. This semi-enclosed space is referred to as the "Gallery Entrance" and can be accessed in two ways: either from the exhibit pathway through a set of doors or from a set of stairs (Figure 1). When otters are brought to this area, a 2.5 foot tall barrier that spans the doors is placed in the doorframe to block the public from the otters, and also to inhibit the otters from getting out into the public space. Olivia and Emilia are the only two otters used in this setting because they could not physically go down the set of stairs for the first several months of their time at the aquarium due to their medical complications. They are also more reliable under stimulus control than Olive. When in the Gallery Entrance the two otters are asked to do their "basic" behaviors, with the exception of asking them to target to a pole held by a guest from the other side of the barrier, rather than from a trainer. The otters are only trained in this area

when:

They are food motivated.

There is a lower density of guests in the building.

There are enough staff. One to train, one to speak to the public, and another to prevent guests from coming up the stairs.

Under these conditions the trainers can confidently train in this space.

Leashed walks in the public and in enclosed spaces can be done throughout the entire aquarium, the surrounding grounds or even in off-site locations (Figure 2). Olive is the only otter that trains with on-leash walks, Olivia and Emilia are still being trained to wear a harness. Otters lack a clavicle bone, and therefore have extremely mobile forelimbs (Reed-Smith, 2008). This adaptation allows them to easily slip out of a harness; therefore, trainers have to be completely confident in Olive's recall and focus before they venture into an open space.

The harness behavior of each otter has evolved over the course of the training. After testing several harness types and methods of securing them, trainers selected a top clip harness and a block for her front legs to help elevate her body while being fitted (Figure 3). Currently, Olive positions herself on the block and targets her nose to the trainer's knee while the harness is clipped. Since her body condition and weight fluctuates with seasonal changes, there are times when the harness fits tighter in certain areas, which makes it difficult for trainers to clip the harness.

One-on-one guest interactions, also known as "meet and greets", are another way in which the otters appear as ambassador animals. This encounter is always in an enclosed space that the otters regularly frequent for their off-leash free contact and socialization sessions. The aquarium guests are seated on chairs in a row on one side of a room and the otters are brought out individually. Each otter can do any combination of the following: "basics", guest targets (guest holds the target pole out in front of them and the otter is sent to them) (Figure 4), photos in front of guests (otter stands on a block/mark in front of the guest and is asked to hold until released by terminal "ok" cue) (Figure 5), and posed photos for the guests (otter stands on block/mark away from the guest and is asked to hold until release cue).

Challenges

The otters provided numerous challenges throughout the training process for each of these interactions. Aggression was the most serious challenge presented. As discussed before, Konrad Lorenz explains that aggression is a natural behavior exhibited in all animals as a form of communication whether it is out of fear, in play, or for control (Zeligs, 2014). River otters, like all social animals use aggression (specifically biting) as a way to communicate to one another, and in some cases their trainers.

On leashed walks, trainers observed Olive's aggression when her proximal space was infringed (e.g. her trainer cut in front of her path) or if the trainer was forced into close proximity to her through doorways and narrowed spaces. Crowds and loud spaces were often associated with these aggressive acts.

Olive's aggression was not limited to leashed walks. She also exhibited aggression in all off-leash training sessions at various points. Standing in front of spaces with the highest reinforcement history elicited aggression (e.g. standing in front of her crate). These behaviors occurred while learning new behaviors as well. For example, as Olive was being trained to "spin", she would stand up on her hind legs and turn clockwise while remaining in the standing position. In order to shape the new behavior, a target pole was utilized to encourage her to move her body in a circle while standing. The trainer in one particular spin session re-cued the high target and Olive bit her on the hand holding the target pole. Aggression was exhibited if the

trainer gave her signals that the training session was going to end. For example, Olive was known to aggress when trainers gave her the cue to return to her enclosure or to go into her crate; these cues indicated that her session was going to end and that her time in the training space was over. Olive's aggression also occurred when one trainer attempted to crate all three otters at once.

Olivia and Emilia also displayed aggressive behaviors; however, those occurrences were more predictable. During their first year at the aquarium, the two otters would behave aggressively in the presence of food due to the malnutrition they experienced before their arrival at the aquarium. This most often occurred during crating.

Trainers were presented with more challenges than just aggression. Keeping the otters focused on the task at hand proved to be extremely challenging. Natural curiosity in North American river otters can be attributed to the hunting techniques employed in their natural habitats. Their natural curiosity led them to want to explore every space in which they were trained, and the explorations often provided them with more reinforcing items than what was offered in the training session. Whether it was a plastic outlet cover, a dripping faucet, a rusty pipe, or even a guest's bare toes the otters found ways to satiate their curiosity.

The crate behavior was, and still is, the most important behavior the otters know, but it has historically been the most inconsistent. Failing to crate was typically the first indicator that the training session was going to go poorly. The breakdown of the behavior has been exhibited in multiple forms: refusal to put their entire bodies in, going in but coming back out when the door was touched, or going in and pushing back out after reinforcement was delivered.

Solutions

The challenges discussed above provided the training staff with opportunities to develop new techniques for handling each situation. Trainers first worked to determine the source of the complications. Aggression, as discussed before, is a natural behavior exhibited by all animals and cannot be eliminated. It can, however, be predicted, controlled, and reduced through proper training (Turner and Tompkins, 1990). According to Jenifer Zelig, when there is a lack of choice and control frustration can build up and lead to aggression, because it is one of the few options available in the animal's behavioral repertoire (Zelig, 2014). Trainers observed that Olive displayed behaviors referred to as "avoidance behaviors" such as grooming, leaving the session for a more reinforcing behavior (most often swimming), exploring the area, offering a behavior with a stronger reinforcement history, nosing boots, and refusing a behavior multiple times. It was when trainers reacted adversely to these behaviors that frustration ensued. Once the precursors of aggression were established trainers had to pinpoint an exact source. After reviewing sessions and records the most common occurrences prior to these events were: a lack of choice and control, a lack of sufficient reinforcement history, a poorly executed Least Reinforcing Scenario (LRS), a lack of clear communication, a lack of variety in a session or behavioral momentum, or lack of space.

Frustration did not always lead to aggression; it could be attributed to behavior breakdown, lack of focus in sessions, and be the cause of an otter seeking out competing forms of reinforcement. Trainers had to evaluate and observe what was occurring in training sessions that attributed to these, and what needed to be done to solve the existing problems and prevent future ones.

As complications presented themselves, trainers brainstormed possible solutions. Some were behavior specific, while others were broader in nature with the ability to solve more than one issue. As lists of solutions were created trainers utilized Susan Friedman's "hierarchy of behavior change procedures" by prioritizing solutions from least to most intrusive (Friedman, 2014). The least intrusive solutions were put into effect immediately while the more intrusive were assigned to individuals to research, train, and eventually implement later.

To help keep active otters stimulated and engaged, trainers made it a priority to move them around throughout the day to one of the many behind the scene areas. These environmental changes allowed the otters to burn off extra energy and to keep their naturally curious minds active. It also served to: (1) build greater reinforcement history and value in the areas where meet and greets and other sessions would occur; and (2) desensitize the otters to potential distractions in these locations.

A variety of reinforcement items, both edible and non-edible, that could be given at any time, proved to be another successful solution to the challenges with these otters. (Table 2).

Table 2:

Variable Reinforcement Items
Whole clams
Whole mussels
Salmon chunks
Soft shell blue crab
Whole mackerel
Whole squid
Ice cubes
Fish juice ice
Fruit ice cubes (primarily melon)
Vegetable ice cubes (carrots, sweet potato)
Feathers
Small cat toys
Golf balls
Shells
Small gems

A schedule was created to ensure that items were incorporated into the daily routine by employing the variable ratio reinforcement schedule, with reinforcement variety (VRRV) technique developed by Sea World (Animal Training Philosophy). There were no specific times, locations, or circumstances that the items were to be given; they could be given as a high valued piece of reinforcement for a difficult behavior, as something to keep a busy otter occupied, or as a piece of enrichment in their enclosure and left to trainer discretion. Most often the items were used to help with crating; since it often was a problematic behavior, trainers found that an item could help make it more positive and the otters tended to be occupied for longer.

Spatial awareness in trainers was extremely important, especially when one of the otters had shown signs of frustration by exhibiting one or more of the previously mentioned “avoidance behaviors”. Working in the same space as Olive meant that every step needed to be calculated. Trainers were encouraged to walk in parallel with her, avoid crossing in front of her crate, and to never try to invade her space while there was food involved. If it were ever necessary to move into her general space, trainers would send her away first and then move forward. These were valuable lessons and clear indications that her control over the environment was crucial.

Eliminating end of session predictors from the trainers was another tactic used (Table 3).

Table 3:

Tactics for elimination of end of session predictors	
Tactic	*How it is executed*
"Musical" otters	Start a session with one otter, leave and train another only to return after a few minutes. Thus turning what would have been one extended session into several mini ones.
"Musical" Trainers	Change out trainers
No crating	Never ask for the crate behavior in the session
Crating several times	Ask for the crate behavior multiple times in one session
Multiple locations	Move the otters and train in several locations
Novel food item	Give a novel food item as a "jackpot" at the end of the session

During every session these predictors were used at the trainer's discretion. Although there was no set schedule each trainer was encouraged to use them frequently and randomly.

Leaving a session, whether out of boredom, curiosity, or frustration, was another issue that had to be addressed. The trainers gave Olive the choice of staying or leaving by training an "end of session" option. Previous work at Dolphin Quest Oahu was done with a common bottlenose dolphin known to exhibit signs of frustration, a history of low focus, and increased rate of undesirable behaviors. Trainers successfully trained the dolphin to swim to a specific symbol to end the session, rather than exhibit the undesirable behaviors (Rocho-Levine and West, 2016). The training staff at the Downtown Aquarium noted the resemblance in behaviors between this dolphin and Olive, and chose to train a similar behavior. A specific square with stripes was chosen and placed into the enclosure with Olive during every session. Every time she touched the square, the trainer immediately ended the session in the most normal way possible. For instance, if in a space other than her enclosure, the trainer would send her into her crate. If the session occurred in her enclosure, the trainer would drop 2-3 pieces of food and leave the space. The shape was always present and within a few weeks Olive began to associate touching the square with the end of a session. Once she had choice and control over the session there was a temporary increase in her ending sessions. As time went on she chose to continue sessions more often than not. The shape was most frequently chosen when working on new behaviors, after multiple errors, and in situations where difficult behaviors were being worked. The two younger otters are currently being trained to use the shape.

Trainers made the otter's choice a priority in every session. It was crucial that trainers recognize which behaviors indicated that the otter did not want to participate in the session and respect that choice. The end of session option was crucial in this step, but there were other behaviors that indicated this. Control indicators, such as a refusal to crate, to come to a shape, or to join a trainer in the training area helped to assess the otter's behavioral state and whether they would participate in a session. Giving the otters enough space to move in, and even having an "escape" area was another important way to give them choice. Leaving gates open to other holding areas allowed them to leave whenever they chose. Finally, to avoid a competitive situation all three otters were given their own to crate.

The strength of the team was an important factor. Ambassador animals almost always have multiple trainers, and with more than one clicker involved things can get complicated quickly without proper communication. Trainers knew that taking on an ambassador river otter meant the usual trainer routine was going to change: schedules had to be altered, personal growth based on constructive feedback had to be a priority, and communication had to be clear. Weekly meetings were held to discuss topics ranging from the latest behavior breakdown to how trainers could successfully utilize a differential reinforcement of an incompatible behavior (DRI) in order to discourage talking during a session.

During training sessions, those trainers that were watching sessions would help identify proper bridging and reinforcement. Utilizing this system helped create a consistency in training and shaped better training skills.

Giving and receiving feedback was already a tool used at every session, but it was evident at the time of the otters' arrival that it would play an even more important role. After every session trainers were encouraged to ask for feedback and have a discussion about the decisions made. And, when a second trainer was not available, recording devices were utilized so the team can give feedback at a later time. Although awkward at times, this created stronger trainers, preventing behavior breakdowns, aggression, and frustration in the animal.

The number of trainers on each otter was eventually limited. As a younger otter, Olive was trained by all of the trainers, whether it was the curator or a part time trainer, it did not matter. The point was to give her the training experience and to give all of the trainers the opportunity to train. Lack of training experience eventually led to uninformed decisions, and this led to aggression from Olive. In order to keep trainers safe and to keep the otters from learning undesirable behaviors, the more inexperienced trainers with weaker relationships were limited to only training sessions in protected contact situations.

Task analysis was applied to problem behaviors in order to help the team figure out the best course of action. For example, in order to give each otter the opportunity crate individually, they had to be separated. Doors could be manipulated just right and lots of distractions could be provided to get each otter into a specific space, but that kind of tactic lead to confusion and otter on otter aggression. The trainers broke down the task of separating them into smaller, more manageable steps. Each otter was assigned a specific colored shape and trained to target to that shape. Then each otter was trained to go to their shape in a specific spot in their overnight holding area. Once this was established, each otter was held under stimulus control and they could be separated as needed. This type of task analysis was frequently applied to the crating behavior as well so that every trainer could fully understand what was expected.

Conclusion

Raising, training, and presenting North American river otters as ambassadors has been full of challenges, but each has been met with creative and effective solutions. While every animal has a unique story, the solutions applied to each of the otter's challenges can be applied across all situations and species. All animals could benefit from VRRV (the variable ratio reinforcement schedule, with reinforcement variety) and end of session options. Preventing trainers from inadvertently communicating end of session cues and providing an animal with plenty of choice and control may be more time consuming, but will make training sessions more positive. This certainly can aid in creating a better training relationship. Employing task analysis is another way to help work through problem behaviors. By breaking a behavior down into every movement, it becomes easier to prevent obstacles in the training process. Through every ordeal and every challenge presented, Olive, Olivia, and Emilia helped the trainers at the aquarium to become a better team and better trainers. They have left a lasting impression on the attitudes of aquarium guests as well. According to a survey conducted at the Downtown Aquarium in 2017, guests overall learned more and were more likely to participate in conservation efforts after meeting the ambassador otters than they were after hearing a keeper chat or watching a training session with the exhibit otters (Schmidt and Beran, 2017). As they grow and approach adulthood they will undoubtedly present the training staff with new challenges; but they are all too ready to tackle whatever may happen.

References

AZA Small Carnivore TAG (2009). Otter (Lutrinae) Care Manual. *Association of Zoos and Aquariums*, Silver Spring, MD. 73-74.

Branigan, H. (Producer). (2017, May 15). *"Force Lite" with Shade Whitesel* [Audio podcast]. Retrieved from https://wonderpupstraining.com/podcast/15/

Friedman, S.G.and Haug L. (2014) From parrots to pigs to pythons: Universal principles and procedures of learning. In: Tynes VV, ed. *The Behavior of Exotic Pets*. Blackwell Publishing, in press.

Reed-Smith, J. (2008). North American River Otter. *AZA Husbandry Notebook,* (3rd Edition). Retrieved from http://

www.otterspecialistgroup.org/Library/TaskForces/OCT/North_American_River_Otter_Husbandry_Manual_3rd_edition.pdf

Rocho-Levine, Julie R. and West, Nicole D. (2016). *Designing Environmental Influence Through Alternative Response Training (ART).* Proceedings from IMATA '16: IMATA conference 2016. San Diego, CA.

Schmidt, LynnLee and Beran, Madison (2017). *The Perception of Zoo Guests – otters*. Downtown Aquarium Denver. 2017.

Turner, T.N. and Tompkins, C. (1990). Aggression: Exploring the Causes and Possible Reduction Techniques. *Soundings, 2 (2).*

Zeligs, Jenifer A. PH. D. (2014). *Animal Training 101: The Complete and Practical Guide to the Art and Science of Behavior Modification.* Minneapolis, MN: Mill City Press, Inc.

Variations in behavior and enclosure use between blind and sighted common guillemots (*Uria aalge*)

Carrie Ellis
Cheyenne Mountain Zoo
Living Coasts Zoo & Aquarium Torquay (United Kingdom)

Evidence-based husbandry and welfare practices are becoming the norm in zoos and other captive-animal facilities around the world, yet research on the benefits of these practices for animals with disabilities remains sparse. To date, very few studies have been conducted which examine the behavior of blind animals in comparison to their sighted conspecifics. For this study, a colony of 32 common guillemots (*Uria aalge) was investigated to explore the behavioral variations of two sight-impaired individuals (N=2) that have been diagnosed with partial to full blindness as a result of age-onset avian cataracts. State behavior and enclosure use data were collected using instantaneous focal sampling methods over a period of 2 months. Analysis revealed statistically significant differences in behavior and enclosure use between the sight-impaired and sighted conspecifics. Both sight impaired guillemots spent statistically significantly more time resting ($F_{2, 77} = 6.9$, $p = 0.002$), less time in the water ($X^2 = 22.56$, $df = 2$, $p < 0.001$) and utilized less of their enclosure than the sighted individuals. Recommendations for maintaining the welfare of sight-impaired individuals include provision of adequate rest/hiding spaces and reliably accessible feed sources. Generalization of these results to the welfare of other zoo animal collections will also be discussed.*

Introduction

One of the primary concerns and responsibilities of accredited zoos and aquaria worldwide is maintaining the highest possible standards of animal welfare (AZA, 2015; BIAZA, 2016). Welfare is typically defined as an animal's quality of life based on various measures of physiological and mental health (Barber, 2009; Dawkins, 2004; Hemsworth et al., 2015), but the assessment of these measures and their effectiveness remains ambiguous. Historically, welfare and husbandry practices have taken a "work with what we have" approach based on the resources available (Whitham and Wielebnowski, 2013), past successes, and human intuition (Robinson, 1997). However, the past decade has seen an increasing demand (both by the public and the greater animal care community) for practices supported by objective scientific research, also known as evidence-based practices (Melfi, 2009; Rushen et al., 2011). Emphasis has also shifted from focusing exclusively on the needs of a species or group of animals as a whole to consideration of the specialized needs of individual animals (Barber, 2009; Hosey et al., 2009; Whitham and Wielebnowski, 2013). Furthermore, past research on animal welfare has been largely conducted within the agricultural industry, and although much of the information obtained from these studies has been valuable in outlining welfare practices for zoos, there is a strong need for furthering welfare research within the zoo world's own sector (Hosey et al., 2009; Melfi, 2009).

While evidence-based practices are gradually starting to become more common in zoos (Whitham and Wielebnowski, 2013), there is a concurrent subcategory within the zoo animal sector where they are even more direly needed. To date, there is very little published research supporting evidence-based practices for the welfare management of captive animals with disabilities or special physical conditions (Melfi, 2009). In the case of this particular study, I refer specifically to animals with vision impairment (blindness), either partial or complete, as a result of various causes.

The research that does exist concerning blindness in animals is largely rooted in the physiological dimension of animal welfare (Ali and Cheng, 1985; Dubey and Crutchley, 2008) or in genetics (Laikre et al., 1993). There has been very little empirical examination into the behavioral or psychological welfare of captive blind animals, and the existing research is rather indeterminate. A study examining frequency reduction in an allele that caused hereditary blindness at birth in a captive population of wolves casually noted that the animals used other forms of sensory input to learn their way around an enclosure and consequently exhibited normal behavior (Laikre et al., 1993). Conversely, Dubey and Crutchley (2008) reported that two adult wallabies who developed temporary blindness as a result of a parasitological toxoplasmosis infection exhibited behaviors "consistent with complete blindness" such as having navigational difficulties and exhibiting signs of stress in a foreign environment. The opposing reports from these studies illustrate the unexplored potential differences in behavior between animals that are born blind and animals who develop blindness over time.

A few comprehensive studies on the behavior of blind animals do actually prove insightful in terms of assessing or at least examining welfare. Following the introduction of three blind brown bears (*Ursus arctos*) into a new enclosure at a zoo in the Netherlands, Koene (1998) observed the animals' progress adapting to the new environment and their consequent social interactions with cohabiting sighted conspecifics. It was found that ultimately all three blind individuals utilized far less of their available enclosure space, which was likely due to aversive experiences with the electric fencing perimeter during initial exploration. However, two of the blind individuals engaged in regular conspecific social interactions (including play behavior). In addition, initially present stereotyping behavior eventually disappeared from all three of the blind individuals' behavioral repertoire (Koene, 1998). Koene concludes that management of blind bears, when executed in gradual stages and with appropriate evaluation, does not prove to be challenging and that blind individuals may experience improved welfare as a result (Koene, 1998).

Bears typically do not rely on sight as heavily as their other senses for environmental interpretation, and thus their welfare may not be as affected by blindness as some other species (Koene, 1998). Birds for example are known to rely heavily on vision for social interactions, foraging, vigilance, etc. (Martin, 2014; Martin and Wanless, 2015). Collins et al. (2011) examined the differences in behavior between genetically blind and sighted chickens and found that blind chicks in their home environment exhibited statistically significantly more sitting, preening and abnormal behaviors (circle walking, air pecking and upward gazing), along with decreases in body weight. Blind chicks also showed less group aggregation, less synchrony in group behavior, and were less stressed when placed in a social isolation condition (Collins et al., 2011). An earlier study by Ali and Cheng (1985) also found decreased levels of social interaction in blind chickens but noted that feeding behaviors and stress levels did not differ statistically significantly between blind and sighted conspecifics. The variable results of all these studies clearly indicate that there is a need for more thorough examination of how the behavior of blind animals compares to that of their conspecifics, and furthermore, how it may affect their welfare.

Living Coasts in Torquay is currently in possession of two common guillemots (*Uria aalge*) with moderate to complete vision impairment that live among a colony of 30 other sighted conspecifics. Guillemots are a circumpolar species of marine bird that spend most of their time in the wild at sea feeding on small fish and invertebrates, coming to land only to breed (Martin and Wanless, 2015). During the breeding season they are highly social, and colonies can contain hundreds of monogamous pairs densely packed together on rocky areas (Lewis et al., 2007). The two guillemots at Living Coasts presented a unique opportunity to empirically examine the behavioral complexities of blind animals (specifically through measurements of state behavior occurrences and enclosure use) with possible implications for enhancing evidence-based welfare practices, which was the overarching purpose of this study.

Based largely on the findings of Collins et al. (2011) and Ali and Cheng (1985), we hypothesized that compared to sighted conspecifics, the two blind guillemots would a) exhibit statistically significantly more stationary behaviors such as resting and standing still, b) exhibit statistically significantly more self-maintenance behaviors such as preening and bathing, and c) utilize

statistically significantly less of their enclosure space. Past research has suggested that such behaviors may be indicators of poor welfare (Collins et al., 2001; Hosey et al., 2009), and potential identification of these trends in the blind guillemots could allow for improved welfare recommendations based on empirical evidence.

Methods

Study site and species:

Living Coasts Zoo & Aquarium in Torquay is the UK's only coastal zoo and aquarium and houses a variety of birds, fish, mammals and invertebrates. The entire facility exists within a net-enclosed aviary. The "Auk Cliff" exhibit is a semi-terrestrial aquatic enclosure with both underwater and above-ground viewing areas that houses 51 animals constituting four different species: 18 tufted puffins (*Fraterculla cirrhata*), 2 red-legged kittiwakes (*Rissa tridactyla*), 4 black-legged kittiwakes (*Rissa brevirostris*) and 32 common guillemots (*Uria aalge*). Two of these guillemots have been diagnosed by the resident veterinary professionals with vision impairment, thought to be caused by age-onset avian cataracts. "M1" (male, born 2002, age 13 at time of study) is affected in both eyes while "F1" (female, born 1986, age 29 at time of study) is affected in only one eye.

All animals in the enclosure are fed a diet of small fish and invertebrates at regular intervals throughout the day. Feeding methods include provision of food bowls twice a day in zones 3 and 5 (see Fig. 1), scatter feeds five times a day, and hand feeding, which is only occasionally employed with a select few individuals (such as F1).

Pilot study:

We conducted an initial pilot study using a previously composed species-specific ethogram (generously provided by Samantha Pacynko, a placement student at Living Coasts' during the time of study) which was then modified to include any additionally observed behaviors (Table 1). A map of the enclosure (provided by Living Coasts) was divided into 9 unequal zones (Fig. 1) for spread of participation index (SPI) measurements, a common method for measuring the enclosure use of captive animals where 0 is equivalent to equal use of all zones within the enclosure and 1 is equivalent to the use of only a single zone (see Fig. 2 for the SPI mathematical formula) (Plowman, 2003).

Sampling methods

Instantaneous focal sampling was used to record the state behavior and enclosure position of a single guillemot at one-minute intervals over the course of a 30 minute session. 80 total sessions were recorded (40 for the blind individuals and 40 for various sighted individuals) comprising a total of 40 hours of data collection. Each observer alternated observation sessions between blind and sighted individuals to account for inter-observer reliability, and when selecting sighted guillemots for observation we tried to observe as many different individuals as possible and not record data for the same individual more than twice. Guillemots were identified predominantly by colored ring tags (or lack thereof, in the case of F1 and a few other individuals). Data were collected from November 2015-January 2016 always between the hours of 10:00-16:00.

Table 1

Behavior Category	Behavior	Description
Locomotion on land	(W) Walking	Various styles of walk, all displayed on land.
	(WP) Walking in Place	Shifting on feet in place continuously, not travelling.
	(FLY) Flying	Moving through the air; feet not on ground; wings beating vigorously.
Locomotion on water	(S) Swimming	On the surface of the water, paddling with the feet.
	(D) Diving	Swimming underwater.
Tactile-manipulation	(TMA) Tactile Manipulation Alone	Manipulating a novel object such as a feather or shell (not food) with the beak, alone. May include moving object on the ground, lifting, pecking, carrying or repeated nipping.
	(TMS) Tactile Manipulation Social	Manipulating a novel object such as a feather or shell (not food) with the beak with another individual(s). May include passing the object back and forth, shared pecking, moving, lifting, pecking and nipping.
Rest	(R) Resting	Lying down, eyes open or closed, bill often tucked under wing. This can be done either on land or on the surface of the water.
	(SS) Standing Still	Standing upright, eyes open or closed, may be looking around the enclosure but no locomotive behaviour.
	(FLO) Floating	Sitting on the surface of the water but not actively moving legs.
Self-maintenance	(P) Preening	Using beak to tidy and clean the feathers. Preening can occur both on land and water.
	(MP) Mutual Preening	Using beak to tidy and clean another guillemot's feathers.
	(HD) Head Dipping	During swimming, head-dips by submerging head above eyes into water; may be repeated frequently with head-shaking.
	(B) Bathing	Erecting in the water, fluffing feathers and vigorously flapping wings; also occurs when a bird lies to one side so that one wing is underwater while other is vertical to water.
Feed	(FAB) Alone from Bowl	Feeding out of food bowls on land, alone.
	(FAS) Alone During Scatter Feed	Diving for food during a scatter feed, alone.
	(FSB) Social from Bowl	Feeding with another individual (usually conspecifics) from the same food bowl simultaneously.
	(FSS) Social During Scatter Feed	Diving for food during a scatter feed whilst other conspecifics are doing the same.
	(FBH) By Hand	Taking food directly from keeper.
	(FOB) From/To Other Bird	Being fed by or feeding another guillemot.
(OOS) Out of sight		Animal cannot be seen.

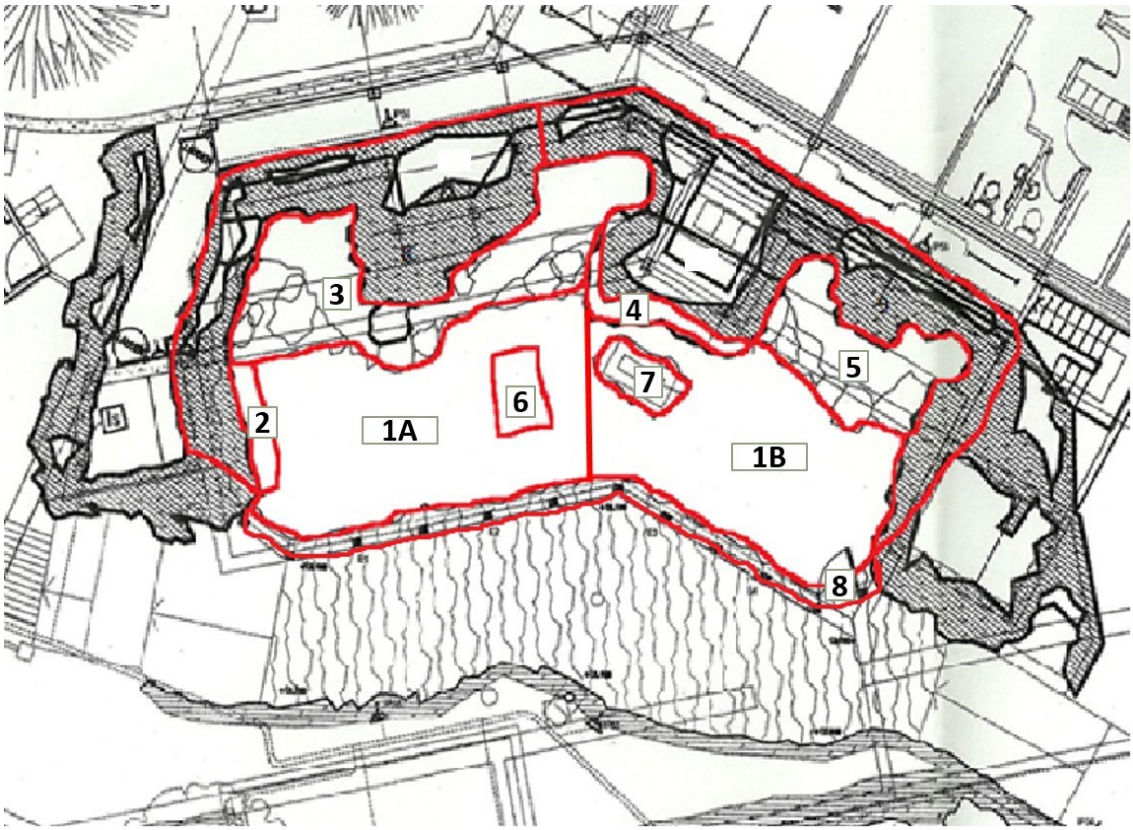


Fig. 1. Aerial map of Auk Cliff at Living Coasts. Zones 1A and 1B are water, all other zones are formed of a solid rock substrate.

Data analysis

All behavioral data were analyzed using SPSS statistical analysis software V22.0. Observed behaviors from the ethogram were grouped into 6 simplified categories (locomotion on land, locomotion on water, tactile-manipulation, rest, self-maintenance and feed) which constituted the behavioral dependent variables. State behavior counts within these categories were transformed into percentages for each 30-minute session. Enclosure use was calculated using the modified SPI formula accounting for unequal zones within the enclosure, as seen in Fig. 2. (Plowman, 2003).

$$\mathrm{SPI} = \frac{\sum |f_o - f_e|}{2(N - f_{e\,\min})}$$

Fig. 2. Modified spread of participation index formula for calculating enclosure use in enclosures with unequal zones (Plowman, 2003).

The original 9 zones in Fig. 1 were eventually merged into 7, as guillemots were never observed in zones 8 or 4.

Initial analyses grouped both blind individuals together resulting in two independent variable groups (blind and sighted). However, initial t-tests and Mann-Whitney U analysis revealed statistically significant differences between the two blind individuals, and it was decided to separate them each into their own group, resulting in three independent variable groups (M1, F1, and Sighted Individuals). This called for an analysis of variance (ANOVA) with a post-hoc Tukey's B test for normally distributed data and a one-way ANOVA (Kruskall-Wallis) for non-normally distributed data.

Results

Behavioral data

For the behavioral data, rest was the only category that showed normal distribution and was thus analyzed using an ANOVA. We found a statistically significant difference in the resting behaviors of all three groups ($F_{2,77} = 6.9$, $p = 0.002$) and post-hoc Tukey's b tests revealed that both blind individuals rested statistically significantly more than the sighted individuals (Fig. 3). All other categories were analyzed using Kruskal-Wallis tests. Analysis revealed statistically significant differences in water locomotion ($X^2 = 22.56$, $df = 2$, $p < 0.001$) and also in self-maintenance ($X^2 = 15.56$, $df = 2$, $p < 0.001$) between all three groups (Fig. 3).

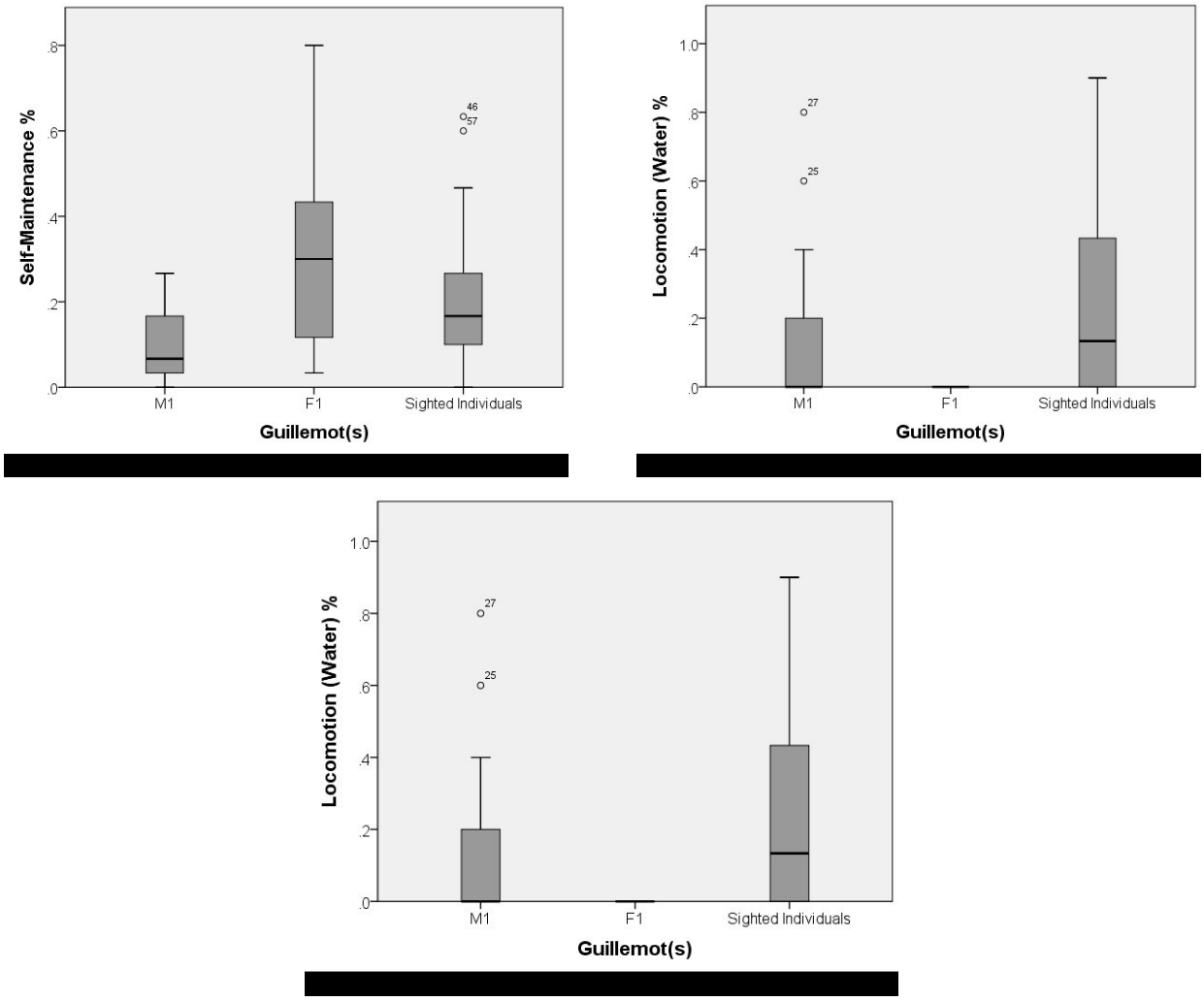


Fig. 3. Average percent of session spent engaging in self-maintenance, locomotion in water, and resting behaviors for all three guillemot groups.

Enclosure use data

SPI calculations revealed a statistically significant difference between the enclosure uses of all three groups (Fig. 4). F1 utilized the least amount of enclosure space (SPI = 0.87) and the sighted individuals utilized all 7 zones (SPI = 0.34), while M1 (SPI = 0.69) was in between these two extremes.

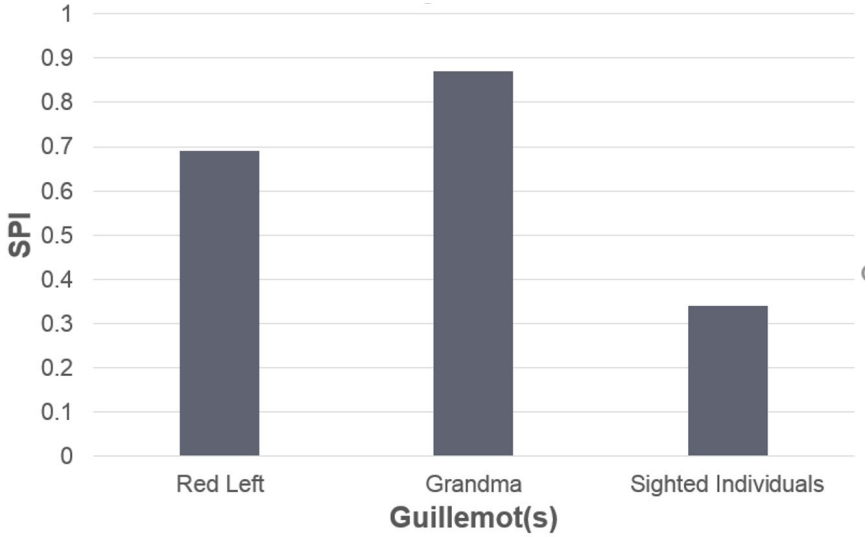


Fig. 4. SPI measurements of enclosure use for all three guillemot groups.

Discussion

Our results supported all our original hypotheses and were consistent with the findings of Collins et al. (2011). The behavior of the blind guillemots differed statistically significantly in terms of increases in resting (both) and self-maintenance behaviors (F1 only), as well as decreases in water locomotion (both) and enclosure use (both), compared to their sighted conspecifics. These results can have different implications for welfare depending on how they are interpreted.

F1 engaged in a statistically significant amount of preening, was never observed in the water during a data collection session and remained in zone 3 throughout the entire course of the study. While F1 did enter the water on two separate occasions, it was always while observations were being taken on a different individual and we were thus unable to incorporate any of this anecdotal data into our analysis. F1 did not show statistically significant differences in feeding behavior compared to either M1 or the sighted individuals, but it is worth noting that her preference for zone 3 of the enclosure meant that she was only ever observed feeding from bowls.

At first glance (especially in comparison to her sighted conspecifics) these behaviors would seem to be indicators of poor welfare for a blind animal. However, a particularly crucial and potentially limiting factor that must be taken into account when interpreting these results is age. Guillemots have an average lifespan of 23 years, and the longest recorded lifespan for a wild guillemot was just shy of 36 years (BTO, 2015). At 29 years old, F1 is the oldest guillemot in the Auk Cliff enclosure by a margin of at least 6 years compared to her conspecifics. Many of F1's behaviors could therefore be attributed to the deleterious physiological effects of senescence (Hosey et al., 2009; Vleck et al., 2007) in addition to her vision impairment. For example, we noted from personal observations and communication with the keepers that F1's plumage is much thinner than the other guillemots and her feathers do not retain the oils essential for flotation in the water as well as the other birds. This could either be a result of her extensive preening, or just a result of plumage-wear due to age.

By the same reasoning, her aversion to water may be due to vision impairment, impaired swimming ability as a result of sparse plumage, or a combination of both. F1's welfare assessment thus becomes much more complex when these numerous variables are taken into account.

M1, the more severely vision-impaired of the two blind guillemots, may be a better model for behavioral comparison with conspecifics as he is much closer in age to most of the other individuals in the colony. M1 did not engage in self-maintenance behavior nearly as often as F1 or even the other sighted individuals. He also tended to spend at least some amount of time locomoting in the water for each session, though still not as much as the sighted individuals. He spent the majority of each session sitting still, usually in zone 3, utilizing statistically significantly less of the available enclosure space than the sighted individuals. While proximity to other conspecifics was not an official measure in this study, we did casually note that M1 was usually in proximity to one or more individuals while engaged in resting behaviors on land, whereas F1 stayed in zone 3 regardless of whether other conspecifics were present. The motivation to engage in on-land resting behaviors is seemingly high for both blind guillemots, and continued provision of adequate space for resting and/or hiding on land is likely essential for their welfare.

While the blind guillemot's increases in resting behavior may suggest that they are experiencing negative welfare due to vision impairment (Colins et al., 2011), the absence of other indicators may actually be interpreted in favor of successful welfare practices. For example, throughout all our observations we never noted the occurrence of any abnormal behaviors (such as those listed in the Collins et al. study) from either of the two blind guillemots, nor did they seem to have trouble navigating their enclosure (i.e., we never observed any collisions between the blind individuals and other animals or structures). Furthermore, the lack of any statistically significant differences in feeding behaviors may be interpreted as a positive welfare indicator, as the two blind guillemots were observed feeding (from bowls for F1 and from both bowls and scatter feeds for M1) just as frequently as their sighted conspecifics and without any issue. However, this last point should be interpreted with caution, as we were unable to observe the guillemots early in the morning when they receive their first feeding of the day and when motivation to feed may have been higher, thus potentially resulting in more occurrences of feeding state behaviors. A longer period of data collection that included observation hours before 10:00 may have yielded statistically significant differences in other behavior categories such as feeding. Additional physiological measurements such as body weight and food intake could give an even more precise assessment of welfare conditions.

Our study was also unable to account for seasonal variations in behavior. Guillemots become much more social during the breeding season in spring (Lewis et al., 2007) and as previously mentioned, most birds rely heavily on vision for facilitating social interactions (Martin, 2014; Martin and Wanless, 2015). Blindness may therefore be a detriment to the social welfare of captive birds, as suggested by the Collins et al. (2011) study where blind chicks reportedly exhibited decreased group aggregation and synchrony of group behaviors. It was beyond the time and scope of our study to examine the effects blindness may have on such behaviors, but further research on this subject would likely prove invaluable to the assessment of captive welfare.

Conclusion

Although our study produced statistically significant results that supported our original hypotheses and coincided with the findings of other studies on blind birds (Ali and Cheng, 1985; Collins et al., 2001), we still cannot fully implicate the occurrence of behavioral differences as being due to blindness. There may be other external or internal factors (e.g. age, as previously mentioned) that are influencing the behavior of these two guillemots. However, with these considerations in mind, we can still make some generalized recommendations for maintaining high standards of welfare for vision-impaired guillemots or other species of seabirds. The following is a list of evidence-based recommendations that were implemented for M1 and F1 at Living Coasts, most of which could be easily replicated by other institutions managing similar species with vision-impairment. Provision of adequate rest and hiding spaces on land for vision-impaired individuals. We recognize that the addition of subsequent land-based areas in an enclosure solely for the benefit of a minority group of individuals (such as the two birds at Living Coasts) may simply not be practical and could in fact be a detriment to the welfare of other animals. Therefore, we would simply recommend

that all seabird enclosures contain some form of land-based substrate in accordance with minimum BIAZA, EAZA and AZA standards, with additional modifications made as necessary.

M1 and F1 were both well acclimated to their current enclosure, and it was therefore recommended that they remain at Living Coasts for the remainder of their lives in order to prevent any unnecessary stress that may be caused by a change in environment (Collins et al., 2011; Koene, 1998).

Employment of multiple different feed methods. The guillemots at Living Coasts were given numerous different choices regarding feeding style: scatter feeding provided naturalistic enrichment for the sighted individuals as well as M1, and the consistent placement of feed bowls in zones 3 and 5 created a reliably accessible food source for both blind individuals. Replication of multiple different feed methods is therefore highly recommended as it simultaneously provides environmental variability while maintaining reliable access to a necessary resource.

Regular quality of life (QoL) evaluations. The use of objective and empirical methodology (such as institution-specific QoL assessment forms) to evaluate an animal's QoL allows caretakers to make informed decisions regarding an animal's welfare and provide optimal care (Green and Mellor, 2011). An example specific to our study would be the high occurrence of self-maintenance behaviors exhibited by F1. Regular assessments and monitoring of this behavior can help ensure that it does not reach a point of detrimental harm. To our knowledge, Living Coasts had not yet implemented formal QoL evaluations with F1 or M1 at the time of this study, but use of such methodology could prove instrumental in helping to further employ evidence-based welfare techniques and aid in decision making around difficult topics such as medical intervention, euthanasia, etc.

Finally, further research into the behavior of blind animals in comparison with conspecifics and how blindness affects captive animal welfare is highly recommended for expanding upon the results of this study. The potential effects of blindness on social interactions such as group synchrony behaviors and aggregation are two topics of particular interest.

Acknowledgements

The researchers would like to thank the Living Coasts staff (particularly Samantha Pacynko) for their provision of vital information throughout the course of this study and for graciously hosting our research. We would also like to thank Sarah Collins and Francis Cabana for their assistance with statistical analysis.

References

Ali, A., Cheng, K.M., (1985). Early egg production in genetically blind (rc/rc) chickens in comparison with sighted (Rc+/rc) controls. Poultry Sci. 64, 789-794.

Association of Zoos and Aquariums [AZA], 2015. Strategic Plan Review and Update 2015-2017. Available at: https://www.aza.org/uploadedFiles/About_Us/AZA-Strategic-Plan-2015-2017.pdf (Accessed on 21 January 2016).

Barber, J.C.E., 2009. Programmatic approaches to assessing and improving animal welfare in zoos and aquariums. Zoo Biol. 28, 219-530.

British and Irish Association of Zoos and Aquariums [BIAZA], 2016. Our Vision and Mission. Available at: http://www.biaza.org.uk/about-biaza/our-vision/ (Accessed on 21 January 2016).

British Trust for Ornithology [BTO], 2015. Longevity records for Britain & Ireland in 2014. Available at http://app.bto.org/ring/countyrec/results2014/longevity.htm#6340 (Accessed on 27 January 2016).

Collins, S., Forkman, B., Kristensen, H.H., Sandøe, P., Hocking, P.M., 2011. Investigating the importance of vision in poultry: comparing the behavior of blind and sighted chickens. Appl. Anim. Behav. Sci. 133, 60-69.

Dawkins, M.S., 2004. Using behaviour to assess animal welfare. Anim. Welf. 13, S3-7.

Dubey, J.P., Crutchley, C., 2008. Toxoplasmosis in wallabies (*Macropus rufogriseus and Macropus eugenii*): Blindness, treatment with atovaquone, and isolation of Toxoplasma gondii. J. Parasitology 94, 929-933.

Green, T.C., Mellor, D.J., 2011. Extending ideas about animal welfare assessment to include 'quality of life' and related concepts. New Zealand Vet. J. 59, 263-271.

Hemsworth, P.H., Mellor, D.J., Cronin, G.M., Tillbrook, A.J., 2015. Scientific assessment of animal welfare. New Zealand Vet. J. 63, 24-30.

Hosey, G., Melfi, V., Pankhurst, S., 2009. Zoo animals: behaviour, management, and welfare. Oxford University Press, Oxford.

Koene, P., 1998. Adaptation of blind brown bears to a new environment and its residents: Stereotypy and play as welfare indicators. Ursus, 579-587.

Lewis, S., Roberts, G., Harris, M.P., Prigmore, C., Wanless, S. 2007. Fitness increases with partner and neighbour allopreening. Biol. Lett. 3, 386-389

Laikre, L., Ryman, N., Thompson, E.A., 1993. Hereditary blindness in a captive wolf (*Canis lupus*) population: Frequency reduction of a deleterious allele in relation to gene conservation. Cons. Biol. 7, 592-601.

Martin, G.R., 2014. The subtlety of simple eyes: the tuning of visual fields to perceptual challenges in birds. Phil. Trans. Of R. Soc. B 369, 20130040.

Martin, G.R., Wanless, S., 2015. The visual fields of Common Guillemots *Uria aalge* and Atlantic Puffins *Fratercula arctica*: foraging, vigilance and collision vulnerability. Int. J. Av. Sci. 157, 798-807.

Melfi, V.A., 2009. There are big gaps in our knowledge, and thus approach, to zoo animal welfare: A case for evidence-based zoo animal management. Zoo Biol. 28, 574-588.

Plowman, A.B., 2003. A note on a modification of the spread of participation index allowing for unequal zones. Appl. Anim. Behav. Sci. 83, 331-336.

Robinson, M.H., 1997. Enriching the lives of zoo animals, and their welfare: Where research can be fundamental. Anim. Welf. 7, 151-175.

Rushen, J., Butterworth, A., Swanson, J.C., 2011. Animal behavior and well-being symposium: Farm animal welfare assurance: Science and application. J. Anim. Sci. 89, 1219-1228.

Vleck, C.M., Haussmann, M.F., Vleck, D., 2007. Avian senescence: underlying mechanisms. J. Ornithol. 148, 611-624.

Whitham, J.C., Wielebnowski, N., 2013. New directions for zoo animal welfare science. Appl. Anim. Behav. Sci. 147, 247-260.

THE USE OF SOCIAL INTRODUCTION OF ASIAN BULL ELEPHANTS TO REDUCE STEREOTYPICAL BEHAVIOR

Danielle Lints
Denver Zoological Foundation

Historically, zoos have managed bulls in a solitary fashion, replicating what was thought to be a natural state for male elephants. Recent research indicates that bulls often come together in loose bachelor groups. This was the inspiration for Denver Zoo when deciding to socialize our 3.0 Asian elephants (Elephas maximus). We hoped this goal could help mimic natural behaviors and potentially reduce stereotypy. In late summer 2016, the bulls demonstrated stereotypy while living alone. Introductions began in December of 2016 with Bodhi (12) and Billy (8). Groucho (47) was introduced a month later. We closely observed social behaviors and monitored stereotypy. The bulls had various social opportunities that encouraged an increase in natural behaviors. We observed that the bulls spent a large amount of time interacting together and we saw a significant decrease in stereotypic behaviors when they had access to social interaction. However, we had an unexpected result with Billy who had previously shown no stereotypy prior to introduction. Billy started exhibiting pacing behaviors along areas where he could see the other elephants when he did not have physical access to them. The team immediately began to assess potential triggers for this behavior and how to address this new stereotypy. The results that we have seen thus far indicate that socializing the three bull elephants at Denver Zoo has had positive impacts on their day-to-day experiences, reduced stereotypy overall, and has continued to challenge our team to pursue best practices for the future of bull management.

Acknowledgements

I would like to express my deep appreciation to Nick Visscher, Denver Zoo's Audience Research and Evaluation Manager in the Learning Experiences department, for his expertise in configuring the data from the observations and his patience while I was pulling the data together.

I would also like to thank Sharon Joseph, Denver Zoo's Animal Welfare and Internal Research Director in the Animal Welfare and Internal Research department, for starting our journey with the observation programs and supporting us during the journey. Finally, I would like to give special thanks to my team for the many hours of observations they did throughout the year and the support they gave while writing this paper.

Historically, bull management mimicked what we believed happened in their natural environment: young males would be pushed out of their herd around the ages of 6-10 years old and live mostly solitary lives. In the wild, they were thought to not need regular socialization and would only encounter other elephants to breed or when sparring with other bulls during musth.

Zoos have focused mostly on female elephants' social dynamics. AZA Standards for Elephant Management and Care states, "Each zoo holding elephants must hold a minimum of three females (or the space to hold three females), two males or three elephants of mixed gender." (AZA, 2012, Section 2.2.1.1) AZA also states, "As a highly social species, female elephants must be returned to their social group as soon as possible." (AZA, 2012, Section 3.3.1.1) However, there are not many guidelines for management of bulls in human care. "Adult males (6 years and above) may be housed alone, but not in complete isolation. Opportunities for tactile, olfactory, visual, and/or auditory interaction with other elephants must be provided" (AZA, 2012, Section 2.2.1.1., para. 2). Per the AZA Standards for Elephant Management and Care, there are currently no standards for bull management.

Today, we are learning more about bulls in the wild and how to translate that information to the care that we give them. Zoos are evolving every day and changing the way we care for animals, including improvements in exhibit design, veterinary care, training, and socialization. We have learned that Asian bull elephants are not as solitary as we once thought. Young bulls come together in loose bachelor groups. This is an opportunity for them to learn from one another, practice sparring, and receive social interaction. Older bulls can be seen with the bachelor groups providing added learning opportunities of proper elephant behavior, submissiveness, and dominance. The bulls will come and go, moving around to different herds or spending time by themselves (C. Fernando, personal communication, 21 July 2016; J. Brown, personal communication, February 2017).

This information inspired Denver Zoo to move forward in managing an all-bull exhibit. We are fortunate to have a facility with five rotating yards that are able to hold multiple bulls, providing increased opportunities for socialization. We currently have 3.0 Asian bull elephants housed in Toyota Elephant Passage: Groucho (48), Bodhi (13), and Billy (10). The bulls were originally housed separately but were able to see and smell each other. Our goal in changing this environment was to mimic the loose bachelor group dynamic and hopefully see a decrease in stereotypy.

Stereotypic Behaviors in Denver's Bull Elephants

Groucho came to Denver Zoo with a whole body stereotypic behavior: bobbing his head up and down while swinging his trunk around. This was observed most often when he was finished eating and waiting for more food. This behavior was usually emitted at doors, gates, and feeding stations.

In late summer of 2016, we observed a route pacing pattern of stereotypy from Bodhi. His slow movements were first recorded as locomotion during observations. After more careful observation, we used our camera system to speed up video playback and confirm that Bodhi had a distinct pacing pattern in certain yards.

Billy did not present any stereotypy behaviors prior to bull socialization.

Introduction of Socialization

We began introductions in December 2016 with Bodhi and Billy. Socialization started out slowly, a couple of hours at a time. The duration of introduction time was increased at a rapid rate for the young bulls because they were showing positive social behaviors. They spent most of their time sparring and socializing with each other. Groucho was introduced to both Bodhi and Billy in January 2017 with very positive results. We wanted to mimic the bachelor behavior seen in the wild, so socializing was varied during the daytime.

Throughout socialization, the bulls were given multiple yards and had the choice to interact with each other or go into separate yards. This type of management allowed the elephants to dictate how often they wanted to socialize. Billy and Bodhi were seen sparring much of the time which improved their body condition through exercise, increased the trust and bonds with each other, and provided opportunities to learn social cues. The younger bulls also learned proper social etiquette, manners, and submissiveness from our older bull, Groucho. Groucho learned to be more dominant, improved his body condition through mild sparring, and had increased mental stimulation while socializing with the other bulls.

Observations Data

During the initial introduction months of December and January, keepers did informal observations throughout the day on all three elephants using ZooMonitor® software. The ZooMonitor® observation design was built in-house by keepers and the Behavioral Husbandry department to gather baseline data on bull behaviors, especially Groucho. These observations took place during periods of bull socialization and while the bulls were alone. Groucho demonstrated head bobbing 17% of time during 23 observations. Bodhi was observed pacing 1% of the time during 22 observations. However, he was observed walking 33% during the observation time. The 33% may have included the slow walking that leads to his pacing behavior that we did not recognize yet as a stereotypic pace.

In January 2017, we joined the AWARE Institute and began participating in the Elephant Welfare Initiative (EWI) observation program. We were part of the pilot program and used this new opportunity to focus on Groucho's stereotypy and socialization.

During January and February, both EWI and our team tried to determine the best way to use this program. Keepers were required to pass an inter-observer reliability test that assured all observers could properly recognize and record behaviors.

EWI set the parameters for the observation data points. Three observations were recorded during the morning (7AM-10AM), mid-day (10AM-2PM), and afternoon (2PM-5PM) for 20 minutes at one-minute intervals. They required a minimum of nine observations on each elephant during the day for a total of 27 observations in a month.

Using the EWI observational tool, we were able to observe a single bull, one bull in a social setting, or two bulls at the same time in a social setting. There were no set guidelines for choosing which bull we would observe, and we often gathered additional observational data points over the minimum required. In March, we added Billy and Bodhi to the EWI observations.

Total data was collected from January 2017 to December 2017. Each elephant had between 113-155 observations, for a total of 381 observations. Just over 30% of observations on Billy and Bodhi occurred while they were in social settings. The remaining observations took place during solitary settings. Unfortunately, 24% of Groucho's observations were not logged into EWI as being in either a social environment or nonsocial environment, so the data collection on him is incomplete (Table 1). The use of "(Blank)" in the charts below represents missing socialization data in EWI, most of which is data on Groucho. We had observational data, but none identifying whether or not he was with other bulls.

Table 1

Not Social vs Social Observations

Bulls	Not Social	Social	(Blank)	Not Social	Social	(Blank)	Total Observations	Total Percentage
Billy	72	40	1	64%	35%	1%	113	100%
Bodhi	71	42		63%	37%	0%	113	100%
Groucho	87	31	37	56%	20%	24%	155	100%
Grand Total	**230**	**113**	**38**	**60%**	**30%**	**10%**	**381**	**100%**

Groucho showed the most stereotypy, spending 35% of his time head bobbing. Billy showed the least amount of stereotypy with 4% of his time pacing (Table 2).

Table 2

No Stereotypy vs Stereotypy During Observations

Bulls	No Stereotypy	Stereotypy	No Stereotypy	Stereotypy	Total Observations	Total Percentage
Billy	108	5	96%	4%	113	100%
Bodhi	93	20	82%	18%	113	100%
Groucho	100	55	65%	35%	155	100%
Grand Total	**301**	**80**	**79%**	**21%**	**381**	**100%**

We were able to observe stereotypic behaviors in both social and non-social settings. In social settings, Billy and Bodhi showed no instances of stereotypic behaviors. Due to the missing socialization data, there are instances when we do not know whether Groucho was with others when emitting stereotypy. Of the total data for Groucho, 32% of the stereotypic behavior is listed as missing data. Of the time recorded as social, 19% observed stereotypic vs. 43% for the non-social time (Table 3).

Table 3

Individual Stereotypy and Socialization Observations

Bulls	No Stereotypy	Stereotypy	No Stereotypy	Stereotypy	Total Observations	Total Percentage
Billy	**108**	**5**	**96%**	**4%**	**113**	**100%**
Not Socialized	67	5	93%	7%	72	100%
Socialized	40		100%	0%	40	100%
(Blank)	1		100%	0%	1	100%
Bodhi	**93**	**20**	**82%**	**18%**	**113**	**100%**
Not Socialized	51	20	72%	28%	71	100%
Socialized	42		100%	0%	42	100%
Groucho	**100**	**55**	**65%**	**35%**	**155**	**100%**
Not Socialized	50	37	57%	43%	87	100%
Socialized	25	6	81%	19%	31	100%
(Blank)	25	12	68%	32%	37	100%
Grand Total	**301**	**80**	**79%**	**21%**	**381**	**100%**

In total, 230 observations were recorded when elephants were alone and 113 were recorded when they were in social groupings. When alone, 27% of behaviors were stereotypic, whereas only 5% of social settings were stereotypic (Table 4).

Table 4

Overall Stereotypy and Socialization Observations

Socialization	No Stereotypy	Stereotypy	No Stereotypy	Stereotypy	Total Observations	Total Percentage
Not Social	168	62	73%	27%	230	100%
Social	107	6	95%	5%	113	100%
Grand Total	**275**	**68**	**80%**	**20%**	**343**	**100%**

Overall, there was a 22% decrease in observed stereotypic behavior when elephants were in a social scenario.

Unanticipated Challenges

During the year of observations, we ran into a couple of hurdles that required troubleshooting. First, we needed to devise a plan for socialization during musth. Musth is a period for bulls that lasts for 2-3 months at varying times of year where testosterone levels triple the usual amount and aggression increases.

Billy was the first to go into musth in April, followed closely by Bodhi. Groucho was not interested in socializing with either Billy or Bodhi while they were in musth and both young bulls were observed with increased aggression towards Groucho.

Based on Groucho's avoidance, we suspended socialization until the younger bulls' musth period ended. During this suspension in social time, we saw a marked increase in Groucho's stereotypy during the months of April and May.

We allowed Billy and Bodhi to come together for brief times during a week when both were in musth at the same time. This allowed the young bulls to interact as they would in the wild, sparring heavily when together and then separating for longer periods. We saw an increase in Billy's pacing stereotypy during April, while separated for his musth. A slight increase of Bodhi's stereotypy was observed when alone during his musth period.

Groucho went into musth throughout November and December. Billy and Bodhi would not socialize with Groucho at this time and we saw an increase in Groucho's stereotypy these months. No increase in stereotypy was observed from either Billy or Bodhi during Groucho's musth, likely because they were able to interact with one another.

Another unexpected hurdle was that we observed the beginning of stereotypic behaviors with Billy. What we thought was anticipation at feed stations and gates, was actually Billy pacing a pattern. This behavior was recorded as anticipation, and accounted for 25% of his observations, but was most likely a developing stereotypy. We started performing additional observations on him to verify both when and where he was pacing. Our observations showed that when Billy was in yards with visual access to other elephants, his pacing was most prevalent. Billy did not exhibit the pacing behavior in yards that were blocked from visual sight or farther away from the other elephants. Throughout this time, we increased his enrichment and training to divert his attention. When housed alone, we also had him in yards where other elephants were neither visible nor nearby.

There was also regression in shifting Billy when he was with other elephants; he did not want to separate during socialization. He would block other elephants from shifting by physically pushing them away from the exit and would not separate to hold at a station alone. When separation was needed for training or shifting, we would reinforce him by giving him access to the other elephants immediately afterwards.

We saw a significant decrease in the pacing stereotypy that Billy was forming. The increased enrichment and training and the decrease of the stereotypic stimuli showed a vast difference in his behavior, as Billy no longer shows anxiety about being separated from the other bulls and will shift readily.

Summary

Bull socialization has been a great tool for altering unwanted stereotypic behaviors. We observed a substantial decrease in stereotypy in Groucho and Bodhi by using socialization. There was a total decrease of stereotypic behavior by 22 % for all elephants. Groucho, who displayed the most stereotypic behavior, decreased significantly from 43% to 19% during social settings. Despite a couple hurdles, we have seen that the bulls have flourished in socialized settings. We are thrilled to see how socialization has improved the everyday life of the elephants, how they grow and learn from each other, and how socialization helped decrease their stereotypic behaviors. These positive results continue to support what we are now discovering about bull elephants; they have more social needs than initially believed.

References

AZA (2012). *AZA standards for elephant management and care*. Silver Spring, MD: American Zoo and Aquarium Association.

Incorporating Conservation and Guest Interaction Into Everyday Animal Training

Basia M Dann and Courtney A Rogers

Cheyenne Mountain Zoo

Cheyenne Mountain Zoo's mission statement encourages, "connecting people with wildlife and wild places through experiences that inspire action." Every person has the potential to become our partner in conserving the planet we all share. The animals in our care serve an important role as ambassadors for their wild counterparts. We will discuss how zookeepers can enable animals and guests to make these connections in ways that leave lasting impressions and inspire conservation action. Many guests come to keeper talks, or pass by animal training sessions and vet procedures. These are opportunities to use "defining moments" to create a dialogue with zoo guests to forge that partnership. "Defining moments" are interactions initiated by zoo employees which leave the guest with an enduring and highly influential memory. By inviting guests to help us train animal behaviors, as well as participate in our keeper talks, or even help during veterinary procedures, we share the responsibility of the care of the animals with our guests, making history by empowering them to engage in future care. Guests can feel this empowerment by translating a conservation message from a bear, providing "prey" for a leopard to drag and cache, or holding a flashlight up to a bear mouth for a dental check. These quick moments give us a chance to add valuable members to our conservation team. These tactics can be used by any zoological facility to increase effectiveness of their conservation programs, connect people to wildlife, and even help keepers save time and increase impact.

Introduction

As institutions, zoos have come a long way in the attempt to foster a culture of exemplary animal care and engagement in conservation worldwide. Though zoos have made a serious impact in the last several decades, the most critical partners in our success and progress are the people who visit. Zoo guests contribute important financial opportunities that allow for the institutions to not only contribute to conservation programs but to continue to introduce future generations to the animals they are sworn to protect. Without their continued interest and dedication, the reach of zoos would be little to none. Thus, it is critical for zoos to foster a relationship with their guests that is positive and influences continued support. By treating every guest as a potential partner in conservation and taking the time to make a connection with them, we gain a loyal following who will speak up for animals as well as for the zoo.

At Cheyenne Mountain Zoo (CMZ), we frequently utilize a concept called a defining moment. Many animal care professionals can pinpoint specific experiences that helped to shape their career and fuel their passion for animal conservation. Every animal keeper at CMZ individually aims to create this same type of experience for at least 200 guests per year. These are generally very quick interactions, and could include asking a guest to help set up enrichment, feed an animal, take a peek into a service area, etc. While there are many variations, the common goal is to provide an experience that will be remembered for a lifetime. The animals in zoos are important ambassadors because they make the "cool nature video" tangible.

When guests have an opportunity to interact first-hand with animals, they gain a better understanding and care for them. Humans protect the things they care about, and it's our job to show them that the world's wildlife deserves our care and protection.

Multitasking to make a difference

Animal keepers are familiar with the concept of setting people up for success when it comes to conservation. Give them quick and easy tasks that won't take much extra effort, and they are far more likely to adopt new habits. Take a look at the items on your daily to-do list and, if it's not there already, add "inspire someone". It may seem overwhelming, but is there a quick and easy way to shorten that list while still getting it all done?

While it is our job to inspire conservation-mindedness in several hundred to several thousand zoo-goers each year, it is not our *only* job. A keeper's job includes ensuring safety of both people and animals, general animal husbandry, cleaning public spaces, providing stimulating enrichment, keeping accurate records, and more. In short, multitasking is something most animal keepers find necessary for efficiency during a sometimes unpredictable work day. Along with all of the typical daily routine, the creation and presentation of engaging and dynamic animal shows is becoming an increasingly important part of a keeper's job. At CMZ we have used these shows as a moment to tackle many of the essential parts of our daily routine. Keepers often combine veterinary exams, animal training and defining moments over the course of a keeper talk to maximize time and impact. Incorporating guest interactions into the animal training or health checks helps to further our own goals and instills a sense of wonder into the people with whom we interact. If a guest learns, even briefly, the feeling of having responsibility for the daily care of an animal through participation in training, it becomes easier to translate this responsibility into a renewed dedication to our shared planet.

Guest participation in keeper talks

Keeper talks are some of the best opportunities to reach a large audience within a small window of time. Steve Martin, president of Natural Encounters, Inc., says that shows provide guests with "...a close encounter with a live animal demonstrating species-appropriate behavior [that] can leave a lasting impression in the minds of zoo visitors" (Martin, 1999). There are so many ways to make sure your talk is engaging and educational, but personalizing it to your audience and involving them in the process makes it exceptional. Keepers are often told to start big and end bigger, and to sandwich the conservation message somewhere in between. We try to make sure our conservation message is short and sweet, but also compelling and memorable. Most talks include simple, everyday actions anyone can do to help save our world's ecosystems. In a look at some of the most successful conservation programs, Barbara Heidenreich (an animal trainer who consults with zoos around the world) found that in each case "...individuals focused on a very specific issue and then accepted the responsibility of making a difference. They then went on to share the information they had and to generate awareness and gather support" (Heidenreich, 2000). Finding ways to include a defining moment into the show itself impacts the chosen guest, their family or friends who are present, and the people they will go on to share their story with for years to come.

Many keeper talks at CMZ incorporate some form of defining moment with an audience member. In the Rainforest Review show, a gibbon brings a message in a bottle to a zoo guest, who holds the message up to reveal the logo for Forest Stewardship Council. One of the most memorable parts of the Amur Leopard show is initiated when a volunteer from the crowd pulls a cable to release a prey item into the exhibit. The prey, a 9 kg (20 lb) section of braided fire hose, plummets into the leopard exhibit and Anya the leopard springs into action to drag it past the cheering crowd, across the exhibit, and up a 6 m (20 ft), near-vertical mountainside. Guests are able to see the leopard utilize her natural adaptations and the experience is just a little extra special for one guest and their family. During the Snow Leopard Show at CMZ, someone is always chosen from the audience to hold a target stick up for our snow leopard to hunt down. Because it is a part of our show, it takes no extra time and still carries a big impact.

The impact of a quick moment in a keeper talk can be far-reaching. A family seen frequently at CMZ credits their decision to purchase a membership to a specific interaction with our snow leopard, Bhutan. In speaking with these guests, keepers learned that more than a year ago, their daughter was chosen to participate in the snow leopard show. What seemed like a small moment to keepers was life-changing for that little girl. Through this interaction, snow leopards have gained a lifetime supporter. The family now donates regularly to the Snow Leopard Trust, an organization that spearheads conservation in the leopards' native territory. Their zoo membership allows them to visit Bhutan as frequently as they wish and a portion of their membership fee is utilized for conservation efforts around the world.

Training new behaviors

Most keepers have likely encountered moments where the resources available for a task were less than ideal. We are familiar with finding fixes to bigger problems with simpler, handy items (like fixing a broken belt buckle with a zip tie). As much as managers try to make sure we have ample staff members to help us achieve our goals for animal care and training, the fact is that sometimes we are short-staffed. At CMZ, we operate under the creed that our guests are, first and foremost, partners in our quest to protect the species we love. So why not use this partnership to help in times of need?

Defining moments like the targeting behavior in the snow leopard show are found nearly across the board in CMZ's keeper talks. With each moment, a guest establishes an important relationship with the ambassador animal and the zoo itself. Most of these behaviors are trained from start-to-finish during scheduled talks, so guests take on an integral role in the training process. These behaviors can heavily impact guests but they also often have an impact on the quality of life of the animals in our care. Steve Martin encourages the use of training as enrichment in animal lives because "Positive reinforcement training creates a stimulating environment that gives animals control, an opportunity to make decisions, then the opportunity to experience the consequence of those decisions. Training gives an animal the ability to 'earn' a living, a most natural and innate behavior" (Martin, 1999). When you incorporate training into shows and guests into the training (whether it's a natural behavior or not) you are helping guests to provide a stimulating environment for your animals. This creates a reinforcing environment in which the guest is reinforced by the special connection, the animal is reinforced by the training and we as keepers are reinforced by the success of the animal and the shared love for a cause we care about.

Husbandry behaviors are incredibly important in ensuring the health and quality of life of the animals in our care. Often, husbandry behaviors require multiple hands on deck. We want our animals to be comfortable with new people in the event of a change in staff or a visit from the vets. Some of the behaviors themselves - like checking the abdomen of a North American porcupine - require a trainer as well as a mechanic to apply a light touch to the porcupine's stomach. Guests can easily be taught the behaviors of the mechanic role and then can lend a helping hand in establishing the behavior.

Guests have helped keepers to train a number of different behaviors: both husbandry and natural behaviors alike. In the amur leopard show, one of the amur leopards walks across a log that sits along the top of the exhibit glass so it looks like the leopard will walk right out into the crowd of guests. This behavior was trained utilizing a guest who could stand and hold a target stick at the front of the exhibit while the keeper cued and reinforced from the top of the exhibit. In the orangutan show, an orangutan comes up to the glass and picks an orangutan-friendly product from two boxes of breakfast cereal held in different spots by a guest. One guest is able to have the unique interaction, but the entire crowd is learning how to shop for sustainable palm oil. Guests help by being uniquely themselves and never holding the images in the same place, trying to trick the orangutans. The grizzly bears were asked to be a part of a zoo ad campaign to highlight just how much of a connection guests can make with animals when they visit zoos. This required a trainer occupying one bear while another worked with the other bear to ask them

to high-five through the glass. Kids were happy to wait for a high-five from a bear through the glass! The bears learned a new behavior, several kids got a hand-to-paw memory to last a lifetime and CMZ ended up with a beautiful behavior to contribute to the ad campaign. While these behaviors could have been trained without guest involvement, they were completed more quickly and made a larger impact with this special set of extra hands.

Hearing a keeper explain the process of training a moose for dental radiographs is impressive in its own right, but sometimes participation has the biggest impact. When CMZ's Canada moose, Tahoma, was in the process of learning this new husbandry behavior, his trainers needed a lot of help. We knew that the finished behavior would involve four people: one to hold the x-ray plate, one to operate the portable x-ray machine, one to change the settings on the machine, and one to guide the moose face. We had old lead aprons to wear, an old x-ray plate, and a cardboard box painted to look like a portable x-ray machine. All of the practice equipment was ready to be used, but we didn't have time for four keepers to go help with training several times a week. Luckily, we had plenty of guests willing to dress up and pretend to be veterinary technicians! Tahoma is used to meeting strangers, and had no issue accepting that different people were holding the faux x-ray machine each training session. It was clear to guests passing by that something interesting was going on, and most stopped to observe. The most fascinated and excited guests seem to be children and teenagers considering a future career in the animal, conservation, or veterinary fields. They ask amazingly insightful questions, and are totally absorbed with watching the process. One such child, Emma, is a regular visitor to CMZ. She has helped keepers with moose training, and she and her parents appreciate the opportunity to experience and learn about a potential career path. Emma now regularly inspires her peers in zoo camp and always makes an effort to seek out her favorite keepers with each visit to learn more about her future career.

Guest participation during veterinary procedures

The Association of Zoos and Aquariums Animal Welfare Committee defines animal welfare as an animal that is "...healthy, comfortable, well-nourished, safe, able to develop and express species-typical relationships, behaviors, and cognitive abilities, and not suffering from unpleasant states such as pain, fear or distress." Quality of life is a multifaceted and complex concept, and veterinary care is undoubtedly an important component. When veterinary staff and keepers are interacting with an animal on exhibit, there is bound to be a crowd of curious onlookers. Many zoo-goers have personal experiences that allow them to easily relate to a vet procedure. It may be that they took their cat to the vet last week and are now watching a lynx get a check-up, or that they are commiserating with a tiger who has broken a tooth, or a moose with arthritis. So take advantage, bring a microphone and biofacts if able, and explain exactly what is going on.

Even the most informed guests are sometimes unaware of the extent of the care that zoos provide our animals. Incorporating a routine vet check-up or medical procedure into a talk is a step forward in connecting guests to the animals and their care. However, many guests may feel nervous interrupting a procedure for clarification or explanation. Often, when a zookeeper initiates a dialogue with an observing guest, the floodgates open and the questions come pouring out. Imagine the impact if a guest was asked to participate in a procedure, instead of simply observing! When guests participate in veterinary checks, this can leave a lasting impression on our guests and they can act as a second set of hands to help free up the time for other staff.

At CMZ, we have utilized guest involvement to help with a number of important husbandry behaviors. During the grizzly bear show, we often ask guests to hold a flashlight up to a bear's open mouth so keepers can take a good picture to send to the dentist. There is something unforgettable about standing in front of a bear and being able to safely peer into his mouth. Guests always walk away saying, "I can't *believe* I was that close to a grizzly!" When asking Canada moose, Tahoma, to stand on the large animal scale, keepers like to make a bit of an impromptu keeper talk around the occasion. Everyone in the ever-growing audience is asked to guess how much they think the moose weighs, and one or two guests are then enlisted to read out and rec-

ord the weight. Keepers focusing on whether or not Tahoma is fully on the scale then get a weight without the stress of having to jump between the moose and the scale reading. With the dry climate in Colorado, the zoo's two Nile hippos sometimes need to have a sprayable lotion applied to keep their skin in great condition. Guests of all ages love being able to apply the lotion using a spray bottle. For most people, these are experiences they never even imagined as a possibility but will now remember for the rest of their lives.

These quick guest moments can also translate into more involved processes. There is a geriatric mountain lion at CMZ, Motega, who has severe arthritis, which means that he often moves with a slight limp. When our vet team prescribed weekly laser therapy, we had the option to complete this treatment in the privacy of an off-exhibit den space. Instead, we chose to utilize a training space visible from the public walkway, which allowed us frequent chances to interpret the training and healthcare provided for zoo animals to our guests. The laser therapy requires Motega to stand still in various positions against a training panel for five minutes. While the trainer cues the behavior and provides reinforcers to the mountain lion, another person is needed to apply the laser to affected joints. Keepers were able to involve zoo guests directly throughout the training and treatment process, and several key benefits were observed. There was always someone willing to stand in as our laser operator, which meant that we could work on training even when vet staff was unavailable. Motega is also one of the zoo's most confident animals when it comes to strangers, meaning that he trains for nearly anyone and in almost all situations, which in part was helped by the changing out of the mechanic in the laser therapy sessions. Motega now participates in his laser therapy treatments on exhibit during a weekly mountain lion talk, much to the delight of our guests. The keepers get to provide care for an animal they love, a memory to last a lifetime for at least one guest, and valuable information to a large crowd of people. Guests have approached keepers with a range of reactions: pleasantly surprised, pleased, reassured, grateful, proud, and encouraging.

What can you do and why should you do it?

"Far more than any book, television, or teacher can convey, a close encounter with a live animal demonstrating species-appropriate behavior can leave a lasting impression in the minds of zoo visitors" (Martin, 1999). So what can your institution do to further connect guests with the animals in your care?

As always, first think about the animals. Are there any behaviors that are top priority to be trained? Do you need any help training these behaviors? Would an untrained person be able to help safely? Think of simple tasks that someone could do to help you train a behavior. Think also about the messages you want to send to your guests. Do you want them to go home with a greater respect for the care zoos provide for their animals? Do you want them to go home fired up and ready to save a species you love? Think of ways that you can have an animal deliver a conservation message to the guest directly. Think of a way that a guest can stimulate a natural behavior in an animal. The possibilities are endless and the result will be incredible.

Conclusion

Incorporating guest interactions and defining moments into the animal training that takes place on a day to day basis is a wonderful and effective method of "connecting people to wildlife and wild places" (CMZ, 2018). By facilitating an unforgettable encounter between a human and an animal, keepers increase the likelihood that a reaffirmed or newfound appreciation for the natural world will translate into conservation actions. These defining moments are useful from a conservation standpoint, but can also serve to help keepers train a behavior faster or even allow for important veterinary procedures to take place. When keepers make an effort to provide these potentially life-changing moments to zoo visitors, our guests can transform into our partners in conservation.

References

Association of Zoos and Aquariums (2018). Animal Welfare Committee. Retrieved 27 March 2018, from https://www.aza.org/animal_welfare_committee

Cheyenne Mountain Zoo (2018). Mission & Vision. Retrieved 10 March 2018, from http://www.cmzoo.org/index.php/about-the-zoo/zoo-facts/mission-vision/

Heidenreich, B. (2000). The Power of One. Retrieved 20 March 2018, from http://naturalencounters.com/site/wp-content/uploads/2015/11/The_Power_of_One-Barbara_Heidenreich.pdf

Martin, S. (1999). Enrichment: What Is It And Why Should You Want It? Retrieved from http://naturalencounters.com/site/wp-content/uploads/2015/11/ Enrichment_What_It_Is_And_Why_Should_You_Want_It-Steve_Martin.pdf

Training Killer Whales (*Orcinus orca*) for Behavioral Audiograms

Shawn Connor and Doug Acton
SeaWorld San Antonio

The widespread distribution of killer whales (Orcinus orca) makes them particularly susceptible to the negative impacts from anthropogenic noise, but previous audiometric data on this species was limited. Eight killer whales housed at SeaWorld San Antonio and SeaWorld San Diego were conditioned to respond to underwater tones to determine their auditory thresholds from 100 Hz to 160 kHz under precise scientific conditions. Over 1500 trials were performed with each whale for the study, in which motivation and behavioral consistency was maintained through the use of variety in reinforcement delivered in variable ratios. This data collected on audio thresholds has increased our knowledge of killer whales' hearing ranges, which has significant conservation value in empowering policy makers to protect wild killer whales from noise pollution.

Introduction

Killer whales (*Orcinus orcas*) are a widespread species often times found close to shore and near human settlements. Like most marine mammals, killer whales have adapted to living in the marine environment utilizing their acute sense of hearing to navigate their environment, forage, and communicate. Since killer whales require their sense of hearing for survival, anthropogenic noise could pose a threat to them in a variety of ways. Killer whale behavior in the Pacific Northwest of the United States has been shown to be significantly affected by vessels within 100 m of them; often times leading to less foraging behavior and more traveling (Lusseau, Bain, Williams, & Smith, 2009). These factors may result in decreasing the fitness and survival of a population of whales, making anthropogenic noise a conservation concern (Lusseau et al., 2009; Williams, Erbe, Ashe, Beerman, & Smith, 2014).

Killer whale hearing ranges have been studied in the past; however the sample size was limited to just three individuals, from two separate studies (Hall and Johnson, 1972; Szymanski, Bain, Kiehl, Pennington, Wong, & Henry, 1999). A larger sample size would increase our knowledge of the species' hearing ability allowing us to better understand them (Branstetter, Leger, Acton, Stewart, Houser, Finneran, & Jenkins, 2017).

In the current study, eight killer whales from SeaWorld San Diego (SWSD) and SeaWorld San Antonio (SWSA) were conditioned to perform a behavioral audiogram using a variety of behavioral modification techniques to achieve consistent data. This paper details those methods and the training process of two male killer whales, housed at SWSA.

Methods

Participants

The two whales in SWSA have extensive experience participating in behavioral modification programs, both having been trained on many behaviors prior to this study. Both were adult males, one 16 years old and the other 24 years old.

Facility

SWSA consists of four pools in which the killer whales live; three large pools and a husbandry pool. The husbandry pool was chosen for this study because it had the least amount of ambient noise levels which could affect the audiogram results. Three female killer whales of varying ages also live in the same facility as the two males studied. While audiograms were being performed, trainers would utilize differential reinforcement techniques on the nonparticipating whales to reinforce quiet behavior (Kazdin, 2001). This lead to less ambient noise levels in the pools resulting in better audiogram data.

Performance of the Audiogram

The complete performance of the audiogram had many segments that were necessary to be sure to keep the scientific integrity of the experiment. First, the whales needed to be in a quiet space so ambient noise wouldn't interfere with the audiogram. This is why the husbandry pool was used. Second, the whales needed to be fully submerged underwater, and have a measured distance from their lower jawbone and ears to the speaker from which the tones of the audiogram were played. This allowed for the sounds that the whales heard to be consistent and measureable. So a hearing test apparatus was constructed. This apparatus hung onto a gate in the animals' environment and had a disc located on a bar that extended from the gate. The whales were trained to rest their rostrum on this disc so that the distance from their ears to the speaker (located on the other side of the gate in an empty pool) would also be consistent (Branstetter et al. 2017).

Tones would then be played from the speaker at varying frequencies and volumes. Each tone trial was approximately 2.5s in duration: 500ms of silence, and 500ms of the tone being played (Branstetter et al. 2017). In order to know if the whales heard the tone they were trained to produce a vocalization known as a "raspberry" (which is produced by letting out a burst of air from their blowhole) when they heard the tone. "Catch trials" or silent trials would also be a part of the whales training and data collection. When no tone was played, the whales were reinforced for remaining still and quiet on the apparatus (Branstetter et al. 2017). This was important for the scientific integrity of the experiment because it ensured that the whales were only responding with a raspberry to the tones, and not to any other possible environmental stimuli. For the purposes of the study, if the whales produced the raspberry vocalization after a tone was played; it indicated that the whales heard the tone. If they did not perform the raspberry after the tone was played, it indicated that the whales did not hear the tone (and was recorded as a "miss"). This acted as the basis for creating the audiogram of the whales' hearing thresholds.

The trainers interacting with the whales at the time of the experiment were also "blind" (or unaware) to whether or not a tone or catch interval was played through the speaker (Branstetter et al. 2017). This was also done to minimize the chance that the whales could possibly be responding to any environmental stimuli other than the tones, in case the trainers were to accidently give one. Because of this, a person removed from the trainer and the whale would communicate to the trainer whether or not a tone or catch interval was played only after the whale responded with a raspberry or not.

A computer generated the sequences of tones and catch intervals throughout the audiogram. This made sure that the audiogram sequences were kept random. This also mitigated the chance of the whales responding to a certain pattern or sequence of intervals to be sure that they were only responding to the tones. All of these methods protected the scientific integrity of the experiment. The entire duration of the whales' dives consisted of a series of tone (or catch) trials that were done randomly from a range of 1 to 30 trials when performing the audiogram (Branstetter et al. 2017).

Conditioning the Whales to Perform the Audiogram

The whales were conditioned to participate in the behavioral audiograms using behavioral modification techniques used by Sea-World trainers. The basis of this technique utilizes operant conditioning with a focus on using positive reinforcement (Kazdin , 2001). Both of these whales had a wide variety of behaviors in their repertoire prior to beginning the training process for this study which were utilized. Some of the behaviors included conditioned movements between pools (such as shifting a whale from one of the larger adjacent pools to the husbandry pool in which the audiograms were conducted), creating the vocalization known as the "raspberry," and wide a variety of other behaviors which allowed for the delivery of reinforcement.

First, an individual whale was shifted into the husbandry pool. The first aspect to conditioning the whales to perform the audiogram was teaching them to station onto the metal disc of the "hearing test apparatus." The whales were conditioned to station onto the metal disc when presented with a discriminative stimulus (cue) from their trainer. The cue was the trainer pointing with an index finger from the whale to the hearing test apparatus. Trainers differentially reinforced the whales for having their rostrum rest still against the metal disc of the apparatus. Once the whales consistently rested their rostrum against the metal disc, reinforcement was contingent on the whales submerging their entire bodies underwater and for the whales to be silent. This method of behavioral conditioning is known as "shaping" (Kazdin, 2001). The end result of the whales' behavioral conditioning with the apparatus was to be fully submerged, still, and quiet while on the apparatus (see Figure 1).

Fig. 1. A whale correctly stationed onto the Hearing Test Apparatus. The whale is fully submerged, quiet and resting his rostrum onto the disc.

The whales were then conditioned to respond to the underwater tones of varying frequencies and volumes of sound levels by producing the raspberry vocalization. The raspberry vocalization was already in the whales' repertoire of behaviors that the trainers had under stimulus control. This discriminative stimulus consisted of the trainer "pointing down" with their index finger. The trainers had to condition the whales to use the new tones as a discriminative stimulus for the raspberry vocalization. This was done by having the tones (of varying frequencies and volumes) played while the whales were stationed on the apparatus and the trainer gave them the raspberry stimulus with their finger. Reinforcement was given to the whales for performing the raspberry vocalization while the tones played. Over time the trainers were able to fade the visual stimulus, and the whales would vocalize with the stimulus of the tones alone. These tones now acted as a discriminative stimulus for the raspberry vocalization.

The whales were conditioned to stay stationed onto the hearing test apparatus until given a cue to return to their trainer. The "return to trainer stimulus" was a hand tapping on the surface of the water by the whales' trainer. This discriminative stimulus also acted a "terminal bridge" for the whales. The terminal bridge indicated to the whales to return to their trainer and they may receive reinforcement from the trainer. Intermediate bridges were also used throughout the audiogram. An intermediate bridge consisted of the use of a previously conditioned reinforcer of the blow of a whistle, which the whales had an intensive history with through past learning. This intermediate bridge was used during the process of the audiogram to provide the whales with

immediate reinforcement for correctly producing a raspberry vocalization after a tone was played, or correctly staying quiet on the apparatus after a catch interval.

After an intermediate bridge was given another tone or catch series could be played while the animal stayed on the apparatus. This allowed for many trials of tones to be played during a single dive down to the apparatus. The trainer would present a hand tap to end that series of trails in the dive with the whale. The whale would then return to the trainer and could receive more reinforcement at that time.

Reinforcement for Performing in the Behavioral Audiogram

A reinforcement schedule of variable ratio of reinforcement variety (VRRV) was used to reinforce the whales. This is the same reinforcement schedule which SeaWorld trainers widely use to modify the behavior of the animals in their care (Animal Training Philosophy at SeaWorld & Busch Gardens). This reinforcement schedule utilizes a schedule of reinforcement that is known as a variable ratio (VR) (Kazdin, 2001). In addition to the VR, a large variety of reinforcements are used to condition behavior.

The duration of the whales' dives consisted of a series of tone (or catch) trails that were done randomly from a range of 1 to 30 trails when performing the audiogram (Branstetter et al. 2017). This allowed for the variable ratio of reinforcement used by SeaWorld trainers. Trainers had the choice of reinforcing the whales with a variety of reinforcement following the duration of a dive, or to have the whales participate in another dive. This maintained the variable ratio used in the training process.

A variety of reinforcement was available to each trainer when interacting with the whales during the audiogram. Each trainer was encouraged to use reinforcement he or she felt would best maintain the behavioral conditioning of the behaviors involved in the audiogram. This reinforcement included both primary reinforcement (which consisted of fish fed to the whales) and conditioned (or secondary) reinforcement. Primary and secondary reinforcement is known to increase the frequency of behavioral responses that it is used in association with (Kazdin, 2001). Table 1 is a list of some of the many reinforcement techniques used with both whales to maintain their behaviors during the study.

Reinforcement	Explanation
Primary	
Feed	Trainers gave the whales a varying amount of food.
Secondary	
Tactile	One or more trainers would provide tactile stimuli to the animals by giving them a rub down on different parts of their body.
Ice	Trainers would offer the whales ice by tossing it into their mouths.
Ice Water Pour	Trainers would pour a mixture of ice and water into the whales' mouths.
Visual	Whales were presented with a variety of visual stimuli that is not typically in their environment. Examples include: showing the whales plush animals, trainers creating "dancing" movements with their bodies, presenting mirrors for the whales to look at, and bubbles blown into the air from the trainer.
Hose Playtime	A hose was brought poolside to be used to interact with the whales. Trainers interacted with the hose and the whales either by spraying water into their mouths or onto their bodies for reinforcement.
Environmental Enrichment Devices	The whales have an intensive reinforcement history with many enrichment devices. These enrichment devices would be presented to the whales to interact with either alone or with their trainer. These devices range from many different kinds of materials, shapes and sizes including: durable fire hoses fashioned together for the whales to play with, large high density planters which could be filled with ice for the whales to have, braided PVC hoses formed into a hoop shape.
Edible Enrichment Playtime	Certain enrichment items can be offered to the whales to interact with, which if they were to consume the item it has been deemed safe by SeaWorld veterinarians. These items include unflavored gelatin and kelp. Trainers would interact with the whales with these items or the whales would interact with the items on their own time.

Table 1. Examples of reinforcement which was used to condition and maintain behaviors the whales performed in association with the audiogram. This list is not limited to all types of reinforcement used.

Response to the Whales Not Meeting Criteria for Reinforcement

There were occasions when the whales did not meet the criteria to receive reinforcement for parts of the behavioral responses necessary for the study to be completed. Examples include incorrect stationing on the hearing test apparatus (the whale not being fully submerged or not having their rostrum on the disc) or the whale having missed a tone for the audiogram. If the whales did not meet criteria for these behavioral responses standard SeaWorld training methods and protocols were followed. This includes offering the animals no reinforcement for the behavior, and then following a chain of behavioral events known as the "Least Reinforcing Stimulus or Scenario" (the "LRS") (Scarpuzzi et al. 1991). This behavioral modification tool uses extinction methodologies to decrease below-criterion responses (Scarpuzzi et al. 1991). The LRS also allows the animal another opportunity for reinforcement to occur following the withholding of reinforcement as long as the animal emits calm behavior through the events of a LRS (Scarpuzzi et al. 1991).

There were also occasions when the whales would not meet criteria for reinforcement while responding (or not responding) to tones. In the event that a tone was played, and the whales did not respond with a raspberry it was documented as a "miss" (Branstetter et al. 2017). This was critical to finding the thresholds of the killer whales' hearing ability. There were also occasions when the whales would raspberry during times of a catch series of no tone being played. This was known as a "false alarm." This also did not meet criteria for reinforcement, as criteria in these times were for the whales to remain on the hearing test apparatus and to be silent. During these times standard SeaWorld methods of the LRS were applied again, with no reinforcement being delivered to the whales (as in no conditioned reinforcement of the whistle being blown). There was then a

pause following the incorrect response which served as the LRS until the next stimulus was given to the whale (of another tone being played, a catch series, or ending that particular dive series with a hand tap by the trainer).

This wide variety of reinforcement applied in a variable ratio allowed the SeaWorld trainers to maintain the whales' motivation to participate in the behavioral audiogram. It also allowed for the behavioral audiogram to maintain consistent data. It is important to note that incorrect responses were necessary to find the proper hearing threshold of the whales through the use of a "miss" being emitted (Branstetter et al. 2017). Since these incorrect responses were integral to the study the trainer's reinforcement history with the whales and the LRS was also extremely important. The trainers needed a well-balanced reinforcement history between the whales and the LRS to maintain their calm behavior during the absence of reinforcement, and for motivation to continue on with the audiogram.

Results and Discussion

Using the behavioral modification techniques as described we were able to successfully train both male killer whales to reliably respond to the behavioral audiogram. Over 1500 trials were completed with each of the whales trained to participate in the behavioral audiogram. The combined data collected from all eight killer whales who participated in this study has also created a larger sample size. This data has led to finding more information on the killer whale's hearing ability, including the frequency range of their greatest threshold sensitivity (Branstetter et al. 2017).

This information can now be used to allow for better interpretation of the effects of anthropogenic noise pollution on killer whale populations in the marine environment. With a better sample size and understanding of the auditory thresholds of the killer whale's hearing range it is our hope that this data may be used to help wild populations of whales who are affected by noise pollution.

This study also serves to show how animals in zoological environments offer opportunities for scientists to learn about their biology. The animals are conditioned to participate in research studies that help gain knowledge that would otherwise be impossible for scientist be attain. This knowledge can then be applied to conservation initiatives to assist with the preservation of the natural world. This reinforces how the zoological world does play an important role in conservation and caring for our planet.

Acknowledgements

The authors would like to thank Dr. Brain K. Branstetter, Judy St. Leger, John Stewart, Dorian Houser, James J. Finneran and Keith Jenkins for their involvement with this study. Their guidance in collecting and interpreting the data was pivotal in allowing this to be a success. We would also like to thank our colleagues of animal trainers both at SeaWorld San Diego and in San Antonio for helping condition all the whales to participate in the study giving us a better understanding of killer whales.

References

Animal Training Philosophy at SeaWorld & Busch Gardens. (n.d.). Retrieved February 26, 2018, from https://seaworld.org/en/animal-info/animal-infobooks/animal-training/animal-training-philosophy

Branstetter, B. K., Leger, J. S., Acton, D., Stewart, J., Houser, D., Finneran, J. J., & Jenkins, K. (**2017**, April 5). "Killer whale (*Orcinus orca*) behavioral audiograms," The Journal of the Acoustical Society of America, 141(4), 2387-2398. doi:10.1121/1.4979116

Hall, J. D., and Johnson, C. S. (**1972**). "Auditory thresholds of a killer whale (*Orcinus orca*) Linnaeus," J. Acoust. Soc. Am. **51**, 515–517.

Kazdin, A. E. (**2001**). "Behavior modification in applied settings," (6th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Lusseau, D., Bain, D., Williams, R., & Smith, J. (**2009**). "Vessel traffic disrupts the foraging behavior of southern resident killer whales *Orcinus orca,*" *Endangered Species Research,* **6**, 211-221. doi:10.3354/esr006211

Scarpuzzi, M. R., Lacinak, C. T., Turner, T. N., Tompkins, C. D., & Force, D. L. (1991). Decreasing the frequency of behavior through extinction: an application for the training of marine mammals. *Proceedings of the International Marine Animal Trainers Association,* 19, 113‡120.

Szymanski, M. D., Bain, D. E., Kiehl, K., Pennington, S., Wong, S., & Henry, K. R. (**1999**). "Killer whale (*Orcinus orca*) hearing: Auditory brainstem response and behavioral audiograms," *The Journal of the Acoustical Society of America,* **106**(2), 1134-1141. doi:10.1121/1.427121

Williams, R., Erbe, C., Ashe, E., Beerman, A., & Smith, J. (**2014**). "Severity of killer whale behavioral responses to ship noise: A dose–response study," *Marine Pollution Bulletin,* **79**(1-2), 254-260. doi:10.1016/j.marpolbul.2013.12.004

A Change in the Flight Plan: Giving Rescued Macaws a Choi

Emily Yunker, Animal Programs Specialist
Columbus Zoo and Aquarium, Columbus Ohio

In September 2017 the Columbus Zoo and Aquarium was made aware of an animal hoarding situation in Enterprise, Alabama. During a confiscation of over 60 dogs, a wildlife officer found 16 macaws in cages wrapped in tarps. A local sanctuary was temporarily housing the macaws, but being a non-profit native wildlife rescue they did not have the ability to care for all of the birds long term. The Columbus Zoo agreed to take all sixteen macaws and assume responsibility for their welfare and placement. With little to no information available on any of their physical conditions or history, the birds had to be restrained for health exams by the zoo's vet staff. Many medical issues were uncovered, including a young hyacinth macaw with old fractures in both legs, a scarlet macaw with a coelomic hernia likely from overbreeding, and a scarlet macaw with a ruptured air sac. Through building trusting relationships with positive reinforcement training we were not only able to improve their quality of life, but also give them a choice to participate in their own healthcare. Voluntary radiographs, ingestion of barium, and removal of air from under the skin are just the beginning stages of creating stress-free and healthful futures for these birds. Despite the fact that all of these macaws came from the same situation, they remain different individuals. Therefore, training was modified to accommodate each animal's needs, making this truly a study of one, and laying the framework for future rescues and conservation efforts.

Introduction

Through a mutual connection, the Columbus Zoo was made aware of an animal hoarding situation in Enterprise, Alabama. The Dothan Animal Shelter confiscated 65 dogs from a local residence and they also discovered 16 macaws in caging under a large tarp in the backyard. The birds' living conditions were absolutely deplorable, including molded tubing as a water source and sub-par cages that provided next to no light for the birds. The caging was constructed for breeding with no doors, just an opening in the nest boxes. This suggested that the birds' enclosures were not regularly cleaned, the birds were not frequently socialized, and any eggs laid were transferred straight into incubators that were attached to the caging. Additionally, the only food items found on the premises were wet dog food and sunflower seeds. Since the cages in which the birds were kept didn't have any doors, when Big Bend Wildlife Sanctuary assisted in the rescue they had to cut through each cage to get the birds out. Being a non-profit wildlife sanctuary and rehabilitation center, Big Bend Wildlife Sanctuary relied on donations of caging and food from the local community. The birds remained at Big Bend Wildlife Sanctuary for 6 months before we heard about the situation. Even though assisting in rescues are not something we typically do, we felt compelled to help and drove to Alabama to assess the situation and pick the birds up.

Some macaw species are endangered and the opportunity to add them to an animal programs setting would be ideal to further education about macaws in the wild. These individuals were unique from other ambassador animals we have worked with due to their unfortunate history, but would provide an amazing platform to help educate others of their plight in the pet trade. There was a potential to develop these birds into program animals, but before we could do so, we needed to assess their health.

Health Exams

The birds that were rescued included an older breeding pair of hyacinth macaws, a breeding pair of scarlet macaws, a pair of young hyacinth macaws, a single hyacinth macaw, a blue throated macaw housed with a harlequin macaw, a blue and gold macaw housed with a blue throated macaw with three of their hybrid offspring, and finally a scarlet macaw housed with an unidentifiable scarlet macaw hybrid. Considering the terrible conditions that these birds were found in, we were not shocked to discover that many of them had health issues. Their health had improved after being fed a more appropriate diet and getting some natural light at Big Bend Wildlife Sanctuary, but we still had some concerns.

Through initial visual inspection, we noted missing toes, feather plucking, stress lines in the feathers, swollen joints, and several other signs of malnutrition and past trauma. Since we had no history on any of these birds, our vet staff performed preliminary health checks on each of them once we returned to Columbus. Each bird was sedated for a thorough exam, which included blood work, radiographs, and body evaluation. Unfortunately, a blue and gold macaw was lost during the initial exams. The necropsy suggested he had multiple underlying health issues involving an enlarged liver and spleen. Pathology also showed lung disease. We also discovered that the harlequin macaw was egg-bound, meaning that due to lack of nutrition, the egg never fully calcified causing it to fuse to organs inside her body. Despite the best efforts of our veterinary staff, she did not survive these complications. Several of the birds were actively plucking themselves or being plucked by another bird. A blue throated macaw was noted to have a contracture of one wing and a metacarpal fracture on the other. There were three birds that required more extensive medical attention; a pair of scarlets and a hyacinth macaw. The scarlet macaw hybrid had a coelomic hernia, potentially containing part of its gastrointestinal (GI) tract. If the GI contents were strangulated, it could potentially cause a life-threatening emergency; however, since the body wall seemed old, the vets said it was unlikely. To make sure, they still wanted to confirm what exactly was in the hernia and if surgery was necessary. The bird she was paired with, a male scarlet, also required attention for a ruptured cervical air sac that would need to be aspirated. Our last main health concern was the single hyacinth. She was acting lethargic and post exam was found to have old fractures in both legs which likely explained her limited mobility.

Back to the Basics

The first few months at the zoo were spent getting the birds settled in. We made sure they were eating the right foods and were thoroughly enriched. We focused our attention on the three macaws with pertinent medical cases first: Nigel, the scarlet with the ruptured air sac, Grover, the single hyacinth with old leg fractures, and Adele, the scarlet hybrid with the coelomic hernia.

After making sure everyone was stable and settled in, we started to create training plans for Nigel, Grover, and Adele. We began from square one, building our relationships through positive reinforcement, starting with offering the birds some high value reinforcers through their caging. Once they were comfortable taking food from us through the caging, we opened the door and began to hand-feed them. They always had the ability to walk away from us, but when they took steps towards us, they were reinforced with nuts and seeds. After everyone learned to step up onto our hands and step onto a scale to get weighed, we trained them to voluntarily walk into a crate. Once the basics were established, our concentration shifted from basic husbandry behaviors to individualized medical behaviors. The first behavior the vet staff asked us to train each bird to do was participating in voluntary radiographs. We placed a perch on the x-ray table that they could step onto and reinforced them for maintaining position and standing still.

Cervical Air Sac Rupture (Nigel)

When the scarlet macaw with the ruptured air sac had his initial exam upon arrival at the zoo, the vets aspirated it to reduce it to normal size. Over time the body cavity around it had filled back up with air. His trained x-ray behavior allowed the vet staff to measure the amount of air trapped in his body. In December, the air sac distension was 14 centimeters in diameter. They stated that it had the potential to heal, but that they would have to continue to catch him up and aspirate it. Our head vet, Dr. Junge, asked if it would be possible to train him to allow them to aspirate the air sac without restraint. I set out to create a training plan. First, I needed him to let us touch the air sac so we knew where to insert the needle. To start out, I asked him to sit on a perch, picking one side to reinforce him on. I wanted to give him the option to move away in hopes of creating more reliable behavior by giving him more control of his environment (Martin, 2016). With small approximations he was reinforced by a secondary trainer for moving towards my hand until I was able to touch his neck area. The secondary trainer reinforced when I bridged for movement towards my hand, and then facing forward and remaining still once he was in the proper position. After the initial touch, I increased the duration of touching until we were able to palpate the entire area.

The next step was adding in the poke of the needle. While palpating the inflated area of his neck, I brought in my other hand using small approximations until I was able to probe the air sac with my finger. After he was comfortable with this, I added in a blunted needle with a tube attached to a syringe. Using the same approximations utilized when introducing the hand for the first time, I was able to get him accustomed to a gentle poke with the blunted needle and the tube dangling near his body with a syringe on the end. Next, I increased the pressure of the poke until I thought he would be able to endure the actual needle.

A behavior that is going to be maintained needs to be generalized to many different trainers, areas, and situations (Stellaard, 2010). After generalizing this behavior to different trainers, Nigel was ready for the vet staff. Dr. Junge was able to remove at least 100 mL of air from the bird that day. We did an x-ray right after to compare from his previous one. After aspiration, his air sac went from 14 centimeters to 12 centimeters. He had the procedure done once more to remove the rest of the air and he has been deflated ever since. We still maintain the behavior in case he ever needs to have the procedure done again.

Coelomic Hernia (Adele)

The most complicated behavior we had to train was a voluntary ingestion of barium. Adele came to us with a hernia. A normal x-ray couldn't tell us if the GI tract was inside the hernia. The options were to catch her up and force feed her barium, or to try and train her to voluntarily take 18 ml of barium.

Our first step was to make her comfortable with a syringe. We used her diet and some of her favorite treats to reinforce her for moving closer and closer to the syringe. We also filled the syringe with banana baby food so that once she got close enough to touch her beak to it, she was reinforced with the baby food as well. Once she touched the syringe with her beak several times, she began to taste the baby food. We continued to reinforce longer durations of her licking the baby food until she was consuming several milliliters at a time. After she was able to walk up to the syringe and ingest the amount suggested by the vets, we tried adding in barium. She did not like the taste of the barium, mixed with the banana baby food resulting in us having to take steps back and relax our criteria. Once we built the behavior back up, we tried using juice concentrate to mask the barium taste, but that didn't work either. Our next thought was to try baby parrot diet. We once again took steps back and relaxed our criteria. She seemed to like the baby parrot diet the most and due to the viscosity it likely masked the taste of the barium. Once we had re-trained the behavior, she voluntarily ingested the full dose of barium mixed with the baby parrot diet. The day of the exam, she took her barium dose and then was able to get her voluntary x-ray right after. We had to do several move x-rays throughout the day to track the progress of the barium. After review, the radiographs showed that there unfortunately was GI tract in the hernia. However, after consulting with specialists, they did not recommend surgery to repair it since she had likely been living with it for a long time. The specialists suggested we continue to monitor her throughout her life and avoid any

breeding. We will continue to maintain her behavior in case she ever needs to participate in a barium study in the future.

Broken Bones and Breathing Issues (Grover)

The single hyacinth, Grover, was one of the first birds we identified as having potential problems in Alabama. She sat very still and didn't vocalize or visibly react to stimulius changes in the envirnoment. From sitting on a perch you could see that her ankles appeared swollen and misshapen. After Grover's initial exam, we found that she had old breaks in both of her legs. She barely moved and when she did, she was off-balance and sometimes fell to the ground. Everything we trained for her had to be modified due to the old injuries in her legs.

When training the scarlet and scarlet hybrid (Nigel and Adele) they quickly associated our presence at an open door with high value reinforcers and we were able to move forward. Grover would not approach us or move much at all. Since reinforcers are highly individual to each animal and circumstance (Martin & Friedman, 2004) we experimented until we discovered Grover's high value reinforcers were banana and macadamia nuts. Once we had a reinforcer for her, we began by placing those items in the food bowl then exiting the room. Eventually, we were able to place the food in her bowl and she would approach the bowl even with us standing in the room. We continued to make small approximations toward being able to hand her a piece of fruit or nut through the cage. Once she began taking food from our hands, we started using her diet to reinforce her walking back and forth on the perching in her house. We started with the step up behavior, but noticed the process was taking a long time and we weren't having a lot of success. We needed to increase the number of positive interactions we were having with Grover, as Martin & Friedman state, positive interactions are not just about animals gaining valued rewards, it's also about having opportunities to make choices (2013). Instead, we decided to take a break with the step up behavior, and train her to walk onto a scale placed on a platform in her enclosure. In order to set her up for success, we arranged the antecedents by customizing the perching in her house to make it easier for her to navigate, and added a perch leading to a platform where we could place a scale.

Once we were able to scale train her, we felt more comfortable managing her diet to gain a little motivation. After working through the scale behavior, we went back to working her towards our hand for a step up. With the balance issues, we had to modify how we taught her to step onto our hand. We noticed that she seemed more comfortable shuffling side to side rather than moving one foot in front of the other. Instead of us offering our hand, her lifting a foot, and us moving our hand in towards her, we had to leave our hand on the perch for her to step onto sideways. Once she showed no hesitation stepping onto our hand and moving around the room, we had built up enough trust to continue training new behaviors, such as voluntary crating and participating in voluntary radiographs.

As she became more and more active, we noticed that she was getting winded quickly and producing wheezing noises. The veterinarians took several lateral x-rays while she stationed on a perch, but with her wings closed it was difficult to get a clear view of her lungs. Our vet staff asked us if we could train her to open and hold her wings out for an x-ray to improve the view of her lungs. We started this behavior by using a target stick and asking her to move closer and closer to it until her wing touched the stick. The plan was to reinforce her for targeting her wing to the stick and then increasing the distance so that her wing began to open. Once we began training the behavior with the target stick, she offered a wing flap. We reinforced it, and she continued to offer a small wing flap and we continued to reinforce it capturing that behavior. We then decided to change strategy and shape the wing flap by reinforcing the first approximation until she offered it no hesitation, then continued to reinforce larger and larger wing flaps until we had the desired duration for the x-ray (Friedman, 2006). After she was able to open her wings and hold them open for about 3 seconds, we started to generalize the behavior. We asked her to step onto different perching and took steps back if there was any hesitation. Once she opened her wings while sitting on a perch on the x-ray table, we had to add in the x-ray plate. Grover's body needed to be facing the plate while she held her wings open to get the desired radiograph. We planned on re-training the behavior so that my cue hand was high enough that she could see it over the x-ray plate, or using a piece of cardboard and in small approximations fade it up to the size of the plate. In the end, I was able to just fade my hand up above the plate quickly. She offered the behavior with the desired duration and we were able to get the radiographs we needed.

After review, the radiographs did not improve the view of her lungs enough to be able to rule out respiratory disease. However, the vets saw that her right nares had some fibrosis which could be the cause of the wheezing. Since she is clinically, externally normal, we are keeping an eye on her. There is still a possibility of a CT scan in the future to rule out the lung disease that was found in the blue and gold macaw in pathology. Even though we didn't get the answers we were looking for, we've seen a drastic improvement in her quality of life. She went from a bird that sat in the back of her cage not interacting with trainers or enrichment to one that eagerly comes to the front of the cage, utilizes her enrichment, and actively participates in training.

A Choice

Our work in training medical behaviors, like stepping up and crating to get x-rays, have made it easier to transition the birds into learning program behaviors. Using these birds as ambassadors allows us to share their story, as well as educate and inspire people about macaws and teach about the conservation of their species.

It is amazing to see how far these birds have come from their previous life. Medical procedures are necessary, but if we have the opportunity and time to use positive reinforcement to train medical behaviors, we should, as it has the potential to make the procedures safer and less stressful. These birds needed to be caught up for the preliminary exams, but now, for the first time in their lives, they had a choice. Rather than being caught up a second time, we worked with our Animal Health Department to design and train complex behaviors while allowing the birds to have control over their own outcomes (Friedman, 2005). They choose to step onto our hands, to trust us, and to participate in their own medical procedures. All of the other rescued macaws have found homes and moved on to reputable facilities, but Grover, Nigel, and Adele are a valuable part of our animal ambassador team at the Columbus Zoo. They will continue to travel with us and do programming to further educate people about what amazing creatures macaws are, and also how to conserve their species in the wild. They are very special and deserving of a wonderful life. Each of these birds are different individuals; therefore, their training needed to be modified in order to ensure their success. They have taught us so much and I am thrilled to be a part of their happy ending.

References:

Friedman, S.G. 2005. *"Empowering Parrots." Bird Talk, p. 21.*

BehaviorWorks.com

Friedman, S.G. *2006. "Shaping New Behaviors." Good Bird, pp. 16–18.*

Martin, S. *2016. Improving Animal Welfare Through Training*

Martin, S & Friedman, S.G. *2013 The Power of Trust*

Martin, S & Friedman, S.G.*2004. Training Animals: The Art of Science*

Stellaard, W. *2010. Why Train That Behavior?*

Training wild animals for the media industry

E. P. Hills

Heythrop Zoological Gardens Ltd. Green Lane, Heythrop, Chipping Norton, Oxon, OX7 5TU

At Heythrop Zoological Gardens we house over 100 species, ranging from tortoises to tigers. We are based in the UK and hold the largest collection of trained animals in Europe. Our animals have been trained exclusively for media projects for over 40 years and we're constantly working on improving and adapting out training methods and striving to put welfare first in a demanding industry. Over the years, we've built important relationships with other trainers, researchers and consultants that offer priceless help in problem solving the best way to positively train our animals. Using positive techniques and allowing the animals to remain empowered throughout the sessions is vital to the long-term success of our built behaviours. By relying on scientific methods and acting on what can be observed rather than personally interpreted, we can be consistent and teach other trainers effectively. In this talk I will be sharing my journey so far, using our zebra training as an example, and discuss the plans we have for making a difference in the media industry by educating production companies and always putting animal welfare at the forefront.

Introduction

The animals housed at Heythrop Zoological Gardens are used exclusively for media projects, with the zoo only open to the public for three days a year. Training is important for all animals at Heythrop, both for media work and for everyday contact. Their training forms part of their individual enrichment programmes to prevent boredom and allows them to be handled safely for routine and medical procedures. Once our animals are comfortable with human handlers and have begun to "learn-to-learn", we can build on this foundation and train specific behaviours depending on the media projects. Positive reinforcement is used to develop clear lines of communication with our animals, while allowing them to remain empowered in their environment. This is particularly important in a new filming location as the animals are confident "resetting" to their station or safe place if something goes wrong. It also allows animals to develop a positive relationship with their handlers. The trainer spends invaluable time in the early stages of training building trust and getting to know the individual animal. This enables the trainer to establish cues that the animals can understand clearly; this dialog continues throughout their relationship. In this paper I will discuss some of the routine training practices that are useful for our animals and a more specific training programme needed to complete a recent project with our zebras.

Basic training and handling

When establishing a relationship with a new animal, building trust is paramount. The trainer must consider several factors: 1) the animal's health status, 2) the species natural history and 3) the individual's learning history (Friedman, 2017). Health and safety is always important when working with any animal, let alone a wild animal.

Food delivery

Food delivery is a very important part of the training process, an inconsistent or messy food delivery can easily cause distraction or frustration which could then result in aggression, especially in wild animals. The mechanics of delivering food should never be taken for granted. Rehearsing with colleagues prior to training can be greatly beneficial and allow the lead trainer to hone their skills. A fast delivery can often be the most effective way to maximise a reinforcer when training a new behaviour (Friedman, 2017). However, the speed of the delivery should be carefully considered when training young, nervous or wild animals as they can be very sensitive to fast movement until trust has developed. The delivery of the reinforcer must always be contingent on the behaviour. The behaviour, consequence (BC) relationship must always be clear. For example, if the trainer wants to reinforce a desired behaviour but during the period of delivery (the trainer getting the food from the pouch) the animal performs a chain of undesirable behaviours, continuing the delivery will only reinforce the most recent chain of behaviour (potentially the undesired).

Reducing distractions during training is important throughout the session, and there should be minimal movement from the trainer prior and during delivery. I always use a continuous schedule of reinforcement. There is a large variety of delivery methods. During training, I use varied delivery (for example delivering reinforcement in position of marked behaviour or throwing the food away), with a variety of reinforcers, which can increase motivation. The anticipation of the delivery can then be reinforcing itself (Pryor, 2008).

Hand delivery of food reinforcers with wild animals isn't always possible and potentially can be too dangerous. If it is possible, a training plan should be written and followed on the procedure of food delivery. This will establish clear boundaries and rules that must be followed by the animal for them to receive their reinforcement (good food manners). For example, our wolves have learned that they will only receive food reinforcement when at arm's length from the trainer, with all four feet on the ground. The food is delivered at this comfortable distance without crowding the trainer.

Specific delivery of food reinforcers should also be considered for each individual animal. For example, three out of four of our zebras take pony nuts from the palm of a hand gently, however one zebra will occasionally pinch the palm of the hand. To avoid frustration due to trainer apprehension of palm pinching, the food is delivered in a bowl on the floor for this individual. The bowl method is also used with one of our foxes, who has previous bite history associated with food. The food delivery is presented in a small bowl held in the trainer's hand. Other methods are necessary when training large carnivores in protected contact. For example, during medical training with a tiger their food reward can be safely delivered by dropping it down a modified section of drainpipe built onto the tightly meshed training area. The food reinforcer arrives on the inside of the enclosure without the trainer needing to put their hands near the animal. This is quick and always consistent, reducing the opportunity of frustration through bad delivery.

Target and station training

One of the first things we always teach our animals at Heythrop is to sit on a station or touch a target. This begins the valuable "learn to learn" process and is a great platform for developing future behaviours. Station training is also transferrable to different environments, which is ideal for filming. We've set this up as a clear line of communication between the trainer and animal, "stay by the target or on your station when you are happy with me to continue what I'm doing". This is empowering for the animal and allows the trainer to monitor their comfort levels. With strong reinforcement history it also becomes their default, so even if something goes wrong they are likely to head back to their station. In the TV industry, we call this a reset.

A slightly adapted system has been developed for our foxes to allow them to feel empowered and in control of their own training session even when the environment is changeable. Using the stress triangle method (Šusta, 2018), their box has been established as a "safe place". This has a strong reinforcement history, and will always be reinforced even when not cued, for example when a fright response is elicited. This is a suitable "incompatible behaviour", unlike their natural escape response (running away). If the

fox returns to the box, the trainer will wait for the fox to relax and come under threshold. The fox can then indicate to the trainer that it is ready to proceed with the session by coming out of the box, sitting at the trainer's feet and making eye contact. The trainer can then decide to reinforce the "I am ready" signal, cue back into the box or cue another behaviour. If the fox doesn't give the "I am ready" cue, after a break the trainer can return to the previously highly reinforced exercise of touching the nose target in the box doorway. The reinforcer will then be delivered at the back of the box to reduce conflict with the outside environment. This will help to build momentum and help the fox to regain confidence.

Duration

I personally feel that duration is very difficult to train, but something that I have found to be helpful is counting down out loud. The animal can then listen to the numbers as you count down. With the foxes, this is trained by approximation, starting at a low number for example "2", "1" then mark on still behaviour while eye contact is maintained on the trainer. This process will be gradually built, ensuring that it is an up and back (ping-pong) method finally getting to 10 to maintain the motivation and to ensure as high a rate of reinforcement as possible. For an animal that finds it difficult to keep still, counting down out loud from 10 on a fixed interval schedule has proved very effective. This is a changing criteria on a continuous reinforcement schedule because even though the duration is variable, when the criteria is met one second or ten seconds, reinforcement is always given. It is difficult to know whether the counting is purely a focused background noise or whether the animal interprets it as a "keep going" signal, however it has proved to be reinforcing as it maintains the wait behaviour. This counting is a tool to establish duration and a cue to keep going, but should be faded after time.

Emotion

When preparing an animal for a media project, we are given a "brief "which is an outline of the story or message intended. This will include what the animal is required to do on the day. Quite often we are not working with animal-minded people, therefore the animal's action and behaviour is often explained of in terms of emotion. For example, they might say that they want a fox to look scared or a wolf to look angry. We then discuss what behaviour we can provide to give that impression without eliciting those emotions.

Fear behaviours are particularly difficult to film. As a trainer, it is vital our animals are empowered and show no (or minimal) signs of stress. For example, a snarl behaviour from a canid potentially requires a lot of emotional fallout. Police dogs are initially provoked to capture that behaviour, which may create future problems and can be extremely dangerous. I am currently working on a shaping plan with a wolf to capture an air snap behaviour, using a long feather. Once the air snap is a chain of snaps with duration, this behaviour can then be seen on camera giving the impression it's an "angry wolf". The "air snap-come snarl" will be taught as a fun game during a shaping session, marking and reinforcing each criterion. The feather will be faded, as it is a prompt, as soon as possible and replaced with a cue. However, there is a chance that this method will elicit tail wagging, which is not a posture often associated with wolf aggression. This unintentional behaviour will be clearly explained to production who can take steps to avoid revealing camera angles and ensure the viewer is in no doubt that the wolf is angry!

There are many other behaviours portrayed on the big screen that can look emotional. Porcupines are an excellent example. A calm porcupine will move slowly, have flat and relaxed quills, and exhibit no foot stomping or no tail rattling. However, often when production imagine a porcupine its quills are erect and displaying. This can come down to the individual animal's character but can be achievable with a relaxed porcupine that is engaged in a training session following cues, ensuring the trainer pays attention to only reinforcing behaviours whilst the quills are erect.

We can train all these behaviours and husbandry procedures but we should never forget to consider (real life) emotion. We are always training emotion, as well as behaviour, and these two go hand in hand. A core base of relaxation needs to be established from the beginning, reinforcing a relaxed state of mind is essential starting point. This is species specific but generally we are looking for relaxed muscles, tail/ears/eyes/stance, flat hackles/feathers etc. We are looking for the animal to remain in the training session and have short latency to cues. We must remember that to change the behaviour we may need to change the environment (S. Friedman, personal communication, 2018). If the animal can be relaxed, they then in turn can be engaged and in a position to learn with positive reinforcement. High energy behaviours can also be achieved in a relaxed state, reducing the risk of the animal going over threshold.

However, after an established relationship with an animal, the trainer can consider a plan to approach threshold during a training session, for example overexcitement or overcoming fears in a controlled manner. Recognising and knowing your individual animal's limitations is essential in pushing the boundaries and then successfully returning to a relaxed state. In this way, you can teach your animal to deal with unforeseen changes in the environment and then learn a safe way to return to an effective training mind-set. This is the "challenge sandwich" (Weston, 2017a,b).

I've only lightly touched on animal emotion but it is a very important point to remember. I hear some people refer to operant conditioning as maths, which I quite like. You add something or take it away and it increases or decreases the four quadrants. That is the science of it. But animals and humans can be unpredictable and their emotions can hugely affect trained behaviours (Panksepp, 2011). When training a behaviour, the emotional state of the animal needs to be carefully monitored. Although we can only measure the external behaviour of the animal, if they are over-threshold there is a chance this will be visible. For example, over arousal in dogs during play can manifest as excessive jumping up, spinning in circles and barking. Internally there may be an increase in heart rate, dry mouth etc.

An example of the interplay between emotion and a trained behaviour was kindly forwarded to me by Musselwhite (Musselwhite personal communication, 2017). In this video, a zorse (a zebra/horse hybrid) has been taught to "march" by training a high placement of front legs, one after the other. The completed action was reinforced and can be cued, but a show of emotion has become part of its performance. The zorse's ears are pinned back and their posture is visually tense through the shoulders and neck, as it places its feet forcefully to the ground each time. It is difficult to interpret this behaviour, is it a show of aggression or sign of negative emotion? Or is it part of the natural behaviour, for example making use of an innate "stamping on a snake" movement? In either case, the final posture displayed may not be an intended part of this action and the animal's emotion should be considered from the beginning of each training session. This is often species specific so you should consider what their emotion looks like and how that individual displays their emotions. If I recognise negative emotion then I can reduce my criteria and make sure to bridge a softer approach.

Zebra project

The brief and requirements

The specific project I will discuss in this paper was for the brand Investec, which use a zebra in their logo. They wanted to update their advertising and shoot a new commercial with our zebras. For this campaign they wanted to use two zebras, a hero, which is the ideal animal, and a backup for insurance. They wanted a mixture of filming and still photography. Filming was to be completed on zoo grounds and the still photography would take place in a London studio several weeks later. At the zoo, they wanted the animals to gallop 100 metres from A to B, being filmed by a tracking vehicle that drove alongside them. This vehicle would be required to reach speeds of up to 30mph and would move alongside the zebra approximately 5 meters from the animal. They wanted the zebras to gallop on a rubber surface in front of a green screen, which could potentially flap in the wind. For the still photography, they wanted to capture the zebras in specific postures in a studio environment. Additionally, we needed to be able to

travel them safely in a horse box, initially from their enclosure to the set across in the field, then transport into London a couple of weeks later.

The training program

Although the zebras had previous training experience, they had no learning history with me and this project required more advanced levels of trained behaviour than previously required. So I was starting from scratch. A full training plan was written for the zebras to first allow me to develop a relationship with them and then to introduce novel behaviours (Table 1).

To train the zebras to run on rubber matting we initially started with small pieces of matting in their enclosure as novel objects in the same way the target stick traffic cone would be introduced. Once the zebras were comfortable with the matting in their environment, we included them in training sessions. Approximating walking over them whilst following a target stick, giving zebra's choice to move away. This was built until the zebras could walk over a continuous surface of matting calmly and confidently. The zebra's enclosure was then adapted so that it extended out onto a piece of private road next to their enclosure. The zebras investigated this area as a herd and if a flight response was triggered they were able to return into familiar territory. Once settled in the extended area, a vehicle was introduced slowly by approximation allowing the zebras to get used to the sound and smell of an engine. Later a moving vehicle was driven alongside the pen. In preparation for travelling both to the field and London we introduced a horse box as a novel object in the zebra's yard area. As with previous novel objects this was done in a herd with the addition of food. The trailer had access at the front and rear ramps opened so the zebras were able to walk through and didn't feel enclosed to begin with. The trailer was then incorporated into training sessions when the zebras were separated into their pairs. The trainers used the following target stick to lead each zebra into, and through, the trailer. This quickly became an established behaviour. As a pair, the zebras were eventually led into the trailer following a target stick and the ramp closed behind them with their trainer inside the trailer with them. Calm behaviours were highly reinforced and the trailer was reopened and the training session continued. Once loading and closing the trailer was a fully established behaviour the zebras were left alone in the trailer for quiet time whilst being observed from the outside by their trainers. Once the zebras were calm throughout, the trailer was driven a short distance down a private road and back to their yard for unloading. Zebras were monitored closely throughout this journey and during the next training session loaded easily into the trailer again, this led us to believe the zebras found the trailer reinforcing. The journey length was gradually built up until the trailer was driven to one of our fields where the zebras were able to graze, relax and kick up their heels in an area designated for filming later on.

To prepare our zebras for the up and coming project we also needed to increase their fitness gradually. We combined this with working on the location in the field, initially walking each zebra a short distance from the other and releasing it, allowing it to canter back down the straight to the other zebra and a trainer into a holding pen (this is a decoy system, making use of a zebra's natural history herding instinct). This was rotated between the two zebras with the distance being gradually built up over a period of two months with each zebra running three to four times per training session. At the end of the two months each zebra could walk the full distance down the 100m straight calmly with its trainer and away from the other zebra before being released to canter back.

We then incorporated a vehicle into our training sessions, this vehicle travelled parallel to the zebras, initially at a distance of around 20m from the zebra and each training session this distance was decreased as the zebras became habituated to a moving vehicle beside them. If the zebra showed signs of an elicited flight response the criteria was reduced. Due to logistics, the rubber matting and green screen were only built up on location a week before filming. However, as the zebras had already trained on the matting throughout the stable environment and yard area, when the matting was moved to the field in a 100m length the trained behaviour was generalised. By this point of the training the zebras had built such a strong relationship and trust in their

trainers the introduction of the green screen didn't elicit any fear response, also the straight A to B for the cantering location was well established (patterned), and both zebras cantered alongside it freely.

On the day

Prior to filming, there were multiple meetings to discuss vehicle logistics, client expectations, individual animal's capabilities on the day and veterinary attendance. On the filming day, the area used by the vehicle and animals was fully fenced with the remaining crew outside of the barrier. This was essential for health and safety purposes and risk assessments. The fenced area was made large enough to allow adequate braking distances for animals and vehicles after the 100m filming length. Rehearsals with the vehicle were carried out thoroughly before any animals were brought to the location on the day of filming. This allowed the driver and cameraman to ensure that when the animals were brought to the set they would be ready to film. As pre- discussed in the meetings, we organised a horse and rider to do a final line-up shot with the vehicles before bringing the zebras out to film.

The filming was successfully completed over the designated days at the zoo. The London studio photography day was also considered a success. The zebras loaded easily into a large horse box which transported them to London. On arrival there was a large pen within the studio area set up for them in which they were able to settle, relax and eat hay. During the mid-day rest break the zebras were reloaded onto the horse box without hesitation to provide a quiet and more restful environment. Throughout the working day the crew were asked to keep noises and movement to a minimum when around the zebras. The penned area opened up into a studio environment which was split using caging to separate the crew from the animals. The photographer was able to capture multiple postures from the zebras through the effective use of the hand-held target stick. The whole campaign was completed under schedule.

Learning from experience

There are always lessons to be learnt from each training program and project. For the zebra project, despite reinforcing calm behaviour throughout training, on the day of filming the zebras were excited, fresh and extremely fit! As they ran along the 100m length there was frequent kicking and bucking, which was unusable material for the client, but only happened on two runs for each zebra. After multiple runs the backup zebra started trotting the first 20 metres before cantering the remaining length. A decision was made to use negative reinforcement in the form of a runner behind the zebra to encourage a canter from the start. This was only necessary for one run. For future projects we would make it clear to production that the first couple of runs may be unusable footage but provides good rehearsal time for the camera and travelling vehicle. For the zebras in future we would also request a rest period of several hours if the animal displayed voluntary decrease in gait (from canter down to a trot).

Welfare of our animals

Our animals' welfare is the most important part of our job. For animal training in the media to be progressive we need to better educate the audiovisual industries. Many years ago, Heythrop Zoo was one of the founding members of ACTA (the Animal Consultants and Trainers Association). This trade body is made up of industry and veterinary professionals and was set up to better self-regulate trainers, handlers and agents for animals used in the audiovisual industries. However, there seems to be less awareness about the animals needs on a film set, despite there being an increased demand for them. Scheduling is often our most difficult problem. Animals are often called to set and then not used for hours. Animals can also be left hanging about between shots. We give maximum times that the animals will be on set, but we have to remind the crew that this is a maximum and not a target. We need to be given the final brief for the animals at least 72 hours before the shoot, with longer periods for training if needed. We discourage last minute good ideas! They need to plan ahead for parking so that we can have fast access to our vehicles in case we need to remove the animal. We ask for a minimum crew. Sets need to be kept as quiet as possible. Where possi-

ble, it's also best for sets to be sealed. For the performers, it's vital that they have enough time to rehearse with the animals so they can approach them calmly and confidently. They also need to be aware that, in line with the Performing Animals Act, any performers working with animals in a live performance need a certificate. We are currently setting up accredited courses for media students which we hope will educate future film crews and animal handlers about the care of animals on film sets. We cover issues we believe are important for crew and performers.

Conclusion

Using trained animals for media projects can be controversial and we are keen to be as open as possible about our methods to encourage informed discussions. Our animals are both our livelihoods and our responsibility, and we care deeply about their welfare. We are strict in managing production expectations, whilst being aware of their creative needs. It is vital that our animals do not experience their "jobs" negatively, not least because a stressed animal will not be able to perform our trained behaviours. Heythrop Zoological Gardens has further taken action to educate the present and future generations of the media industry, from supporting artists to production management, with educational workshops covering all aspects of animals working on set.

As trainers, we are in the best position to know each individual animal and their species-specific needs, and we should take care to continue to educate ourselves and the people that we are working with. My ultimate aim as a trainer would be to carry out media projects whilst enjoying the challenges of teaching an animal something new. To achieve this, I engage my animals in an extension of the games we play at home, sharing a magical moment with that individual of two species speaking the same language. What better way to capture that than on the big screen!

References

Friedman, S. G. (2017). Tsk, No, Eh-eh: Clearing the Path to Reinforcement with an Errorless Learning Mindset. *Journal of Animal Behavior Technology, 6 (1)*, 13-18.

Panksepp, J. (2011). The basic emotional circuits of mammalian brains: do animals have affective lives?. Neuroscience & Biobehavioral Reviews, 35 (9), 1791-1804.

Pryor, K. (2008). Working for the joy of it! Practical use of non-food reinforcers. Curriculum for Karen Pryor's Clicker Expos.

Šusta, F. (2018). Training is dialogue: Stress triangle. Retrieved 30 March 2018, from http://treninkjerozhovor.cz/data/stress_triangletxt15338.pdf

Weston, H. (2017a). Connection training: Challenge sandwich. Retrieved 30 March 2018, from https://connectiontraining.com/challenge-sandwich/

Weston, H. (2017b). Connection training: How to get relaxation in training. Retrieved 30 March 208, from https://connectiontraining.com/get-relaxation-training/

A Shifty Past: Training a Successful Shifting Program for a White-Cheeked Family Group Using Operant Conditioning

Jaimie Howard, Animal Care Specialist
San Antonio Zoo

Introduction

San Antonio Zoo houses a family group of white-cheeked gibbons (*Nomascus leucogenys*). Originally the adults would not reliably shift into indoor holdings to be locked inside in order for animal care staff to safely enter the exhibit. The exhibit could not be accessed if the adult male, Mel, was outside due to his territorial behavior; however, animal care in teams of two were able to service the exhibit with the adult female, Maya, and her offspring on exhibit. To address this issue, animal care staff began to focus on developing and implementing a successful shifting protocol for the growing white-cheeked gibbon group.

The Beginning

Both adult gibbons were uncomfortable being brought inside and therefore the offspring were unwilling to shift as well. There was a lack of positive association with holdings and occasional unwillingness for the gibbons to be in such close quarters with each other. This issue was compounded by the lay-out of the indoor holdings. There are a total of three holdings: two upstairs spaces and one space downstairs that connects to the upper level through a trapdoor in the ceiling. Every holding area has a combination of shelving, ropes, and perching that allow the gibbons to access all areas of the space. There was not a lot of flexibility on how to move animals around once they were brought inside to accommodate the evolving dynamics within the group.

At first, the focus was on Mel so staff could access the exhibit. Animal care staff began incorporating more relationship building into their daily routine. It quickly became apparent that Mel was more likely to come into the holdings to receive food from staff, especially if the risk of being locked in was low. This positive association with food and care staff interaction translated into an increased likelihood that Mel would shift inside when asked. Once inside, he was shifted into a holding by himself with his diet portion. Eating without having the others steal his food was rewarding within itself and continued to build up positive associations with holdings.

In comparison to Mel, developing a consistent shifting routine for Maya was more of a challenge. Maya tended to be more wary of staff and darted out of holdings at the first sign of the door closing. Closing the door was put on a cue and incorporated into the middle of a training session as opposed to at the beginning or ending. Staff began only partially closing the door and gradually worked up to being able to fully shut the door. Initially Maya was only brought inside for short amounts of time, and then the duration of the behavior increased.

The Challenge: Group Dynamic Change

At this time, Mel and Maya lived with two female offspring. The group dynamic was drastically changing as the oldest daughter, Gibson, approached sexual maturity. Animal staff began observing Maya exhibiting aggressive behavior towards Gibson, which is normal as adult white-cheeked gibbons usually kick out juveniles when they approach sexual maturity. The decision was made to separate Gibson from Maya and keep Gibson in the holdings for the time being. Since Gibson could still be with her sister and Mel, they were put together in holdings whenever possible. During this time, Maya gave birth to a boy, adding another gibbon to

the mix. When Maya began turning her aggression towards her younger daughter, she was also brought inside and kept with Gibson.

Eventually the juveniles were moved out. But while everyone was together but separate it made shifting extremely challenging. The daughters could be together, but only Gibson was able to be with Mel. Maya did not want to share a holding area with Mel or with either daughter. The holdings are in a linear structure so there are limited ways to move animals, especially when trying to bring everyone in while keeping some individuals apart. After being brought inside for an extended period of time due to exhibit maintenance, Maya was less trusting of care staff. The newly found shifting success was falling apart. It was yet to be a fully maintained behavior, but staff had to put Maya's shifting progress on hold to handle the immediate complications of the changing group dynamics.

The Challenge: Staff Consistency

Concurrently, there were a lot of staff changes occurring in the department. Early on it was found that the gibbons, especially Maya, responded best with consistency. If turn-over occurred too quickly or too many new faces appeared too closely together, Maya was hesitant with care staff. Animal staff had to take a step back and work on rebuilding a foundation of trust with Maya, and to a lesser extent, with Mel.

When a male staff member began working with the gibbons, it threw the adult gibbons into a tailspin. They both had negative history dealing with males from nearly a decade ago. Previously most of the relationship building took place in holdings to positively associate the holdings and the keeper simultaneously. This was successful in the past, but it was not going to work now as the gibbons would not approach holdings when the male keeper was inside. Since everything was done with protected contact, relationship building could take place with the gibbons on exhibit. Although Maya continued to shift inside fairly reliably for female staff members, it was close to seven months of relationship work and training before she would shift comfortably inside for the male staff member.

Current and Future Goals

The white-cheeked gibbon group will currently shift inside with about an eighty percent success rate on any given day. Mel is still shifted in separately and Maya, her son, and new daughter are shifted in together. Recently the group was brought inside for a few weeks so exhibit renovations could take place. The group readily shifted back inside within a couple of days after being let out. In the past, it took months to get back to that level but with the added training sessions using positive reinforcement, there has been vast improvement. Training sessions continue to take place in holdings and on exhibit not just for the husbandry benefits, but to continue to create a trusting relationship between care staff and the gibbons. New staff continues to be trained in the area.

Conclusion

Consistency and continuous relationship building proved to be imperative to the shifting process. It allowed animal care staff to work through transitional periods and gaining the gibbons' trust. Using these methods, the number of staff members that can reliably shift in the gibbons is the highest it has ever been.

EVALUATING ENRICHMENT- USING ACTIVITY BUDGETS TO ASSESS A SPECIES-SPECIFIC ENRICHMENT PROGRAM

Allison Kao, Jason D. Wark

Lincoln Park Zoo, Chicago IL

Environmental enrichment is a core component of animal husbandry programs but evaluating the efficacy of enrichment has proven challenging. Currently, many zoos assess enrichment based on an animals' interaction with enrichment items, often using a qualitative rating scale. Although systematic, these ratings have several limitations as they are often subjective, based on indirect evidence, and too narrow to comprehensively evaluate enrichment that may target multiple behavior goals. At Lincoln Park Zoo, the behavioral husbandry and enrichment program is developing and implementing a three- tier evaluation process that animal managers and keepers are using to gain a better understanding of the impact and needed improvements to species-specific enrichment programs. The tiers include qualitative keeper records, enrichment object evaluation, and evaluation of activity budget goals for a species. Goals are being established for six standardized behavior categories (Inactive, Feed/Forage/Drink, Locomotion, Undesirable, Other Solitary, Social) and important species-specific natural behaviors using previous data and published reports of zoo or free-ranging populations as a guide. Using the ZooMonitor app, volunteers, interns and staff are aiding in gathering and compiling the data needed to assess the enrichment program in a holistic manner. These results are guiding modifications of the enrichment and management plans, allowing us to continually evaluate and enhance each species-specific enrichment program on a quarterly basis.

Due to this new evaluation process, we have seen several positive changes. First, this has helped shift the cultural view of enrichment as item based to a focus on species-specific behavioral goals. As a result, our animal care department started thinking about enrichment as a broad term encompassing the many aspects of animal care. All the tools used to manage and care for our animals contribute to allowing animals to exhibit natural behaviors. This can include management decisions such as how and when to feed, what access they are given throughout the day, social housing, what type of food and how it is presented as well as exhibit design. These components of animal care are a part of our enrichment program allowing us to give our animals the opportunity to perform or participate in species appropriate behaviors. This program has also fostered a shift toward evidence-based enrichment decisions. Collectively reviewing the data has helped spur productive discussions, sometimes yielding new insights into the behavior of the animals. Using standardized data and clear, objective goals has been fundamental for our progress towards promoting positive welfare through our enrichment program.

Program Description

The SPIDER model, which originated from Disney's Animal Kingdom (Mellen and MacPhee, 2001), is used to give structure to the program. Our evaluate/enhance model focuses on setting goals and documenting enrichment. We then use that information to evaluate and enhance the program on a quarterly basis.

Setting Goals:

The animal care team works together to research natural and individual history of the species for which they are building an enrichment program. Articles outlining time budgets of both wild and captive animals are explored when available. From this research, the animal care team finalize an ethogram for the species. This ethogram includes all behaviors identified as overall goal behaviors as well as any other behaviors of interest. These behaviors are grouped into six mutually exclusive categories, including inactive behaviors, feeding related behaviors, non-stereotypic locomotor behaviors, stereotypic or other undesirable behaviors, other solitary behaviors, and social behaviors. Ethograms must be exhaustive and need to include all standard maintenance behaviors (e.g. inactive, feeding, locomotion, etc.) as well as other and not visible options.

Species-specific time budget goals are set for the six broad behavior categories, as well as any important natural behaviors of interest (e.g. browsing by giraffes). In certain situations, these time budget goals may be modified based on the age class (e.g. juvenile and geriatric animals) or health conditions of an individual. These time budget goals are based on previously published literature, when possible, as well as previously collected data on the zoo's individuals. The purpose of these goals is to not simply estimate what the animals are currently doing or to definitively set a time budget as the "gold standard", but instead serve as a guide for a desired behavior profile for a given species. As a guide, these goals are also part of our evaluation process to ensure they represent our current expectations based on the most up-to-date knowledge of the species and individuals. Figure 1 shows examples of activity budget percent goals set for Pygmy Hippo.

Inactive	Feed/Forage/ Drink	Locomotion	Undesirable	Other Solitary	Social
65% (60-70)	15% (10-20)	7.5% (5-10)	0% (0-5)	7.5% (2.5-10)	5% (0-5)

Figure 1 – Recent activity budget percent goals and ranges for Pygmy Hippo

Documentation:

Enrichment items given daily are documented by keeper staff using the enrichment module on the TRACKS (https://www.trackssoftware.com/) record keeping system. In addition, behavioral observations are taken daily using the ZooMonitor app. Management changes and exhibit enhancements are documented in each quarterly report.

Evaluation:

The enrichment program is evaluated on a quarterly basis based off a three-tier system (Fig. 3).

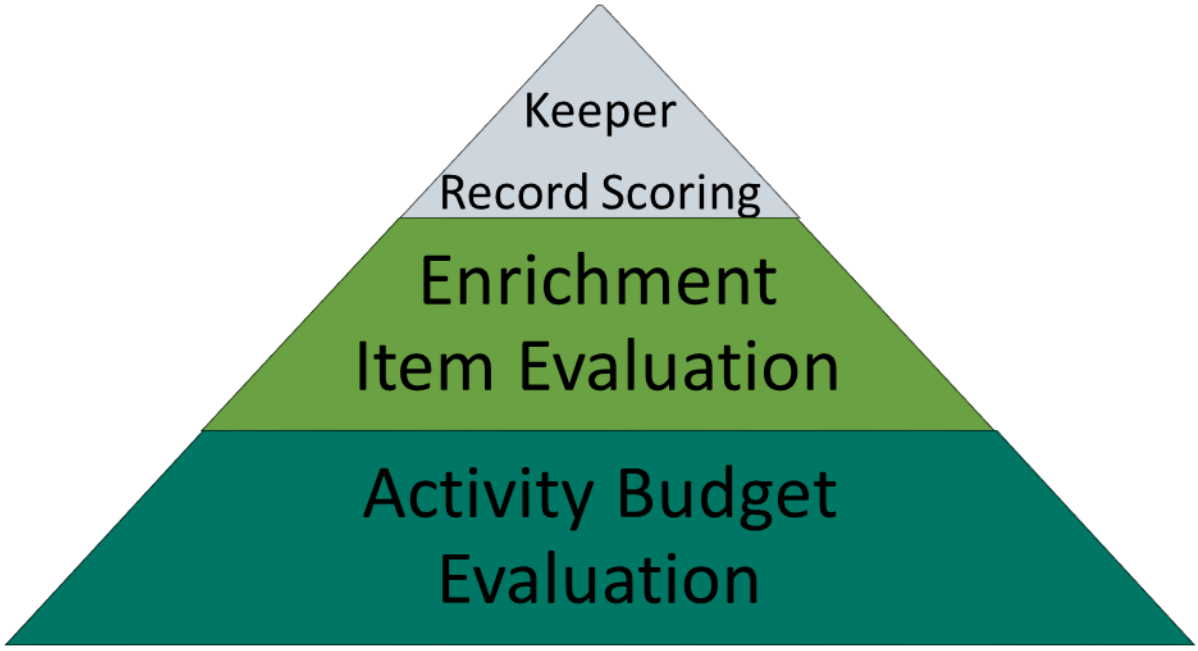


Figure 3. A diagram of the three-tier enrichment evaluation process at Lincoln Park Zoo.

Tier 1- Keeper Records:

When items are recorded on TRACKS they are scored if observed. This scoring system gives a quick snap shot of the level of interaction and type of usage by the animals. This information is subjective and may not be consistent. Keepers are instructed to only rate enrichment if they could observe the interaction but are not required to conduct standardized behavioral observations. Keepers qualitatively rate enrichment items based on the item's usage (4-point scale: 1-Behavior not observed; 2-Engaged with enrichment at the time of observation; 3-Not engaged with enrichment at the time of observation; 4-No behavior observed but signs of interaction) and whether the item elicited the target behaviors it was intended for (5-point scale: 1-Behavior not observed; 2-No response; 3-Fearful response; 4-Used but not goal behavior; 5-Goal behavior).

This tier of evaluation allows us to review what enrichment items were used during the quarter and gives us a quick snap shot of the items that may be effective. During the readjustment step we can consider this information when updating planned enrichment calendars.

Tier 2- Enrichment item evaluation:

Enrichment items go through an evaluation process to determine if they successfully elicit assigned behavioral goals and if they pose any unforeseen safety concerns. Target behaviors, chosen from the species' ethogram, are first assigned to an enrichment item. The enrichment item is then evaluated using the ZooMonitor app. Each enrichment item is observed for a minimum of thirty sessions, with each session representing a 5-minute observation. The behavior and duration of the interaction are scored any time an animal uses the focal enrichment item. These quantitative data are then gathered over time for multiple enrichment items. The purpose of this evaluation is to help make better informed decisions about which items are most successful in promoting goal behaviors. Similar to the previous evaluation tier, this evaluation is used as a tool to guide the readjustment process. A database is kept to track information for each specific enrichment item. Information on all enrichment items is gathered over time. As information is obtained, it can be used to make better-informed decisions about which items are most successful in promoting goal behaviors.

Tier 3 – Activity Budget Evaluation:

Activity budget data is generated from the zoo's on-going behavioral monitoring program. Volunteers and staff are routinely recording the behavior and space use of animals at Lincoln Park Zoo using the ZooMonitor app. These observations are 10 minutes in duration and behaviors are recorded using an interval sampling method with one scan per minute. Observations are structured throughout the day to give a daily picture of the animal's activity. Using these data, the observed activity budget for an animal is compared each quarter to the broad behavior category time budget goals that were set. In addition, the percent of time engaged in

specific goal behaviors that were identified are also evaluated.

Re-adjustment:

On a quarterly basis, the animal care teams review activity budget reports to assess if staff have successfully reached activity budget goals for each individual or group. During this time, activity budget behavioral goals can be adjusted if needed and ideas are shared about what changes need to be made to help better reach specific goals. Information from the item-based evaluation as well as daily records are considered when adjusting the use and delivery of enrichment items. Management changes may be made to give animals better opportunities to practice certain behaviors. This is a time for management and keeper staff to take a deep dive into possible causes and solutions to behavioral problems. In addition, daily routine can be evaluated and animal care staff can be challenged to improve on day-to-day management protocols.

Case Study:

Using this enrichment program evaluation process, we determined our 1.1 pygmy hippos were spending more time inactive and less time feeding and foraging than desired. During the second quarter of 2017, the hippos spent 86% of their time inactive (goal=60-70%) and only 2% of their time feeding and foraging on-exhibit (goal=10-20%). Based off this information, animal care brainstormed ideas of how to reduce their inactivity and increase their foraging time. It was decided we would try to change the way they were being fed throughout the day. Typically, the hippos were fed twice a day, once in the morning and once in the afternoon. Food was placed in a pile, usually in the same few spots each day. To change up location of food and allow the hippos the opportunity to forage throughout the day, four timed belt feeders were installed around the exhibit. Their diet, which used to be split 50/50 for AM and PM was split 80/20, allowing the majority of their diet to be provided through the belt feeders while still maintaining some food to be used as reinforcement for shifting off exhibit. When the program was re-evaluated in quarter three for 2017 after these changes, a decrease in inactivity and an increase in foraging behaviors were seen. In addition, our female hippo, who had previously only spent time in one specific area of the habitat, was now observed traveling to all areas of the habitat space to gain food from the belt feeders.

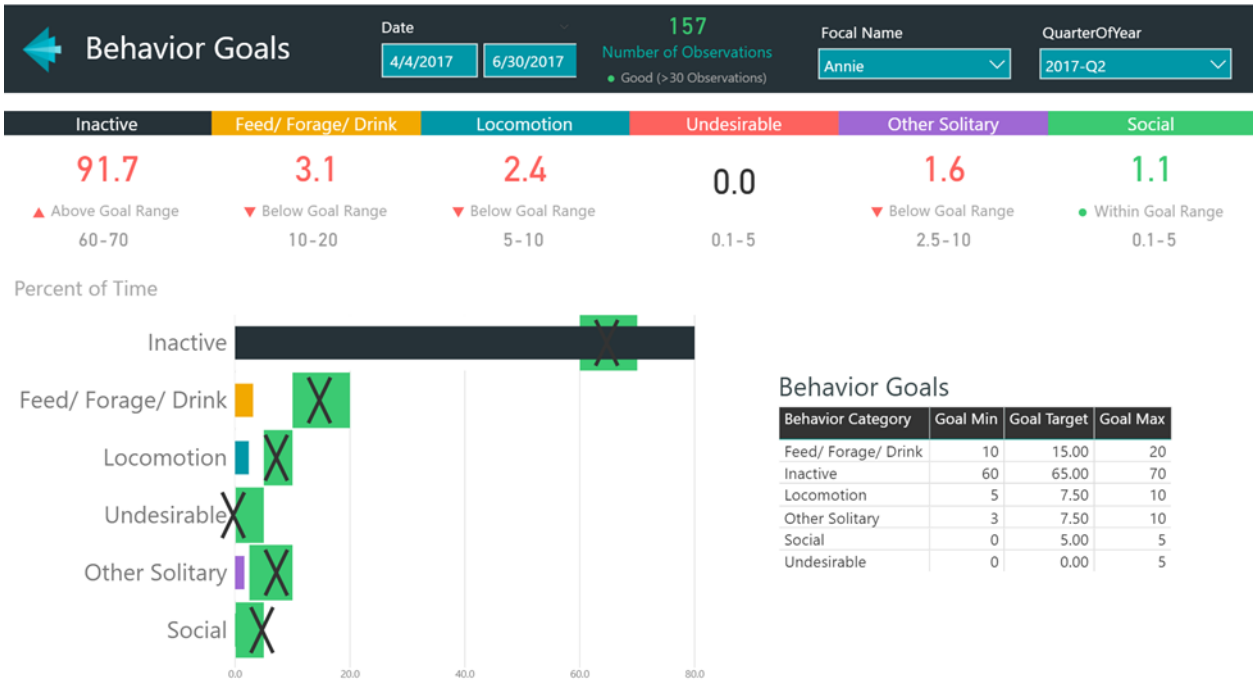


Figure 4. The activity budget report for Annie (0.1 pygmy hippo) in quarter 2, 2017, generated using data from the ZooMonitor app.

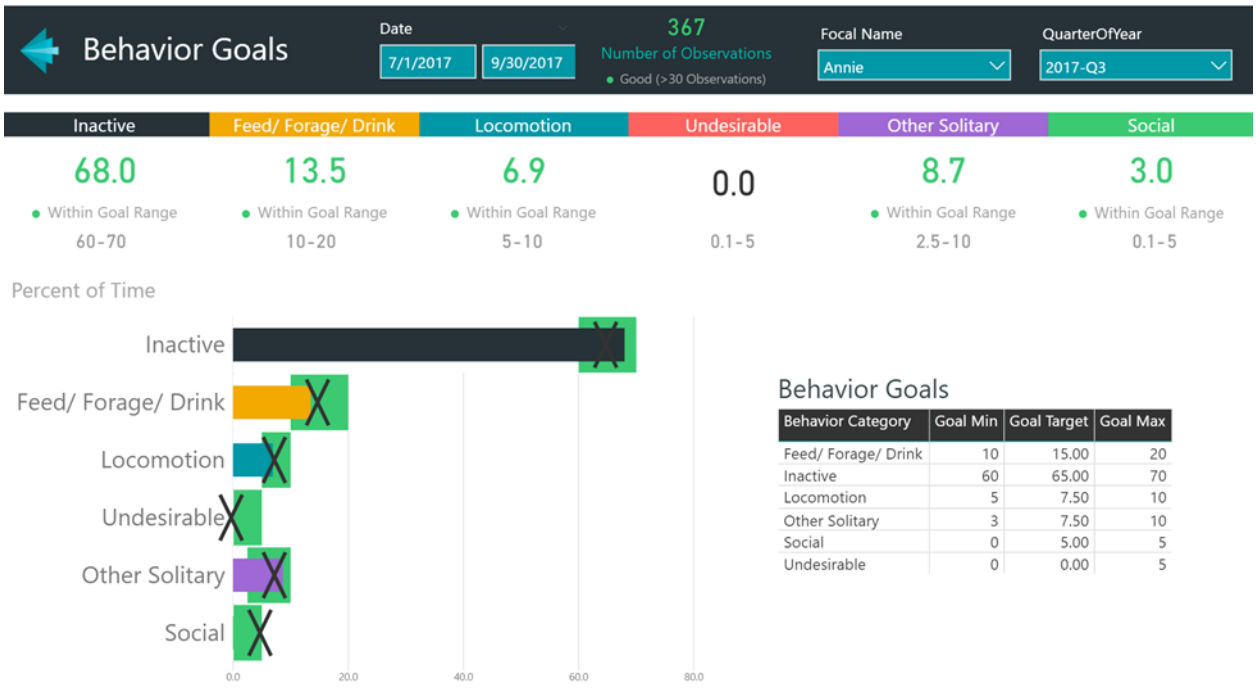


Figure 5. The activity budget report for Annie (0.1 pygmy hippo) in quarter 3, 2017, after implementing husbandry changes.

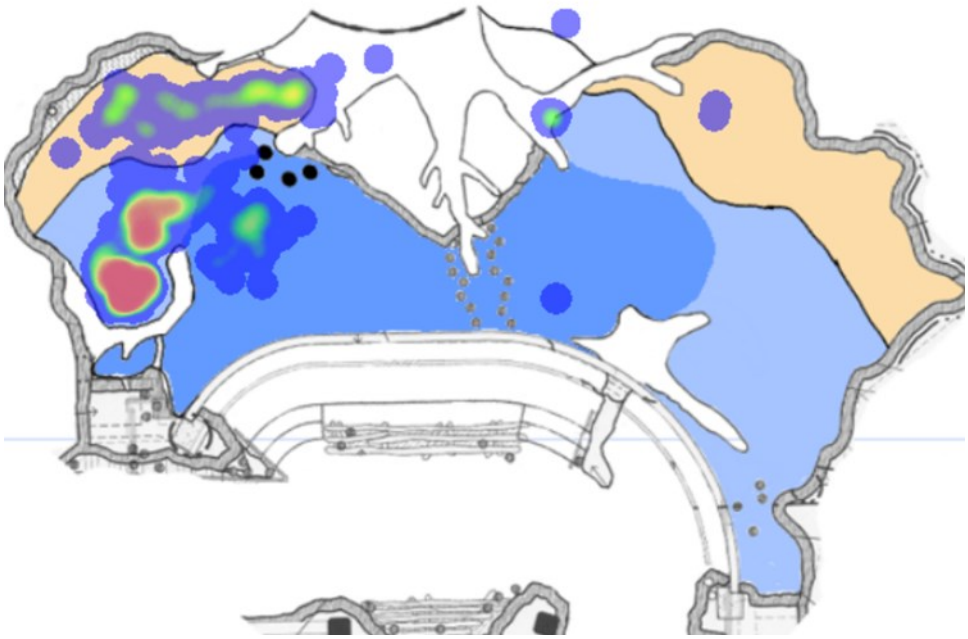


Figure 6. An overhead illustration of the habitat depicting a heat map of space usage by a female pygmy hippo in quarter 2, 2017, before husbandry changes.

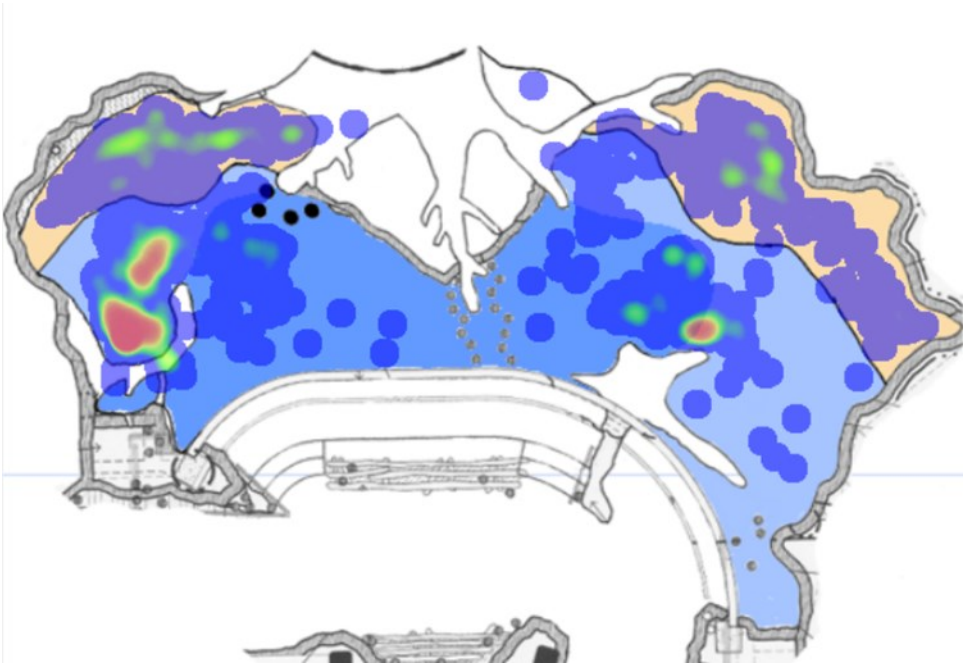


Figure 7. An overhead illustration of the habitat depicting a heat map of space usage by a female pygmy hippo in quarter 3, 2017, after husbandry changes.

Conclusion:

Cultural change and program shifts take time to reach a point where instructional goals are being reached. At Lincoln Park Zoo, the enrichment program has been in the process of being revamped for the past three years. During this time, enrichment inventories have been reviewed, ethograms have been developed, and behavioral goals have been set. To obtain enough data to be able to make meaningful decisions, we have a group of over forty volunteers taking behavior observations daily. In addition, a growing internship program is in place to supplement behavioral observation needs and assist in building ethograms and exploring research topics. Currently, five species are being evaluated using all three tiers and our goal is to add additional species each year. Overall, this program can be challenging to get off the ground and does take a lot of effort to maintain. However, the benefits are many—this program gives an in-depth view of our animal's daily activity and allows us to make informed decisions about how to improve enrichment and management. It allows both management and keeper staff to take a deeper look into their species and become experts of their natural behavioral history. Animal care members take a deeper dive into behavior, looking at the mechanics and motivations for certain behaviors.

References:

Mellen and MacPhee (2001). Philosophy of environmental enrichment: Past, present, and future. *Zoo Biology*, 20, 211-226

Using Operant Conditioning to Treat for Complimentary Alternative Therapy in Carnivores

Katie Buckley-Jones

Houston Zoo, Inc.

The Houston Zoo veterinary and animal care staff has been working closely with a consulting complementary therapy veterinarian to provide the animals with a variety of treatments ranging from chiropractic adjustments, laser acupuncture, and therapeutic stretches in conjunction with traditional Western medicine. In the carnivore department, operant conditioning and positive reinforcement techniques are utilized to more completely care for some of the medical cases. The complimentary therapy veterinarian has prescribed a variety of stretches for the animals, so it has been the keeper's challenge to train them to participate in their own medical care. For example, there is a cheetah who is working on his rear leg strength, a leopard with nerve issues who does stretches, a bear who was trained for multiple stretches, and a few cats who have been conditioned to receive laser acupuncture alleviate discomfort associated with arthritis. The leopard has shown significant improvement with his nerve damage due to his stretching regime and acupuncture. The geriatric Andean bear also showed mobility improvement when she began her stretching. One side effect that has been observed is some animals appear to enjoy the laser acupuncture so much, the treatment itself becomes the reinforcement and no food reinforcement is needed. The ability to train for complementary medicinal treatments has improved the comfort and wellbeing for many of the Houston Zoo's carnivores and shows promise for other species, as well.

The Houston Zoo has been committed to exemplary animal care since its founding in 1922. With geriatric animals living at the zoo, many treatment options have been pursued to ensure life-long comfort. Western medicine can provide effective pain management for arthritis, spondylosis, and other aches and pains, but our veterinarian staff has recognized the value in adjunctive, complementary therapies to help our elderly animals feel even more comfortable.

In 2013, the Houston Zoo began collaborating with Jessica Marziani, DVM, CVA, CVC, CCRT to provide the collection with complementary therapies utilizing Eastern medicine practices. Dr. Marziani is an expert in acupuncture, chiropractic adjustments, and therapeutic rehabilitation therapies. Historically, chiropractic adjustments have been done during routine sedation procedures, but rehabilitation therapies or therapeutic exercises and laser acupuncture (using a specialized laser acupuncture pointer) treatments have been given while animals are awake.

The Houston Zoo carnivore department has an elderly population of animals with a wide range of needs that we felt could benefit from Dr. Marziani's treatment. This includes: two elderly Malayan tigers *(Panthera tigris jacksoni)* with arthritis, a geriatric Andean bear *(Tremarctos ornatus)* with a stiff hind end, an elderly jaguar *(Panthera onca)* who had spondylosis, two geriatric leopards *(Panthera pardus pardus)* with arthritis, and an active aging cheetah *(Acinonyx jubatus)* who showed signs of stiffness and arthritis after running. After assessments by the zoo's staff veterinarians, Dr. Marziani consulted with us and prescribed a variety of therapeutic exercises and laser acupuncture sessions on all these cases.

The carnivore team faced the challenge of training these animals to participate in laser acupuncture treatments and incorporating patient specific therapeutic exercises into their daily routines. Some animals proved to be more difficult than others, but over the course of treatments and training, all benefited from these complementary therapies.

One interesting benefit we discovered was that many animals appeared to enjoy the laser acupuncture sessions, thus making the sessions therapeutic and enriching. Animals who were difficult to move around would gladly get up and walk over to Dr. Marziani and participate in sessions. We found that diluted goat's milk worked better than meat at keeping the animal in position for a longer period of time. For some of our animals, the actual treatment ended up being so positive it acted as a secondary reinforcer; eliminating the need for food reinforcement. The laser acupuncture helps release natural endorphins causing the animals to become relaxed and even stretch out allowing certain acupuncture points to be targeted with the laser.

One of the leopards continues to be one of our most successful cases. Kadu came to us as a rescue from a private owner. He had been previously declawed on all four feet and at 15 years of age, began to limp on his front right foot. During a diagnostic sedation to find the cause of Kadu's lameness, we discovered he had a spinal lesion and probable nerve entrapment in his neck. Instead of having significant arthritis in the joints of his right front limb, he had changes in his lower cervical spine suggesting an impingement of the cervical nerve root that feeds the right front. He was prescribed gabapentin, a medication for nerve pain, but was not considered to be a candidate for surgery, so other options for long-term pain management were also pursued. Dr. Marziani prescribed Kadu four daily stretches and we jumped at the opportunity to train him for these exercises. We began training by targeting him into the positions needed for the exercises. Kadu was an excellent learner and very food motivated. Once targeting was successfully achieved, his primary trainer then began incorporating cues and phasing out the target stick. He now has all four stretches on cue and we are working on increasing duration and depth of the stretch. By doing these targeted stretches, we are increasing the core muscle strength in his neck to improve his flexibility and to help protect the nerves from getting pinched. In this way we are helping Kadu improve his lameness and comfort.

Our Andean bear, Patty, was another case that directly benefited from trained therapeutic exercises. She was known as a particularly difficult animal that chose not to train with some staff members. At 32 years old, Patty was treated successfully with a low dose of meloxicam for a few years before she began showing increased discomfort and additional lameness in her hind end. In addition to an increased meloxicam dosage, Dr. Marziani prescribed two exercises to strengthen her legs and hips. One exercise required her to get on a table and shuffle both sidewise and back and forth. Another exercise required her to enter a chute and back out multiple times. We trained these behaviors by desensitizing her to the tables built for her exercises and the chute. We initially used targeting to get her where needed and later phased out the target and added cues. Patty appeared to enjoy participating in her exercises so much that she would often anticipate sessions and be inside waiting on her exercise table beforehand. The chute became one of her favorite places, and we were able to utilize this to assist training other behaviors, like a line up for an injection. We noticed that Patty showed very positive effects from the combination of increased meloxicam and daily therapeutic exercises.

One of our most difficult cases was a 20-year-old jaguar named Kan Balam. In his earlier years, Kan Balam had an altercation with another jaguar at a different institution that caused the loss of half of his front right foot. Due to the amputation, he developed a chronic limp and hunched back. He was treated with gabapentin and meloxicam, but he was also a prime candidate for complementary therapies, as well. Kan Balam was known as the department's most opinionated animal and like most cats, he would not do anything unless he wanted to. One of our best indicators that the laser acupuncture was effective came from watching Kan Balam willingly line up and move around for his laser acupuncture treatments. Sometimes, when doing treatments from the front of the exhibit, he would often run over to participate in the session. The exhibit offered him many places to hide or climb, so his open participation showed us that he enjoyed the session. We used goat's milk as a reinforcer, which was never one of his favorite food items, so it seems he was reinforced by the endorphins that the acupuncture induced.

The Houston Zoo's ambassador cheetah program has also benefitted from Dr. Marziani's therapies. Staff noticed that one of the cheetahs, Kito, was stiff and seemed uninterested in running. After a consultation with the zoo veterinarians and Dr. Marziani, we decided to treat the cheetah's arthritis with monthly Adequan injections, a medication that promotes joint heath, and daily therapeutic exercises. In order to engage his hind end, staff built a table and would target him onto it, eventually adding cues to the behavior. These therapeutic exercises are performed on exhibit and in holding areas, during both protected and free contact situations. These therapeutic exercises, when paired with other treatments, have helped manage arthritis and Kito now participates in running again.

Training for complimentary therapies did prove to have some challenges. There were times when animals choose not to participate in sessions. Since the animals are never forced to participate and everything is voluntary, this occasionally proved problematic. We also had difficulty incorporating the entire team into the training process instead of having one trainer responsible for doing daily therapeutic exercises. Sometimes the laser or needle hit an acupuncture point, which caused a negative reaction. When hitting acupuncture points elicited a negative response (ie: flicking of a tail, hissing, pulling away, kicking a foot, or twitching), we stopped treating that spot, allowed the trainer to reinforce the animal for staying in the position and then began again at an alternative spot. These negative reactions were minimal and intermittent. Overall, each session remained positive and rarely was participation refused. Another challenge that we encountered included figuring out how to get the animals into the correct position to achieve the goal of the exercise. This required keepers to fully understand antecedent arrangement and create situations to be able to reinforce the animals for being in the correct position. We built various exercise tables and set up areas to allow better alignment to ensure the animals were in the proper positions for treatments.

The carnivore department has utilized complementary therapies in conjunction with Western treatments on animals with a variety of conditions, including arthritis, spondylosis, and lameness. The Houston Zoo has also used these therapies with over 40 different animal species. The training and treatment is individual to each case, which has inspired a variety of creative solutions from the staff. Animals appear to feel better after treatments by displaying increased activity, decreased lameness over time, and active participation in training and treatment sessions.

Special thanks to Jessica A. Marziani, DVM, CVA, CVC, CCRT, Christine Molter, DVM, Dipl. ACZM, and the Houston Zoo Carnivore Department.

References

Marziani, J. (2018). Nontraditional Therapies (Traditional Chinese Veterinary Medicine and Chiropractic) in Exotic Animals. *Veterinary Clinics of North America: Exotic Animal Practice*

THE USE OF STRING ENRICHMENT TO REDUCE FEATHER PLUCKING

Emily J. Kinsey and Gary Fortier

Delaware Valley University

String enrichment was provided to a flock of 12 bantam hens to reduce aggressive pecking and feather loss. After eight weeks, the enriched birds showed significant improvement in their plumage and greatly decreased their rate of aggressive pecking relative to control hens that were not enriched. Chickens continued to direct pecks to the strings even after eight weeks of use, indicating this simple, inexpensive enrichment has the potential to provide long term benefits.

INTRODUCTION

Delaware Valley University houses 24 chickens (Rhode Island Red bantams) for use in teaching and research. The animals are housed in groups of 12 in two large, indoor kennels. At 14 months of age these animals began to exhibit aggressive feather pecking. The pecking increased over a period of several months, resulting in severe feather loss in many of the birds.

Our goal was to use additional enrichment to reduce the misdirected pecking and improve the condition of the birds' plumage. Environmental enrichment has previously been used to treat aggressive pecking and feather plucking (Tahamatani et al., 2016). However, our chickens were already receiving multiple forms of enrichment including wood shavings, a variety of nest boxes and feeders, suspended toys, scatter feeding and training.

A review of the literature suggested that one form of enrichment, suspended strings, might address this challenging problem. String enrichment has been used to reduce pecking behavior, but results from prior studies have been mixed. String has been more successful with laying hens (Jones et al., 2002) than broilers (Hocking and Jones, 2006). Success also varies with the age of introduction (Hartcher et al., 2015) with the highest success coming from very early exposure. Like many forms of enrichment, string is more successful at preventing aggressive pecking than eliminating established behaviors (McAdie et al., 2005). Traditionally, string is added to the chickens' enclosure and allowed to remain for extended periods of time. We hypothesized that we could increase the effectiveness of the string by introducing it on a more intermittent schedule using limited periods of exposure. If successful, this simple change should allow us to finally overcome an established stereotypical behavior in our adult birds.

Our specific goals were to:

Reduced aggressive pecking between chickens.

Improve plumage condition and reduce balding areas.

Produce a sustained interest in the enrichment.

METHODS

Enrichment

The string enrichment created was simple and inexpensive to make. The strings were made of polypropylene twine 0.3 cm wide and 16 cm in length, tied in three bunches of eight strings each. Strings were suspended on a one meter PVC pole at the height of the birds' heads. It was provided four days a week for three hours a day for a duration of eight weeks.

Measuring Behavior

Chickens were observed for aggressive pecking and use of the enrichment each week. At the start of the observation period the birds were given five minutes to habituate to the presence of a single observer outside the kennel. The chickens at DVU are frequently handled during training and teaching exercises and were familiar with the observer. After the habituation period ended, aggressive pecks were counted for thirty minutes. There was a second, 15 minute observation period for the chickens receiving the new enrichment. During this interval the observer counted the number of pecks directed at the strings.

Plumage

Chickens had their plumage evaluated each week by covering their back with the smallest circle that completely obscured the bald area. This allowed us to measure the largest diameter of an irregularly shaped area. The laminated circles were numbered to reflect their diameter in cm.

RESULTS

Pecking behavior

Chickens that were provided with string enrichment experienced significant decline in aggressive pecking relative to the unenriched controls (t-test, $p < 0.05$). Aggressive pecking dropped by 80% within two weeks after the introduction of the string and remained low for the duration of the study (Fig. 1)

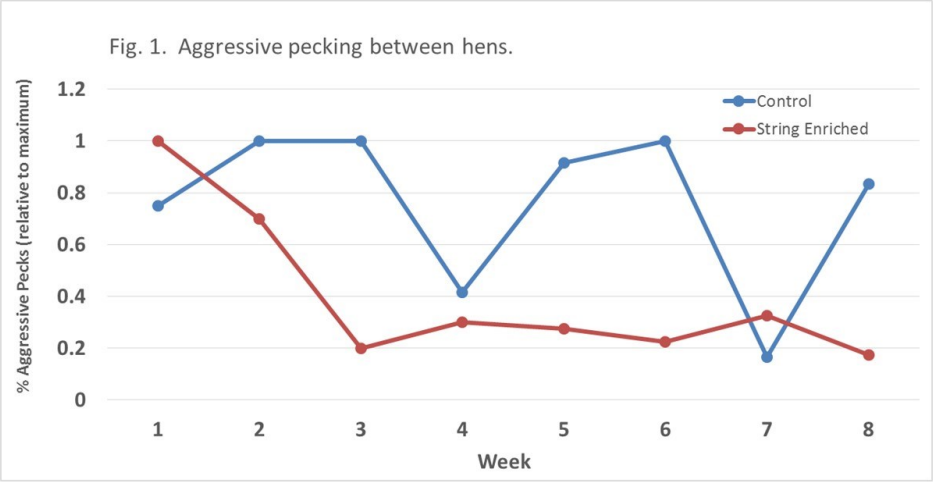


Fig. 1. Aggressive pecking between hens.

Plumage condition

Enriched chickens showed a marked improvement in plumage condition over the eight weeks of the study (Fig. 2). Over 80% of the enriched birds showed improvement while none of these birds experienced a decline in condition. While some of the unen-

riched birds also showed improvement, 34% of these birds showed a *decline* in plumage condition by the end of the study. Differences between treatment groups were marginally significant (Fisher's exact test, p = 0.07)

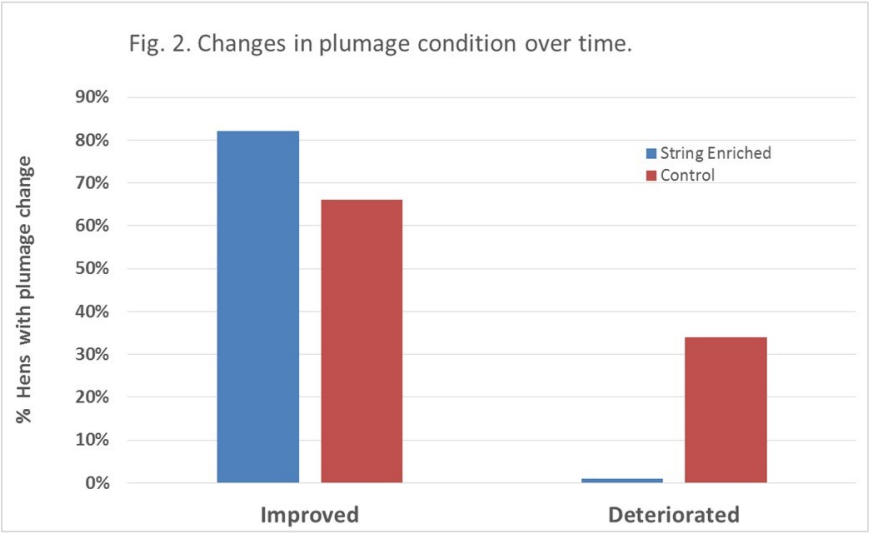


Fig. 2. Changes in plumage condition over time.

Enrichment Use

While enrichment use peaked in the first two weeks after introduction, chickens continued to use the enrichment throughout the study, averaging 20-30 pecks per hour (Fig. 3).

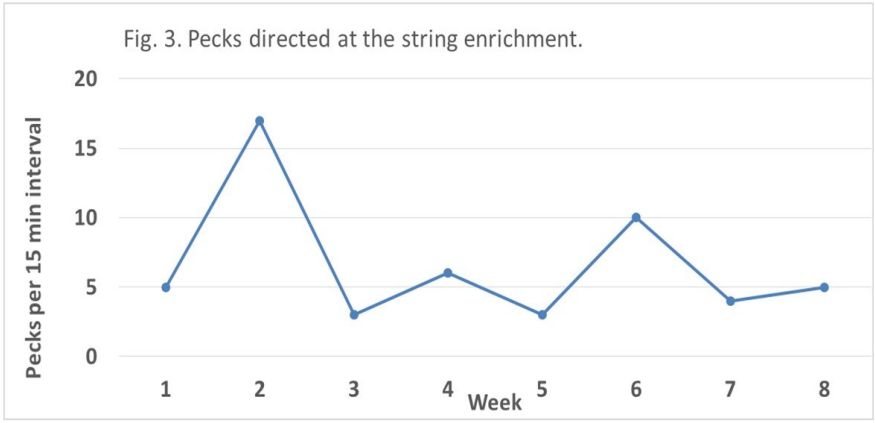


Fig. 3. Pecks directed at the string enrichment.

CONCLUSIONS

Chickens that received the string continued to use the enrichment for the full eight weeks of the study. During that time they experienced a dramatic decrease in aggressive pecking and a concomitant improvement in plumage condition (Fig. 4). By simply modifying the duration and frequency of the enrichment we were able to extend the benefits to a difficult group – adult birds with entrenched behaviors. The new string enrichment is inexpensive, sanitary and easy to provide. It is now a permanent component of our enrichment protocol for this species.

REFERENCES

Hartcher, K.M., Tran, M.K.T.N., Wilkinson, S.J., Hemsworth, P.H., Thomson, P.C. & Cronin, G.M. (2015). Plumage damage in free-range laying hens: Behavioural characteristics in the rearing period and the effects of environmental enrichment and beak-trimming. *Applied Animal Behaviour Science*, 164, 64-72.

Hocking, P.M. and Jones, E.K.M. (2006). On-farm assessment of environmental enrichment for broiler breeders. *British Poultry Science*, 47, 418-425.

Jones, R.B., McAdie, T.M., McCorquodale, C. & Keeling, L.J. (2002). Pecking at other birds and at string enrichment devices by adult laying hens. (2002). *British Poultry Science*, 43:337-343.

Mcadie, T. M., Brantsaeter, M. Nordgreen, J., Sandberg, E., Hansen, T.B., Nodtvedt, A., Rodenburg, T.B., Moe, R.O., & Janczak, A.M. (2005). Reduction in Feather Pecking and Improvement of Feather Condition with the Presentation of a String Device to Chickens. *Applied Animal Behaviour Science*, 93, 67–80.

Tahamtani, F.M., Brantsaeter, M., Nordgreen, J., Sandberg, E., Hansen, T.B., Nodtvedt, A., Rodenburg, T.B., Moe, R.O., & Janczak, A.M. (2016). Effects of litter provision during early rearing and environmental enrichment during the production phase on feather pecking and feather damage in laying hens. *Poultry Science*, 95, 2747-2756.

ACKNOWLEDGEMENTS

We would like to thank Rebecca Hughes, Diane Pilchak and the animal care staff at Delaware Valley University for their assistance with the project. Funds were provided by a grant from Bristol Myers Squibb.

Providing Choice and Control for Ambassador Animals by Training Communicative Behaviors

Kristen Frizzell, Chelsea Koenig, Liz Evans

National Aquarium

Baltimore, MD

Providing animals with choice and control has become a major focus in the animal care industry. We have recognized these concepts as primary reinforcers and have come to respect that animals should not feel trapped in a situation or forced to do something. The Animal Programs department at the National Aquarium has implemented such practices and is now taking it to the next level by training animals to communicate their preferences. Using a similar approach to the Norwegian horse blanket study (Mejdell et al 2016), a non-flighted hyacinth macaw (Anodorhynchus hyacinthinus) was taught to ring a doorbell on her perch in order to communicate when she is ready to return to her enclosure. By utilizing successive approximations, creative engineering, and a fantastic team, we were able to teach the behavior within a few months. We have learned a great deal about our hyacinth macaw's preferences since training this behavior and learned that some of our assumptions were wrong. We plan to expand upon this communication training by teaching her to ring different bells to communicate other requests and by continuing to work on other choice and control opportunities with all our ambassador animals. We hope this work inspires other facilities to develop new and exciting ways to teach animals to communicate their preferences. You never know what you will learn about your animals until you give them the opportunity to tell you.

Introduction

A key concept to animal welfare and behavior management is understanding choice and control as a primary reinforcer. Allowing animals choice in participating in human interactions and accepting their response, is critical to empowering animals and increasing their welfare. Studies on animal learning demonstrate that animals thrive when given the ability to exert control over their lives and their environment even in small ways and that these choices are self-reinforcing. Animals can learn that producing desired behaviors leads to desired consequences, such as a food reinforcement, while undesired behaviors are ignored. Empowered by their knowledge of cause and effect and their ability to choose, animals have the ability to exert control over themselves and their environment and make choices that lead to their preferred consequences (Martin, 2015). In the interest of promoting good welfare, the Animal Programs department at National Aquarium is fostering communicative behaviors—taught behaviors that promote a direct dialogue between the animal and its keeper regarding preferences. These communicative behaviors are more than a right to refuse; they are a way for an animal to manipulate its environment through conscious choice. Promoting communicative behaviors for indicating preference encourages keepers to think innovatively to enable choice in novel ways.

Aim

Animals under human care do not have as much control over their lives. We decide when they get food, when they get exercise, what types of food they receive, when they interact with caretakers, what enrichment they receive, etc. The daily routine of the National Aquarium's non-flighted hyacinth macaw is based on keepers' decision of what she should do, when she should do it, and where she should be located throughout the day. Although she has a home enclosure with food, water, treats, enrichment, another enclosure with different enrichment items referred to as her "play area," and a perching area where she can interact with trainers and see out the windows - she is unable to move freely between these spaces. In a typical day, she is placed in the perching area until it is time to go out for the morning program. After the program, she returns to the perching area, where she stays until she is put her back in her enclosure, usually around lunchtime. In the afternoon, she is returns to the perching area where she remains until put away for the rest of the day.

Staff started noticing behaviors that seemed to be her way to communicate that she wanted to return to her enclosure, such as leaning in the direction of her enclosure and specific vocalizations. With this in mind, a trainer came up with an idea for a communicative behavior so that our hyacinth macaw could tell us when she is ready to return to her home. The goal was to use a doorbell on the perching area that is accessible at all times while the bird is perched out Whenever she is ready to return to her enclosure, all she would need to do is ring the bell to prompt staff.

Methods

For this behavior to work, some creative engineering was necessary to "parrot-proof" a generic doorbell to be indestructible. A 3" polyvinyl chloride (PVC) female adapter part, along with a 3"cap, and 3" plug (see Figure 1) housed the doorbell. The Volcus VC102 Wireless Smart Doorbell came with a transmitter and two plug-in receivers. The transmitter was placed in the PVC device with one receiver in the bird room for the hyacinth macaw to hear when she triggered the bell (along with any staff in the bird room area) and one receiver in the department hallway to ensure staff could hear the doorbell if they were elsewhere in the department.

Training began with a primary trainer in order to ensure consistency and progression. The trainer showed the hyacinth macaw the device and would have her touch the trigger with her beak until it emitted the doorbell sound. As soon as the sound was made, she was bridged and reinforced. This step was important to emphasize not chewing on the trigger. Once that was established, each trainer in the department presented the doorbell any time we had to put her in her enclosure to build the association of the ringing sound with going home. After stepping off in her enclosure, she was reinforced, thus completing the full behavior.

The team maintained the behavior of holding up the device and presenting it to her when it was time to go home while the primary trainer spearheaded the progression of the behavior. This consisted of placing the doorbell on the perch in random places so the hyacinth macaw would have to walk to it rather than walk over to the trainer. To elaborate on that behavior, the trainer would try to discreetly place the doorbell on the perch without drawing the hyacinth macaw's attention to it. That way when the animal did see it, she could go to it when she was ready without accidentally being cued by the trainer. Most of the time, the "discreet" was not as discreet as the trainer would have hoped because the hyacinth macaw is very attentive to her surroundings and the trainer's placement of the object often accidentally prompted the animal to ring the doorbell.

The final step in the training process was to set up the doorbell on the perching area for the hyacinth macaw to have access to at all times while perched out of her enclosure. The primary trainer set up the doorbell on the perching area at the beginning of the day and allowed the hyacinth macaw access for the entire duration of her time perched out. From that point on, the doorbell was secured to her perch, giving the hyacinth macaw the choice to decide when she wanted to return home by triggering the doorbell.

The very first time the hyacinth macaw stepped off onto the perching area, it took her a little bit to realize she had access to the doorbell. Once she realized it was accessible, she went over to it and rang it. The trainer was there to respond and step her up,

reinforce her, take her to her enclosure, step her off, and reinforce her again. The hyacinth macaw learned very quickly (within a day of having constant access to the doorbell in the perching area) that she now had control over her environment. After a couple of times of ringing the bell fairly quickly after being perched out, she started to stay perched out longer and essentially made her own routine.

Results

We have had to learn that with great power comes great responsibility. There have been many roadblocks and speed bumps to work through and overcome. For our macaw, it can be an attention seeking behavior to ring the bell to have someone appear. Staff work diligently to ensure that we keep training positive. High-value treats are used for stepping up and stepping off the trainer's hand. If she refuses to step up, we remove the social reinforcer (ourselves) from the area for a few seconds and try again with a higher-valued treat or multiple treats. Placement of the bell had was adjusted to guide the hyacinth macaw to an ideal location for stepping up. We also had to address accidental rings caused by the animal dropping objects onto the trigger or the doorbell button sticking and ringing continuously.

It has been a very interesting learning and observational period. We have started to learn her preferences that we were not aware of before because she had no way of communicating them. What we thought our hyacinth macaw would prefer is not how she chooses to spend her day. Her former human-determined routine was to perch out for approximately three hours in the morning and two hours in the afternoon. During those times, she would regularly participate in training sessions, 15 to 45-minute programs, and short walks around the Aquarium's backup spaces. Our hyacinth macaw has taught us that in the mornings she prefers to be perched out when people are present, otherwise, she typically choses to go home to her enclosure space. In the afternoons, she prefers to be in her enclosure and will perch for short periods, whether people are present or not. This is interesting because she is a highly social animal who usually prefers to be near people, especially those who are not typically in her space. In the afternoon, our volunteers would go in and spend time with her to encourage the perching area to be more positive, but she would still ring the bell to go home. She does prefer to stay out if it is with someone with whom she has little or no experience, but for the most part, she shows a preference for being perched out in the morning and a preference to be in her enclosure in the afternoon.

Conclusion

Moving forward, our department is taking the doorbell training to the next level with construction of a new, permanent doorbell fixture in our hyacinth macaw's enclosure to communicate when she wants to come out of her perching area. With this behavior, we will need a delta to signal and communicate to her when staff are present and able to respond to her. At this time, we are looking at a light (A manually operated or Bluetooth-enabled nightlight) for staff to turn on when they arrive and off when they leave or are not available to bring her out of her enclosure. We are also increasing the number of doorbells she has access to on her perching area to include an option that signals she wants to go to her "play area" enclosure. This doorbell structure will be a different color and omit a different ring to differentiate it from the other doorbell. We will also have a third bell to present when it is time for programs so she can pick between the three options and communicate if she wants to go home, to her play area, or to the program. This will give her a clear method indicating her choices. There is also discussion of a doorbell at her program space so she can communicate when she is done and ready to head home.

All of this doorbell training is only possible because we have flexibility in our presentation schedule. If the hyacinth macaw chooses to ring the doorbell to her enclosure right before her scheduled program, then we can simply take another animal. We have alternate animal options for every program and never guarantee a specific animal.

The addition of communicative behaviors to an animal's repertoire is a unique tool that can increase the welfare of the animals in our care. By permitting a dialogue to occur between keeper and animal, animals can express their preferences, allowing them choice and control over themselves and their environment. The National Aquarium's ambassador hyacinth macaw was trained

to perform the communicative behavior of ringing a doorbell to signal that she wanted to be shifted from her perching area to her enclosure. We found that providing this form of communication allowed her to have more choice in where she spends her time during the day. Though we believed that she preferred to spend more of her day in the perching area, we were quickly disproven. By enabling the macaw to choose her own location, we found that she preferred spending time in her enclosure, regardless of social presence. We never could have known that if we had not designed a way for the hyacinth macaw to communicate with us. As caretakers, trainers, keepers, and biologists, we can become the linguist to help break down barriers. By training communicative behaviors, we can start that dialogue and discover the voice of our animals. I challenge you to think about how you can take the ways you provide choice and control to your animals and expand them in order to discover their true preferences.

References

Mejdell, C. M., Buvik, T., Jørgensen, G. H., & Bøe, K. E. (2016). Horses can learn to use symbols to communicate their preferences. *Applied Animal Behaviour Science*, *184*, 66-73.

Martin, S. (2015). The Right Tool for the Job. Retrieved April 4, 2017, from http://naturalencounters.com/site/wp-content/uploads/2015/11/TheRightToolForTheJob.pdf

Training a Voluntary Eye Medication Application with a Harris Hawk (*Parabuteo unicinctus*)

Autumn Henry[1], Sean McLaughlin[1], Lauren Wilson[1]
[1]Texas State Aquarium

We have several different species of birds at the Texas State Aquarium, including a male Harris Hawk (Parabuteo unicinctus), Maverick. Maverick has had problems with his left eye for several years, holding his eye shut usually during periods of low temperatures or high wind speeds. Despite multiple veterinarian visits, no solution was found. It was decided that in order to provide relief for Maverick, a medicated gel would be applied to his eye TID. In the beginning of this gel application, trainers caught Maverick in a towel in order to apply the medication directly to his eye. However, it was clear that this had negative effects on Maverick's training. He began demonstrating clear avoidance behavior of both the glove and trainers who were responsible for the catch-ups. It was decided that since the eye issue was ongoing, a voluntary medication behavior should be trained. In order to create a safe environment for his trainers, we redesigned one of his crates for medical use. A hole was carved into a sliding plastic door that could replace the original one during treatments, large enough that Maverick could solely extend his neck through the opening. Maverick was then trained to pass his head through this opening to target to the hand for reinforcement. This allowed for a second trainer to approach Maverick's left eyeball with the medication in slow increments. We were successfully able to apply the gel to the eye and Maverick was able to withdraw at any time if he were uncomfortable. This technique allowed for medical treatment without compromising valuable relationships and training.

Introduction

The Texas State Aquarium is a non-profit facility located on the coast of Corpus Christi, TX. It has a number of aquatic species but is unique in the fact that there is also a fairly large Bird and Mammal Department. The Bird and Mammal Department is responsible for the Wildflight show, a multi-species free-flight presentation that focuses on natural behaviors of native and exotic birds and mammals. At the Texas State Aquarium we utilize operant conditioning to train and maintain such behaviors, including several basic husbandry behaviors to aid in daily care. Many of our animals are trained behaviors that assist our veterinary staff during physicals and other medical events. We have found that the voluntary choice to participate in these sessions creates a less stressful situation for the animal. Consequently, this allows our facility to provide good animal welfare through better physical condition via check-ups and natural behaviors, supervision of proper mental health, and support for positive emotional states (AZA Animal Welfare Committee).

In the Wildflight show we fly three male Harris Hawks (*Parabuteo unicinctus*). These individuals have been trained to perform a variety of behaviors such as being called to location, crating, and allowing telemetry placement. While two males were hand-raised at a facility for show purposes, the third male, Maverick, was a wild bird deemed non-releasable by Texas Parks and Wildlife. Little is known about Maverick's history prior to 2008 when he arrived at the Texas State Aquarium. In 2016, trainers noticed a tendency for Maverick to hold his left eye closed, particularly after periods of low temperature or high wind speeds. Trainers and veterinary staff monitored the issue and it was discovered that the eye would often remain closed during the morning; however, he commonly would open it to perform active behaviors regardless of time of day. After several examinations both on-site veterinarians and veterinarian ophthalmologic specialists found no reason for these eye issues. The Texas State Aquarium's lead veterinarian prescribed an antibiotic eye gel to be applied 3 times a day (TID) to provide some relief

for his eye. Due to the immediate necessity of the topical application, trainers would call Maverick to glove and were required to physically restrain him in order to forcefully apply the gel. After a couple of days of this treatment Maverick began to show clear avoidance behaviors; refusing to fly to the glove or go near trainers responsible for these catch-ups. This made necessary show behaviors such as telemetry impossible. Since the eye issues were continuous, trainers decided to train a voluntary eye medication procedure to lessen Maverick's stress and to recreate positive associations with both his trainers and the glove.

Methods

The location chosen for training the behavior was Maverick's enclosure: a 15 ft x 10 ft x 10 ft mew with perching in the corners. While Maverick has exhibited aggressive tendencies in this environment, there were few other locations where this behavior could be trained due to his behavioral breakdown. We instead decided to utilize the positive associations he had within his enclosure – comfort and reinforcement history – to create a successful behavior. Maverick was crated in a 28 in. x 20.5 in. x 21.5 in. Grreat Choice® crate, was modified so the metal door was replaced with trex tracks and a shower board sliding door. A 2.5 in. diameter hole was cut into the center of the board 3 in. from the top. Adult mice and day old chicks were cut into nickel-sized pieces to be used as the primary reinforcement for this behavior; the maximum combined weight of reinforcement used per training session was 32g. Initially, only the trainers who were not involved with the physical catch ups were training this behavior. At the beginning of the session, Maverick was asked into the crate with the modified door. Pieces of food were held in the trainer's fist so that Maverick could see a small portion of the food, which prompted a target. Reinforcement was only given when his head was approximately 4 in. outside of the hole with both feet planted firmly on the floor of the crate. After he exhibited success at this step, criteria was increased so that reinforcement could only be received by longer durations of the target, effectively turning the hand into a station. Limited movement was allowed during this station as long as Maverick's head remained outside of the door. Once this behavior was consistent, a secondary trainer stood at Maverick's left eye with a sterilized pointer finger held a foot away from Maverick's head. The distance was closed during each session based on Maverick's behavior and he was reinforced for targeting to hand with relative stillness, feet on the floor, and tolerating the proximity of the finger. When the second trainer's finger made contact with the ridge above or directly behind his eye, criteria was lessened for the duration of targeting and instead reinforced for his head remaining outside of the door. Criteria was then increased allowing access to the reinforcement in the hand if he allowed touching of the area around his eye for 2-3 seconds with no extreme head movement. Once he was used to us touching this area with a finger, it was slowly moved so that the finger was hovering above the eye and gently touching the orb. While the first trainer targeted him, the second trainer would place a 3-mm strip of Terramycin in accordance with his prescription on his or her sterilized pointer finger and then swipe it over Maverick's left eye. He was then reinforced and released from his crate.

Results

The complete behavior with the application of the eye medication took two weeks to train before the eye medication was being delivered solely by this method. Maverick was visually aware of when these medication sessions occurred because his crate was outfitted with his specialized medication door prior to calling him inside. Once inside his crate, Maverick was successful in his eye medication behavior, with few events where he grabbed for the reinforcement with his feet or retreated back into the crate. In the event he retreated, trainers waited a couple of moments and then asked Maverick to retarget; he almost always took this opportunity. The application of the medication was completed within a minute of Maverick crating. Maverick did not emit avoidance behaviors towards the medicating trainers or the crate itself, as well as showed no discrimination between the show and medical doors. He allowed trainers to equip telemetry in his enclosure, was more likely to come to glove when called, and was more reliable in shows.

Discussion

Our goal in training this behavior was to provide an environment in which Maverick had choice and control, trainers could maintain a degree of safety, and in which we would eventually gain back his old repertoire of behaviors. All of these were important factors to the trainers in creating an increased standard of care for Maverick via this voluntary medication application. Throughout the training process, we kept the principles of good animal welfare in mind – mental, physical, and emotional wellbeing (AZA Animal Welfare Committee).

When considering Maverick's mental and emotional states in regards to the process of training this behavior, we believe Maverick felt empowered because he chose to allow physical contact with a sensitive area. Since only trainers who were not responsible for the initial catch-ups were training the behavior, there was no need to counter-condition Maverick to their presence. Utilizing this reinforcement history associated with various steps throughout the behavior, Maverick chose to take an optimistic decision-making approach towards all of the cued behaviors rather than choose to avoid the crate entirely (University of Bristol, 2010). His crate was already a highly reinforcing area. Utilizing this location gave both Maverick and his trainers an opportunity for a behavior that was safe and mutually beneficial. Maverick eventually allowed trainers who caught him up previously to medicate him via this process. This demonstrated that he had choice and control in this environment. While he had the option to retreat into his crate, he chose to maintain this station a high percentage of the time.

Raptors have a natural inclination to utilize their feet when feeding (Slagsvold, Sonerud, Grønlien, & Stige, 2010) and Maverick in particular has shown a tendency to foot for food when feeling frustrated. We knew that the application method of targeting Maverick through a novel door would take longer to train, however, we believed for physical wellbeing of both Maverick and his trainer that this method would provide safety and, subsequently, success during application. The location has a history of aggression so it is essential that Maverick be worked in a degree of protected contact. His crate provided this and allowed him choice and control in the behavior, as mentioned previously. By providing some relief, the medicated gel improved Maverick's physical wellbeing. Though antibiotics did not cure the issue, GenTeal has been applied consistently and has resulted in him squinting less in the morning. We believe this provided visible relief and helped Maverick with any sort of dryness he may be experiencing.

Flight is one of the most natural behaviors that a bird can demonstrate and the Wildflight team utilizes this for both shows and enrichment sessions. This voluntary medication application allowed Maverick to regain original criteria for previous behaviors, such as telemetry application and flying to glove, enabling him to fly in shows and during hawk walks once again. While he had the opportunity for short flights in his mew, as well as occasional flights indoors, these were either not to the extent that he was used to or a rare occurrence. The production of natural behavior, such as flight in a raptor's case, prevents boredom, creates a variable routine, and ultimately increases the animal's wellbeing, which is why it was so important that he gain back those behaviors associated with flight.

Conclusion

The training of this voluntary eye medication application behavior greatly increased Maverick's quality of life. Not only was the eye gel providing relief that could be visibly seen by the amount of time his eye remained open after consistent application, the option for choice and control in Maverick's environment dramatically decreased the amount of stress involved with physical restraint and medical application. When Maverick was allowed the opportunity to participate in his own medication procedures, he chose to do so for reinforcement whereas before he was given no control. This manifested in a hawk that was less likely to work with his trainers, creating a situation where both parties suffered – Maverick could no longer fly in shows and the trainers disliked their role as a newly perceived "villain" to Maverick. With the voluntary eye application, Maverick has a good relationship with all of his trainers, a valuable partnership that enables us to take him outside for flights in show and during hawk walks. All of this increases his welfare tremendously, allowing him the least amount of stress while continuing to provide the best quality medical care. Future work with this behavior will include desensitizing him for medication application to the right eye, as recently both eyes have been seen shut in the morning, and to create an even better station-

ing behavior with higher criteria. Overall, this situation has inspired Wildflight to search for more innovative and creative solutions to medical and behavioral issues, training voluntary procedures that allow for a stress-free and collaborative environment between animal and trainer.

Acknowledgements

We would like to thank the Bird and Mammal staff and the veterinarian staff at the Texas State Aquarium for their continued help and support. We would also like to thank the Texas State Aquarium for the opportunity to present this paper at the ABMA National Conference in San Antonio, TX.

References

AZA Animal Welfare Committee (1997-2018). Animal Welfare Committee's Definition of Animal Welfare. Retrieved 25 March 2018 from https://www.aza.org/animal_welfare_committee

Slagsvold, T., Sonerud, G.A., Grønlien, H.A., & Stige, L.C. (2010). Prey handling in raptors in relation to their morphology and feeding niches. *Journal of Avian Biology*, 41: 488-497.

University of Bristol (2010). Emotions help animals to make choices, research suggests. *Science Daily*. Retrieved March 27, 2018 from https://www.sciencedaily.com/releases/2010/08/100803212013.htm

Socialization in Training: Successful Voluntary Hip Injection

Alysia Lavender & Emily Mittleman
San Antonio Zoo

San Antonio Zoo achieved a new milestone with the birth of 2.1 African Lion cubs in July of 2015.Given that this was the first lion cub birth at the zoo in over 3 decades and the emergence in popularity of parent reared carnivore offspring socialization, the decision was made to pursue socializing as a benefit for both the cubs and their animal care staff. Daily socialization sessions began with the cubs at approximately 1 month old and continued until the cubs reached 3 months. Sessions consisted of general play, basic training and relationship building with the 2.1 cubs. Early on in socialization sessions animal care staff noticed the 0.1 lion cub would often present her hip for tactile reinforcement. Building on our socialization and her bond with animal care staff, we were able to capture the hip presentation behavior much quicker once the training foundation had been established. Positive relationship building and frequent socialization sessions increased the overall success in the training of new behaviors further down the road. Using these tools, we were able to successfully voluntary inject all three cubs with vaccines within a three week deadline.

Materials and Methods

For the first time in over three decades 2.1 African Lion (*Panthera leo*) cubs were born at San Antonio Zoo overnight on July 25th of 2015. Socialization of carnivores was new to San Antonio Zoo and had not been previously done. With the new information available for the benefits of socialization in parent reared carnivore offspring the decision was made to start socializing the cubs beginning at three weeks of age. Two years beforehand, 0.2 Sumatran Tiger (*Panthera tigris*) cubs were born at the zoo who were not socialized. At six months old one of the 0.1 tiger cubs fell and fractured her leg. The process of vet care was very stressful on the dam and the injured cub. In light of this incident, we were especially compelled to consider socialization and all of its benefits to animal care. Once the decision was made, the primary carnivore trainer wrote a protocol specifically for socialization of the 2.1 lion cubs based off of her previous experience, the species AZA husbandry manual, and communication with peers currently socializing lions at their facilities. This protocol was made available to staff in the department and staff were rotated into sessions with the primary trainer and trained on how to safely work in a free contact setting with the cubs. Throughout this process, the dam was always allowed visual access to the cubs and the positive relationship between the dam and animal care team was maintained by positively reinforcing her calm behavior during the sessions. The sessions were between ten to fifteen minutes to start and then time was increased as the cubs became more mobile and investigative. The ultimate goal of the socialization was to allow the cubs to interact and investigate animal care staff to foster a positive relationship for future husbandry and training. This was done through the daily session by allowing safe exploration and interaction with animal care staff through appropriate enrichment items. Play and positive interactions were encouraged and negative behaviors were redirected or ignored. Almost immediately we noticed that the 0.1 lion cub, Axelle, was very social and sought out tactile reinforcement. In contrast, the 2.0 lion cubs, Tony and Josh, were very engaged in play behaviors with each other and were slower to acclimate to animal care staff presence and never took to tactile as a reinforcer. At four months of age we noticed a behavioral shift in how the cubs interacted with their animal care staff and moved from a free contact to protected contact socialization. With the protected contact socialization Axelle continued to seek tactile reinforcement by pressing her body, hip, and tail on the mesh. This was encouraged by safely giving reinforcement each time the behavior was displayed and

would eventually tie into the primary trainer's injection training.

Training with the cubs began as soon as they exhibited a reliable interest in food which varied by the individual. We began with the basics of bridge association and target training and progressed to standard behaviors. As we began building a repertoire of behaviors for each cub we were presented with several challenges, the first being the renovation of the lion outside habitat. We were pressed to find a way to shift the lions out into the tiger yard to provide them with time outside during the long renovation, however, the two holdings were not connected. Management approved the addition of a chute, with a squeeze, to connect the two sides for shifting, which in turn, provided us an opportunity to create a space for medical training. The veterinarian team was in the process of streamlining the vaccinations schedules for their records and planned to use the squeeze or darts in three weeks to give multiple vaccinations to each lion cub. The primary trainer approached management with the idea of allowing us to try to condition voluntary injections before squeezing or darting the cats for their vaccinations. They approved our proposal with a three week time constraint.

At this point we had desensitized the lions and tigers to using the chute as a transfer, as was required for shifting on and off the shared exhibit during the renovation, and for obtaining voluntary weights, but had not done any formal training for voluntary injections. The first step in training in the chute was further acclimation. We asked for calm behavior before moving on to any other aspects of voluntary injection, which was done using their previously trained "lay down" behavior. Once they were acclimated to the chute we added a second trainer at the lion's hip. Once the lion was comfortable, the second trainer started touching the hip muscle with a blunt feed stick, then poking with the same feed stick, until finally progressing to using a sharper feed stick to poke. A verbal "poke" cue was introduced during the training process and a primary reinforcer of ground meat was used. Additional praise was also given for a particularly good behavior. Once they were acclimated to being poked with a feed stick we introduced the vet tech, who would be giving the injection, as the secondary trainer and added the pole syringe. The pole syringe was initially used without a needle and then a blunt needle was added. While the cubs would occasionally get overexcited in a session, making it difficult to poke the hip, they rarely showed any adverse reaction to the poke itself. During this process we noticed a marked difference in Axelle's behavior in the chute and to being touched when compared to her brothers. She was much calmer and focused and had a minimal reaction to being touched throughout the entire process. The final step resulted in successfully, voluntarily giving all three vaccines in a single session.

As we started the injection training we saw a lot of progression, but we were only three quarters of the way through our plan when the three week deadline was reached. After seeing how close the cubs were to being conditioned to voluntary injections we received an additional three weeks, but all lion cubs received their vaccinations just one week after the extension. This was a huge accomplishment for the carnivore training team and a first for San Antonio Zoo. We faced several challenges throughout this process including the fact that the trainers all had regular duties to complete and had to fit the time to train into their day. This required coordination on the trainers' parts as well as the part of the vet tech who had her own regular duties to attend to.

The introduction of a socialization protocol at San Antonio Zoo had tangible and lasting impacts on the day-to-day husbandry of our lion cubs. We were not only able to condition the lions to voluntary vaccinations in a short period of time, but were able to polish the behavior for the next year's vaccinations. A few months later we achieved another training milestone as a direct result of the socialization. As was previously mentioned, Axelle's propensity for tactile reinforcement continued once protected contact was implemented. After vaccinations we utilized this to capture a hip present behavior in a single session. We were able to use this behavior to successfully, voluntarily sedate her for a birth control implant within two weeks of capturing the behavior.

Conclusion

This opportunity to socialize the lion cubs has significantly impacted the level of welfare and care that we continue to provide to our lions, while fostering positive relationships that directly impacted their trust in their trainers during a potentially stressful time. It also enabled us to administer injections without the use of an aversive solution and has made us all better train-

ers and animal care professionals. Overall, it was an amazing opportunity to learn and grow our team's approach to the care we provide to our carnivores here at San Antonio Zoo.

Acknowledgements

We would first like to thank Ellie Koons, who was at the forefront of creating and executing the lion cub socialization and training program at San Antonio Zoo and who made all of this possible. The Veterinary, Carnivore and Management teams at San Antonio Zoo also deserve a huge thank you from us for playing integral parts in this process and allowing us to share our experience.

I OTTER TAKE A HEARING TEST
(*Otters learn to voluntarily take a hearing test.*)

Lesa Scheifele, University of Cincinnati's FETCHLAB[1]
[1]**F**acility for the **E**ducation and **T**raining of **C**anine **H**earing and **L**aboratory for **A**nimal **B**ioacoustics

As animal caretakers, it's easy for us to visualize daily needs of clean food, water and shelter. We see to health needs; obvious injuries and not so obvious parasites, but an area of care that is rarely thought about yet can have a major impact is animal hearing. Waterfalls echoing off the walls, constant filtration sending noise into an aquatic animal's pool at levels we know would damage human ears, animals having difficulty in species interactions and training scenarios due to undiagnosed problems with their hearing, neurological issues which can be diagnosed earlier with a simple audiological test done in conjunction with a regular sedated physical; audiological testing can give insight to all. Arguably the most important role that our charges fill is that of teaching us about their wild counterparts. We have become sophisticated in our knowledge of what protecting habitat entails. But what if an endangered species is being interrupted during critical breeding times by man-made noise? Without being able to prove what the range of hearing is for the animal, we are at a loss in court to answer how we know that the animals are bothered by the sounds. In conjunction with FETCHLAB at the University of Cincinnati, we taught two otters to take a hearing test by entering a box and exiting on the side they heard a tone issued. The fun part of the training came in teaching them to tell us when they did not hear a tone even though we had played one.

Humans hear from 20 Hz to 20,000 Hz. This limited range serves us well until we take into consideration what range of sounds the animals that we care for can hear. We can be oblivious to communications happening right in front of us that are below or above our range, sounds that are hidden from our ears by the water-air interface, and sounds that may seem innocuous to us that cause stress in an animal with a hearing deficit. Modern zoos and aquaria are full of awesome technological features. Any water exhibit has pumps and filtration machinery which can create a noisy environment especially under the surface of the water. Since sound travels much more efficiently in water, sounds that may seem negligible in the air can become damaging to an animal that spends a good deal of time submerged. Waterfalls and other features add to the exhibit noise. Are these noises causing the animals stress?

Taking this a step further, let's look at conservation. It's an unfortunate fact that humans have become an infestation. Rare is the habitat where we do not have a presence. But to human credit, within our infesting hoards are groups of conservationists, environmentalists, rehabilitators, wildlife veterinarians, and a host of other professionals who work to keep back the human infestation. But these professionals must have proof on their side. How can they argue in court to protect a fragile breeding colony from stressful construction noise if they cannot prove that the noise is even heard by the animals?

Audiological research that is being done in zoos and aquaria helps to protect hearing and reduce stress in our captive populations. This provides baseline information for professionals working with wild populations.

Materials

As a keeper, you worry about daily vitamins, bumps and bruises, hormone levels and eye tests. If an animal needs a sedated physical, you have an opportunity to also run a quick hearing test called an Auditory Brainstem Response (ABR). This quick test takes from 30 seconds to a few minutes but can alert you to hearing problems AND tumors forming along the central

hearing system. Performed by a trained animal audiologist each year, a keeper will have an established baseline and year to year evaluation of hearing acuity. Knowing that an elderly animal is beginning to acquire a hearing deficit allows us as keepers and trainers to start pairing visual cues with what was, for example, previously a verbal recall. As the animal becomes less able to hear as the years progress, it will have already learned a visual cue, reducing stress.

If you want to follow us completely out of the box, FETCHLAB™, the world's first animal audiology center, has fitted the first dogs with modern hearing aids. While not likely something to be found in every home in the future, hearing aids have the potential to lengthen the working life of some types of working dogs, such as search and rescue, steadying dogs, seizure dogs, etc. It is not out of the realm of possibility, as technology advances, that a well trained exotic could also benefit.

So what are some of the practical applications of our research? One of our students studied the noises produced by chickens in large scale farming. He recorded the vocalizations made by the chickens when they were stressed from being too hot or too cold, or alarmed by a predator. These sounds were fed into a computer program with engineering collaborators at Marquette University. The computer learned to analyze the chicken sounds, learning a rudimentary language. The result? The farm was able to install recorders that would listen to the chickens and send a text alert to the farmer when the birds were in distress. Imagine this technology being applied to zookeeping. You could be anywhere in your zoo or aquarium and receive a text that your animals were fighting, or emitting fear sounds, or whining for more food (well, maybe you wouldn't want every alert).

This work has continued. With the use of a type of neural computer program, and in collaboration with Mike Johnson at the University of Kentucky, FETCHLAB has been gathering audio files paired with behaviors that are fed into the computer. The computer is using the audio files to attempt to create a type of rudimentary language base for African Elephants (*Loxodonta africana*), buntings (Emberizidae), Asian Small Clawed otters (*Aonyx cinereus)*, and Beluga Whales *(Delphinapterus leucas)* so far.

One zoo asked us to investigate an exhibit as they were having trouble with their breeding program. When we mapped the denning area, we found the sound levels to be uncomfortably high. It has been proven with humans that exposure to too much sound can cause problems in pregnancy, so we suggested ways for them to mitigate the sound issue in the denning area.

At Georgia Aquarium, before the exhibits were built, FETCHLAB was consulted on how to design the tanks to create the quietist environment for the animals. As the tanks were installed and filled, we were able to suggest changes to filter mounts to deaden the transfer of sound through the concrete. Once up and running, FETCHLAB was able to save the aquarium potentially thousands of dollars by pinpointing a flaw in the build of one of the main filters, allowing that filter to be taken apart and fixed before the faulty part caused additional damage. Our equipment heard the difference in that filter vs the others.

Georgia Aquarium continues to have FETCHLAB monitor one of their main tanks in real time when they have DJ's playing music for events. A graduate student in Cincinnati receives the transmissions from Georgia and is able to alert the aquarium if too much sound is in the water, allowing them to tone done the DJ before their animals become stressed. We also do a monthly maintenance monitor to listen for any mechanical problems.

Multiple aquaria and zoos have had us acoustically map their pools. Mapping a pool allows us to check for areas where the physics of the tank has created standing waves….areas of the pool where machinery sound builds on itself to create an area of especially loud, potentially damaging, sound.

At Mystic Aquarium we set up a hydrophone in the water so that the public can hear the belugas in real time during educational talks. We also did electrophysiological research with the belugas which furthered the understanding of how cetaceans process sound in their brains. The more we understand this, the better we understand how anthropogenic (human created) noise in the oceans affects the health and behavior of wild populations.

The beluga whale population in the Saint Laurence Sea Way in Canada is endangered, mostly due to previous industrial pollution which is still present in the substrate. The area of the sea way where the belugas live is similar to a flooded Grand Canyon. It is possible to launch a minisub from the shore and immediately drop down hundreds of feet next to a rock wall. Blue Whales and many other cetaceans can be seen from the shore. Sounds in the water reverberate off the rock walls. The Canadian government asked us to monitor the noise that would be produced by a project to replace an aging ferry dock. The construction would require the use of large industrial hydraulic rock hammers. After tests and trials, we designed a bubble wall that acoustically insulated the hammer strikes away from the water way, protecting the whales and other aquatic life.

For the past six months we have been undertaking a complex experiment with Atlantic Bottle Nosed Dolphins (*Tursiops truncatus*) at the Indianapolis Zoo. Three of the dolphins have been trained to accept non-invasive cup electrodes held onto their skin for 8 minutes while a test called a "mismatched negativity" is run. This audiological test requires them to listen to tones and other sounds played through an underwater speaker while a computer program analyzes what their brain does with the sounds. An analogy is a person hearing someone repeating over and over "Would you like to eat a piece of pizza?" but then "Would you like to drink a piece of pizza?" is mixed in. For the first time ever, this science will be comparing a dolphin brain response as compared to a human's. As with the belugas, the more we learn about how dolphins process sound, the better equipped we are to understand the effects of human produced sounds into the oceans. Sounds from large ocean vessels, military sonar pings, drilling operations, and blasting, just to name a few, affect their environment.

Before beginning the experiment at Indianapolis Zoo, we acoustically mapped all of the dolphin pools, checking the health of their system in the process. Indianapolis Zoo has dolphins ranging in age from a few years old to in their 30s. At their request, FETCHLAB is providing them with ABRs on all their dolphins which will provide a baseline for their veterinary staff heading into the future. The research has been very rewarding for all involved and the dolphins seem to be enjoying their part!

At Newport Aquarium in Newport, Kentucky, close to FETCHLAB at the University of Cincinnati, we have multiple research projects happening. For the first time in the world, we are doing ABR's on Sharkrays *(Rhina ancylostoma)* an animal that hears with a lateral line. Sea horses (*Hippocampus*) are notoriously sensitive to sound in their environment. By mapping their exhibits and working with the aquarists, we were able to significantly reduce vibrational noise which had been disrupting the sea horses. A sea horse masters project studied their snicks and clicks to further the understanding of accompanying behaviors. In another experiment, we took advantage of the human population of divers in the tanks to study how well the human ear can handle understanding language underwater. King Penguin (*Aptenodytes patagonicus*) hatchlings have very similar vocalization stages as compared to human infants. They even have a babbling stage. This comparative study holds promise to better understand the evolution of vocal communication in both species.

Methods

This brings us to otter research at Newport Aquarium. Newport housed two Asian Small Clawed Otters (ASCO) which we were allowed to train for research as part of the otters' enrichment. As per the aquarium rules, the otters were trained with their daily ration. They were on the overweight side and we were not allowed to cut back on their diets. The training sessions had to be interesting to them for us to get anything accomplished.

Both ABRs and behavioral testing give us information about the range and required intensity (loudness of the required sounds) that an animal can hear. The tests are used to check against each other. Sometimes there will be an aberration that will continually show up in the comparison of the two types of tests, which then leads to further research to determine the cause. The results of this further research combined with results of the two tests provides a clearer picture of the hearing of the species compared to just one test alone. This was the first time that a behavioral test was ever accomplished with ASCOs.

In preparation for the study, FETCHLAB performed ABR tests on both otters during their regularly scheduled sedated veterinary exams. If an animal is willing to be still and compliant, they do not have to be sedated to run an ABR, but in the case of the otters, this was the easier and safer method.

The otters were taught to hold to a target pole and were acclimated to tones playing from a small speaker in protected contact in their backup area. The two otters were housed separately due to an unrelated issue so there was no direct interference from each other during training sessions.

The exhibit consisted of a large deep pool with a very loud ten foot waterfall feature. About a third of the exhibit space was the pool, and two thirds mostly flat dirt, grass and stone. Since the waterfall reverberated within the concrete and acrylic wall of this indoor exhibit, we needed to give the otters a way to concentrate on the acoustic tones in a quieter space. This was accomplished by the purchase of a 1.12 meter (44 inch) long heavily insulated Coleman cooler. A hole just large enough to allow the otters to pass was cut into each long side near one end of the cooler. An entrance hole was cut into the short other end, and a viewing window for the trainer was cut into the top.

The most time intensive part of the training was acclimating the otters to the cooler. Neither otter was previously crate trained. Both were too suspicious of the cooler to enter until we removed the top. Once removed, we were able to make the cooler part of play enrichment with treats and toys laying it on its side and eventually upright until entering it became commonplace. Adding back the top was accomplished in stages, placing it leaning, then covering just a quarter of the top while allowing the otters to exit from any direction, and over the course of many sessions, slowly sliding the top into position.

As the otters were acclimating to the cooler, we added in plastic holders which attached to the inside of the cooler walls with strong Velcro and would protect the wireless speakers while holding them in place. We added 90 degree PVC elbows to the side holes. These elbows required the otters to fully commit to leaving the cooler to see the trainer for their reward, and they seemed to add a level of fun to the research game the otters were learning to play.

We were ready to start. The goal: Ask the otter to enter the cooler from the open short end and hold at the target pole held by the trainer through the top opening. This stations the otter's head between the two blue tooth speakers mounted next to the side openings. Once in position, the trainer signals to the researcher sitting in the public area outside the exhibit. The researcher plays a tone on one side or the other using the blue tooth connection to their phone. The otter listens for the tone coming from one of the speakers. To be correct, the otter must choose to exit from the same side from which the tone emanated. The trainer has no knowledge of which side the tone was played on until the animal makes a choice to avoid the trainer giving subconscious cues to the otter. As the animal exits, the researcher signals to the trainer whether or not the correct choice was made.

We started by having only one speaker and mount in place. The otter was rewarded for entering the box at the entrance. If he entered the box from the side, he was not rewarded but was allowed to move into position and hold to the target. As the otters became better at entering properly, their excitement for the task increased and the reward for entering was elimi-

nated.

Once stationed, a tone audible to the trainer and otter was played and the otter was encouraged by leading with a fish to exit on that side. Within a session, the otter was happily exiting on just that side with or without waiting for the tone. The next session we switched to mounting a speaker on the other side. The otter initially exited on the incorrect side but with some encouragement, picked up the idea of exiting on the correct side. Over the next sessions, as we switched the speaker side to side, we reestablished the need to stay at station until a tone was played, and purposely started to vary how long the wait would be. We spent a few sessions alternating which side the speaker was on by throwing the reward into the water, giving us time to quickly stick the speaker onto the opposite side. The otters were rewarded with fish for exiting on the correct side, and given a negating hand signal when they looked up for fish but had exited on the incorrect side.

Now that the idea of exiting on either side was established, we attached both speakers to the walls of the cooler. As the speakers together significantly imposed on the space where the otters put their heads, with just a few inches on either side, the otters needed time to adjust and be comfortable at station, but within two sessions they were comfortable. The speaker holders were made large and extended to the cooler lid to make it more difficult for the otters to pry them off the wall. This allowed us to let the otters touch and explore the holders. We believe this aided in their comfort.

The training with both speakers was done with the trainer being aware of which side the tone was being played. The cooler muffled the sound enough that it was difficult without communication from the researchers to figure out which side was being played. For the initial training, it was beneficial to have the trainer know which side to expect the otter to exit for a correct response as it allowed quick and clear communication to the otter, along with encouragement when the otter was hesitant. The trainer made a point of keeping the sessions flowing quickly, using variable rewards and trying to keep it fun by having the researchers vary the tones being used and setting up the otter for success with a tone that the otter seemed especially solid on if there were signs of frustration. After 5 to 8 runs, if the otter seemed frustrated, other established behaviors were requested in various areas of the exhibit before tone work was reinitiated. Sessions were always ended on a positive.

After about 8 sessions, something clicked and the otters really seemed to get the idea. They were excited to see the box come out and sometimes were stationing before the trainer was in position. We were able to eliminate rewarding for stationing. They were able to correctly exit with sometimes no errors over the course of 25 repetitions, though 3 or 4 errors were more usual. When they made an incorrect choice and saw the negative hand signal with no fish forthcoming, they responded by quickly running to the opening and restationing to await the next tone without being asked.

As they became very good at the behavior, we began to vary the tones and the trainer was left out of the knowledge of which side to expect. Data began to be collected. Unfortunately, as the otters got better at the behavior, they became much faster and less patient with the slow humans. They would run into the box and immediately exit, tone playing as their tails were clearing the box. This caused some frustration in the otters and humans. We went back to rewarding for stationing and making a point to be very clear with our body language that no reward would be given for an early exit. We did some setting up, where we purposely would play no tone and watch for an early exit, then reward if they continued station. Sometimes we would take a time out, walking to a corner of the exhibit with back turned, or in rare cases, leaving the exhibit for a minute or two. This usually helped.

With data being collected, and the otters performing the task well, we needed to start using some testing tones outside the range of human hearing. As stated, humans hear from 20 Hz to 20,000 Hz. The expected but not proven range for ASCO is about 120 Hz to 34,000 Hz. We knew we were going to start testing the otters on some tones that they might not be able to hear, and we needed to teach them a nil response…a response where they could be rewarded for telling us that they could not hear a tone even though one was played. This presented a training problem. How could we reward them for not exiting the box when we played a tone without having them start to cheat? It was as if we would be untraining everything we had just worked for.

We decided to see what the otters would offer if we didn't play a tone when expected. The male surprised us by showing confusion as to which side to exit, then turning around and exiting out the entrance! We rewarded and he continued to do this as we experimented with how to train this, but it was not as solid a response as we needed. Sometimes he would just stay at station or tentatively exit out a side. The female showed frustration at no tone and our changes were starting to make both refuse the en-

tire behavior. We decided to try stationing as usual, then after the time when a tone would have been expected, asking the otter to stand up, bringing his head out the top of the cooler. This worked well, and the otters were once again excited about the behavior and this third type of acceptable response.

But then they started to cheat, popping up as if they did not hear a tone even if the tone was one we could hear and for which they had regularly exited to the side previously. They had us over a barrel as we needed to let them subjectively tell us by their behavior what they could and could not hear, yet we needed them to be honest. This brought us back to the drawing board and we decided to use the otters' hyperactive nature against them. If we had a technical glitch, sometimes we would lose the session as we lost their interest, regardless of how much fish we had. Throughout the training they were happiest and most excited when we moved quickly through the behaviors, keeping things interesting and fun.

So we decided to make the fastest path to a fish require them to be more careful about their choices. If they stood up when a tone was playing, they would have to wait a long time for us to reward what they considered a nil response. If they exited out the side they heard the tone, the reward would be immediate and much faster than if they waited. If they guessed at a tone they couldn't hear, or when no tone was played, most of the time there would be no reward. (There was the possibility they guessed at a tone they did not hear and exited correctly.) This required them to be more discriminating when they made their response choice and we were back on track. Since these difficult to hear tones were a small percentage of the tones being played, it was in their best interest not to guess.

As the otters grew more skilled, they were bored unless we were mixing up at least four different tones in a session, which kept the research team scrambling to keep up with the otters' agility at eating and stationing again quickly.

Once the otters were working well and we started gathering useful data, we tested them on 12 separate frequencies until we had a minimum of 30 trials for each frequency, in most cases many more data points than that. The preliminary results showed that they hear better in the range of 250 Hz to 10,000 Hz, well within human hearing, and they started to drop off in their accuracy below and above those frequencies.

Results

Some unexpected training problems occurred. The male otter, Chop, began to act aggressively and quickly ramped up to attacks on the trainer. It would occur when he was at station in the box awaiting a tone, and would suddenly launch out of the top of the box, springing off the edge for a mid-air leaping attack. To understand what was going on, we had to look at the training objectively from his viewpoint. The trainer and the researchers were unable to hear each other through the walls of the exhibit. This meant communicating only through gestures. Before this problem, we had not given much thought to these gestures, and once the otter was stationed, the trainer would point at the researchers with her free hand, slightly extending her arm as she pointed. From the otter's point of view looking up through the small window from inside the box, it appeared as if the trainer were throwing a piece of fish out of sight. Once we changed the gesture to an open hand closing to a fist, all fully in view of the otter, all aggression ceased.

When we added in tones that were likely too low for the otters and sometimes the trainer to hear, the otters learned to reach for the speakers and feel for vibration before making their choice. This was a unique behavior that the Director of FETCHLAB is very excited about and wants to investigate in a future experiment.

Animal Audiology and Bioacoustics are new fields on the cutting edge of our understanding. They hold the promise of new tools and technologies to aid our husbandry practices, and offer research opportunities that can aid conservation efforts. Please feel free to contact FETCHLAB at the University of Cincinnati, Ohio, USA if you would like to collaborate in research or have questions about the content of this paper.

AN APPROACH TO ASSESSING AND SUPPORTING THE BEHAVIORAL WELLNESS OF AGEING ZOO ANIMALS

Debra Marrin, Bethany L. Krebs, and Jason V. Watters

San Francisco Zoo and Gardens

A cradle-to-grave approach for managing animal welfare requires care adjustments for varied life stages. It is now very common for zoo animals to reach extended ages. Aged animals may experience frequent physical and behavioral changes. As a result, assessing the well-being of these animals should occur frequently. San Francisco Zoological Society's Wellness Team has developed a simple behavior-based method that can be used to assess the well-being of ageing animals. The technique is inexpensive and based on both inputs that support and outputs that indicate behavioral wellness. It considers both caretaker effort and animals' perspectives of their well-being. Our approach can be used to monitor quality of life of animals as well as the efficacy of modifications to housing, training, enrichment, husbandry and medication aimed at supporting quality of life. Ensuring positive quality of life for our animals supports the education and conservation missions of modern zoos by allowing our animals to be the best ambassadors for their species across all life stages.

Recent veterinary and nutritional advances in zoos and aquariums mean many species of animals live longer than their wild counterparts. Although many animals may remain physiologically healthy well into old age, this increase in longevity may come with any number of physical, mental and behavioral changes. Further complicating management of ageing animals are the individual idiosyncrasies of ageing – even two animals of the same species will likely enter advanced age with different physical and behavioral challenges. As each animal experiences a unique combination of progressive age-related changes, management of ageing animals must be adapted to each individual continuously. Adaptive management requires consistent, systematic assessment of the animal's responses to modifications implemented to address observed or expected physical, psychological and health challenges.

San Francisco Zoological Society's Wellness Team has developed a simple behavior-based method that can be used to assess the well-being of ageing animals. The technique is inexpensive and based on both inputs that support and outputs that indicate behavioral wellness. It considers both caretaker effort and animals' own perspectives of their well-being – as articulated in their behavior. This approach can be used to monitor animals' expression of quality of life in response to modifications of management inputs.

Inputs - Management Modifications

Animal care adjustments are made in multiple categories including access to resources, changes in bedding, enrichment opportunities, voluntary medical behaviors, diets, medications and habitats.

Bedding

Arthritic changes are common in older animals (Adkesson & Rubin, 2012; Hardie, Roe, & Martin, 2002)and decreases in muscle mass or body condition are also common (Bellows et al., 2016). Laying directly on a floor or other hard surface may become uncomfortable for ageing animals – especially those with joint or mobility issues. Increasing bedding materials,

adding stall floor padding or softer substrates in conjunction with proper veterinary treatment, may help ease discomfort of arthritic individuals. Incontinence is also a common issue for ageing animals (Landsberg & Araujo, 2005) and elevated beds with drainage can alleviate health risks associated with laying in soiled bedding overnight.

Enrichment

Mental and physical stimulation are critical for maintaining well-being at all life stages (Kempermann, Gast, & Gage, 2002) however changing cognitive and physical abilities of ageing animals may necessitate changes to allow the animal to participate in activities they enjoy. A polar bear (*Ursus maritimus*) at San Francisco zoo began having difficulty catching live fish in her pool due to slower reflexes and limited diving ability as she aged. To provide her the same behavioral opportunity in a more accessible way, care staff began providing a large tub of water in which she could stand and catch live fish. Animals that would normally be able to jump and climb to investigate and acquire rewards may need enrichment opportunities closer to the ground and easier to acquire.

Training

Although voluntary medical behaviors are useful at any time in an animal's life, they may become invaluable as animals experience changes in their physical health associated with age. A positive relationship with their trainers and a good foundation of behaviors provide caretakers options for diagnosis and treatment that are only possible with the animal's cooperation. The stronger the relationship between human and animal the more likely the animal will participate voluntarily when it is not motivated by food. As the animal's needs change the veterinary staff may ask for new behaviors to optimize care. Animals with a solid training foundation may be able to learn new behaviors faster. At the San Francisco Zoo we have added behaviors such as voluntary blood pressure readings, acceptance of subcutaneous fluids, and physical therapy exercises to our aged animal's repertoire. Ageing animals may also experience discomfort performing behaviors that have been reliable for years(Azkona et al., 2009). It is the trainer's responsibility to read their animals behavior and adjust antecedents and behavioral criteria accordingly to set their animals up to succeed.

Diet

Ageing animals may require dietary changes as well. Changes in digestive function may necessitate substituting dietary staples with easier to digest alternatives – ageing carnivores may need fur removed from whole prey items for example. As advanced dental disease or wear can make chewing difficult, hard foods may need to be soaked in water or be substituted with softer alternatives requiring less chewing and lowering the possibility of choking (Bellows et al., 2016; Longley, 2012).

Medications

Behavioral monitoring can help inform medical regimes by providing evidence for the effectiveness of changes to treatments. Animal caregivers commonly see changes in behavior which may indicate pain or discomfort long before a medical issue is diagnosed (Colles et al., 2016; González, Tolkamp, Coffey, Ferret, & Kyriazakis, 2008; Medrano-Galarza, Gibbons, Wagner, de Passillé, & Rushen, 2012). Therefore changes in behavior following medication adjustments can indicate whether or not the adjustment was effective.

Environment/Habitat

Changes in physical ability can make previously accessible parts of an exhibit inaccessible or even hazardous for ageing animals (Zucker, Deitchman, & Watts, 1991). Declining strength or mobility is common in older animals and simple modifications to an enclosure can help animals utilize all available space. San Francisco zoo has had success installing steps in an elderly polar bear's habitat that resulted in the animal doubling her utilized space. Occasionally, changes to mobility may come with safety concerns for parts of an exhibit. When an ageing Sumatran tiger (*Panthera tigris sumatrae*) developed balance problems, it

became necessary to install a fence along a steep drop off in the exhibit moat to prevent dangerous falls or the inability to exit the moat. This modification allowed the animal to maintain access to outdoor spaces as her physical ability to use different parts of her exhibit changed.

Outputs – Animal Behavior

Before implementing behavioral observations, wellness staff consult with curators, care staff and veterinarians familiar with the animal and its history. All parties work together to fill out a detailed questionnaire regarding the animal's medical history, behavior, enclosure, social environment, and daily routine. This process provides a history of the animal and helps identify specific behavioral indicators of interest for that individual. For example, observations of an animal with arthritis may need to include details describing the posture or gait to help assess management of the animal's discomfort levels.

We start with one to three observation periods per day. The data collection is simple. Observers, either an animal's regular caretakers or welfare staff, stand outside of the animal's exhibit or holding space. The observer writes down simple descriptions of the animal's behavior every minute for five minutes. Observers are encouraged to make comments regarding whether the behavior is normal or abnormal for the animal, or include relative descriptions of the behavior (e.g. 'looks slower than yesterday', 'laid down but stiff going down', 'standing with rear left leg held forward - unusual'), as this can aid in interpreting the significance of the behavior. Whenever possible observations should include explicit descriptions of body postures, social interactions, and location of the animal. Some behavioral observations should happen when staff are not in keeper areas, as understanding of what animals do when staff are not driving their behavior provides information about an animal's overall day. To get a complete picture though, some observations should occur when staff are driving animal behavior. So staff should also record how responsive the animal is to various opportunities they provide throughout the day in the motivation section of the data sheet. Possible examples of this include: responsiveness to training opportunities, securing when asked, responsiveness to feedings or keeper interactions.

Every interval observation of animal behavior is scored as either representing a positive experience for an animal or a negative one. Potentially ambiguous behaviors such as lying down or standing are scored as negative to minimize false positive moments in scoring. In humans, there is a known positive affective bias in otherwise neutral affective situations – in a 'default' state, humans experience the world as slightly more positive than negative (Diener & Diener, 1996). Positive affective experiences are also self-reported more frequently than negative ones in humans as well (Myers & Diener, 1995), although positive experiences may be shorter in duration than negative ones (Brosschot & Thayer, 2003). This assessment model assumes these characteristics are also true of affective experiences in animals. As we are interested in assessing moments of positive well-being, we would consider it acceptable for the animal to have more positive experiences than we are able to definitively identify. Scoring positive moments conservatively ensures that an animal showing at least 50% positive behavioral indicators is likely to have more positive than negative moments in its daily life, which we define as a positive quality of life.

Each observation is also scored as either active or inactive (1/0), and potentially indicative of pain or discomfort (1/0). Behaviors relevant to this item are based on medical information available for the animal, and informed by caretaker knowledge of the animal's normal behaviors. Finally, each observation is scored as either positive (1), no information (0), or negative (-1) in each of five domains: physical, psychological, level of independence, social, and environmental. At San Francisco Zoo, scoring is completed by animal wellness staff who do not work directly with the animals and are trained in the interpretation of animal behavior data. It is generally more useful to have observations scored by an independent observer. As each behavioral observation is associated with a date, and animals are observed multiple times a day, we can calculate the total proportion of positive and negative indicators for each category at varying periods of time: daily, weekly, or monthly. This allows us to assess changes over time or in response to changes in inputs (as described in the previous sections) for positive and negative behavioral indicators, activity levels, or possible discomfort behaviors. Signs of declining quality of life may include declines in overall positive indicators, positive indicators across multiple domains comprising less than 50% of total observations in a given time period or an increase in potential discomfort behaviors or decrease in overall activity level.

The utility of this method lies in the consistent and systematic observation of animal behavior to assess the success of

management interventions intended to promote positive quality of life. By including multiple stakeholders, this flexible approach allows institutions to define what 'a life worth living' looks like for an individual animal based on its personality, medical history, and individual needs.

References

Adkesson, M. J., & Rubin, D. A. (2012). Degenerative Skeletal Diseases of Primates. In R. E. Miller & M. Fowler (Eds.), *Fowler's Zoo and Wild Animal Medicine Current Therapy* (Vol. 7, pp. 396-407). St. Louis, MO: Elsevier.

Azkona, G., García-Belenguer, S., Chacón, G., Rosado, B., León, M., & Palacio, J. (2009). Prevalence and risk factors of behavioural changes associated with age-related cognitive impairment in geriatric dogs. *Journal of Small Animal Practice, 50* (2), 87-91. doi:10.1111/j.1748-5827.2008.00718.x

Bellows, J., Center, S., Daristotle, L., Estrada, A., Flickinger, E. A., Horwitz, D. F., Shoveller, A. K. (2016). Aging in cats: Common physical and functional changes. *Journal of Feline Medicine and Surgery, 18*(7), 533-550. doi:10.1177/1098612X16649523

Brosschot, J. F., & Thayer, J. F. (2003). Heart rate response is longer after negative emotions than after positive emotions. *International Journal of Psychophysiology, 50*(3), 181-187. doi:https://doi.org/10.1016/S0167-8760(03)00146-6

Colles, F. M., Cain, R. J., Nickson, T., Smith, A. L., Roberts, S. J., Maiden, M. C. J., Dawkins, M. S. (2016). Monitoring chicken flock behaviour provides early warning of infection by human pathogen *Campylobacter*. *Proceedings of the Royal Society B: Biological Sciences, 283*(1822).

Diener, E., & Diener, C. (1996). Most People Are Happy. *Psychological Science, 7*(3), 181-185. doi:10.1111/j.1467-9280.1996.tb00354.x

González, L. A., Tolkamp, B. J., Coffey, M. P., Ferret, A., & Kyriazakis, I. (2008). Changes in Feeding Behavior as Possible Indicators for the Automatic Monitoring of Health Disorders in Dairy Cows. *Journal of Dairy Science, 91*(3), 1017-1028. doi:10.3168/jds.2007-0530

Hardie, E. M., Roe, S. C., & Martin, F. R. (2002). Radiographic evidence of degenerative joint disease in geriatric cats: 100 cases (1994–1997). *Journal of the American Veterinary Medical Association, 220*(5), 628-632. doi:10.2460/javma.2002.220.628

Kempermann, G., Gast, D., & Gage, F. H. (2002). Neuroplasticity in old age: Sustained fivefold induction of hippocampal neurogenesis by long-term environmental enrichment. *Annals of Neurology, 52*(2), 135-143. doi:10.1002/ana.10262

Landsberg, G., & Araujo, J. A. (2005). Behavior problems in geriatric pets. *Veterinary Clinics: Small Animal Practice, 35*(3), 675-698.

Longley, L. (2012). Aging in Large Felids. In R. E. Miller & M. Fowler (Eds.), *Fowler's Zoo and Wild Animal Medicine: Current Therapy* (Vol. 7, pp. 465-469). St. Louis, MO: Elsevier Saunders.

Medrano-Galarza, C., Gibbons, J., Wagner, S., de Passillé, A. M., & Rushen, J. (2012). Behavioral changes in dairy cows with mastitis. *Journal of Dairy Science, 95*(12), 6994-7002. doi:10.3168/jds.2011-5247

Myers, D. G., & Diener, E. (1995). Who Is Happy? *Psychological Science, 6*(1), 10-19. doi:10.1111/j.1467-9280.1995.tb00298.x

Zucker, E. L., Deitchman, M., & Watts, E. (1991). Behavioral evaluation of exhibit modifications designed to accommodate an aged diana monkey. *Zoo Biology, 10*(1), 69-74. doi:10.1002/zoo.1430100109

OTTERLY UNIQUE: THE PARADOX OF OUR OTTER PAIR

Meredith A. Swortwood
The Columbus Zoo and Aquarium

For animal lovers, there are favorite creatures that trigger instant reactions. Hearts swell, pupils dilate, and gasps of excitement release as smartphones emerge to document. For some, otters induce this strong reaction with their cute antics. The Asian Small-Clawed otter is no exception when it comes to adorable. While our zoo exhibits this species, our Animal Programs department houses two adult males, Yin and Yang, who are a part of an ambassador collection. From the beginning, Yang showed comfortable behaviors during educational programming. Alternatively, Yin showed signs of hesitation in areas such as being held and coming out of his crate. We constantly compared the two and found ourselves puzzled when Yin's behavior did not meet our expectations. We had set the same criteria for both individuals based on one's success. Yin's outreach participation decreased and caused us to re-evaluate our otter routine to ensure the future success of both as program animals. This paper will outline Yin's extensive training plan and his slow introduction back into his role as an ambassador. From new behaviors such as voluntarily climbing in and out of an arm "chute," we created our own criteria that coincided with Yin's.

Yin and Yang have truly shown their importance as conservation tools to engage the public and start meaningful conversations to inspire action. Otters' natural behaviors are a draw to everyone they meet. When Yin vocalizes with charming squeaks or grooms his belly with his hands, he unknowingly seduces the public with cuteness.

Introduction

Comparing and contrasting objects, people, and animals is an inherent natural behavior that humans do on a daily basis. These thoughts allow us to make daily decisions between options and can influence our future actions. In terms of animal training, this is especially relevant when working with more than one individual. When one behavior is completed with one individual, it is natural to apply the same criteria to the next conspecific. Sibling conspecifics can offer a lot of similarities as well as differences. Consider Yin and Yang for example, two 5-year-old male Asian Small-Clawed Otters (*Amblonyx cinereus*), who were both raised in the same environment in terms of socializing, housing and diet. While these facets helped shape a lot of their behavior, there were inherent contrasts between the two.

As babies, we frequently took them together to educational programs but as they grew into adults, we slowly separated them in programming as the number of people who worked with them decreased. Some behaviors we saw were the same be-

tween the two such as the incessant urge to touch every new object within reach and their addiction to cuddling each other under bedding. Other behaviors were unique to each. During guest engagement, Yang frequently situated himself towards the audience. Yin usually laid on his back and cradled into our bodies- with the occasional rogue hand exploring our uniforms. While these behaviors were quite cute, we discovered that Yang had a fascination with shoving human hair into his mouth, and Yin's vocalizing reached new Mariah Carey-like octaves during meal times.

Antics aside, we noticed some major differences in ambassador related behaviors. For example, when we would reach down towards Yang, he would stand up half way or completely stretch into our arms. When picking Yin up, his body felt slightly tense in comparison. While he didn't run away from us, he wasn't leaping into our arms the same way that Yang did. Yang continued to travel with relative ease, and Yin would more often than not refuse to leave his crate in the van or in behind the scenes areas. This behavior looked like an otter peeking from the opening of the crate, our hands reaching towards him and Yin moving himself backward, which was sometimes paired with loud vocalizing. When he did come out, he didn't completely back up inside the crate, but at the same time he still didn't reach out to us in the same way that Yang did. We grew frustrated because as the number of programs Yang attended increased, Yin's by comparison decreased. In talking to each other, we said, "Yang came out on my program today but yesterday Yin didn't. I don't know why! It was weird. He wouldn't come out of the crate and I couldn't pick him up." What did Yang's behavior during programming have anything to do with Yin?

During the summer of 2015, one of our busiest seasons, Yin hardly attended any programs. The push for action came in September after planning to train both boys to do a voluntary x-ray behavior in order conduct a yearly medical exam. During our training sessions, we would pick up each otter and carry him over to the lobby where we had a table set up with the practice x-ray plate. Picking up Yin felt tenser than it did in the past and at times he would push his mouth and teeth against my arm. This looked like a behavior that could easily move to biting. We decided as an otter team that we wanted to enact a change- to create a new plan that was unique to Yin. We would no longer pick Yin up until there was a clear behavior created that offered him choice to do so. Our goal was to have Yin do the following voluntarily: enter and exit his house, move in and out of a crate, and be held in various scenarios such as on programs and around the building.

Station Training

While we recognized that Yin's behaviors related to programming were a concern, our priority was to complete an x-ray behavior as they had a medical exam scheduled for October. First, in order to get Yin to and from the lobby for training sessions, he needed to be given the choice to go to and from his house. Because of their ninja skills, as well as their love of a separate heating system, the otters have a separate room and door from the other small mammals in the same hallway. This housing set up allowed us to work on stationing safely. If he left station and decided to walk out of his house, there was no risk of him encountering another animal or reaching into another enclosure. For training we utilized the lake smelt from his diet as a reinforcer. Both otters were given a smaller fish breakfast and had access to ferret maintenance kibble throughout the day. Yin participated in these

sessions alone, while Yang was shifted outside or participated in training in the lobby with other handlers.

Using our right hand as a guide, Yin was reinforced for facing forward near the hinge of the enclosure door, which opened inwardly. To make the behavior even more clear to him, we reinforced him for reaching a hand and then both hands, underneath the door in a symmetrical fashion. We continued to reinforce this position and then incorporated a second person to conduct approximations with their hand towards the enclosure door. Yin was reinforced for remaining in his station position after every bridge. Eventually through multiple reps, the second person was able to wiggle and touch the door handle. After remaining successfully in his station, we then opened the handle several times without moving the door. Eventually, the second person could open the handle and the door a few inches without Yin moving from his station. We then incorporated a cue for Yin to leave his house. Secondary reinforcers outside of the house offered a challenge. Touching windows and Rubbermaid containers offered a lot of value to Yin, so we increased the amount of primary reinforcers offered when going home. In order to solidify the behavior, we continually reinforced him walking into his house and into his station without shutting or even touching the door. We approximated the door moving and then closing while reinforcing Yin for remaining in the station position. The second person was faded out and I could now operate the door with one hand and cue Yin to station with the other. Ok, now Yin could move in and out of his house…what next? How do we get him to the table for other training sessions?

Crate Training

Introducing the crate to Yin in a non-program setting offered a new set of challenges. There was a history with the crate as he had been taken in and out of it without clear choice. When the crate was initially introduced, the door was completely removed. In addition to this and in order to give him a better visual of where the reinforcer would be coming from, the crate was flipped upside down so the opening to the sides were lower to the ground and more in line with his vision. We reinforced for steps near the lip of the crate and then using our hand as a guide through the side of the crate, we reinforced for each step into it. Once he entered into the crate with his entire body, we completed multiple repetitions and intermittently cued him to his station at home and then back into the crate to his previous position of success. There was an ebb and flow in this process as some days offered less motivation for his diet and we would see an increase in exploratory behavior around the room to touch enrichment items taken out of the house or rubbing on extra bedding. We would ignore these behaviors and wait until we saw some attention towards us by him moving close to his door or near our feet. We found that the antecedent arrangement was important in this regard and removed enrichment and bedding items from the room before sessions began.

After showing confidence going in and out of the crate consistently, we reattached the door and incorporated it into the sessions. As the crate was within immediate reach, I could kneel down and cue him to go inside of it, reinforce him and then with approximations of my left hand towards the crate door, I could reinforce him inside the crate with my right hand. Introducing the door caused us to reevaluate Yin's body position. We found that once the door was closing, Yin did not have a clear body position that we had reinforced often enough- we were only reinforcing his body going into the crate and then staying there long enough for us to manipulate the door. With this in mind, we found that he would sometimes offer the behavior to

push against the door or touch it with his hands. We realized that in some moments, he did not have a complete visual of the door. In order to continue successfully, we wanted to see that he was completely aware of the door's movement during every repetition. We reinforced a station position that utilized Yin's hand placement in a similar way to his station at home. As Yin was comfortable moving in and out of the crate, we were able to flip it right side up and shape the behavior with Yin standing up. Now that our hand was higher, he could walk into the crate and look up towards the trainer's hand, be reinforced, and then continually be reinforced for standing with his body in profile to the door's opening. To give him room for his tail, we only reinforced him through the last 4-6 holes on the side. Once here, we shaped the behavior by reinforcing when either of his hands entered through one of the holes. After offering one hand, we reinforced offering two hands (one through each hole), and eventually each hand was reaching out with two or three holes in between. His head was free to look around, which allowed him to glance right while his hands were still in position and watch as the door was manipulated. We completed the door closing with further approximations as there was a communicated agreement between the otter and the trainer: the trainer never touched the door in any way unless Yin was standing in his station in the crate, and if Yin ever broke station before the door was shut and before being reinforced, the door was moved open and he was given the choice to leave. This clear communication allowed us to continue building our trust account with Yin as well offering him further opportunities of empowerment (Friedman 2012). Applying these criteria made for very clear behavior between the trainer and Yin as well. Now that Yin comfortably entered the crate with the door closing, we extended the duration inside and began lifting it off the ground a few inches and then back down. He was reinforced in his station when the crate lifted and when it was put down. To gauge whether or not the lifting caused regression in his crating, we would cue him to go home after each lift and then once seeing him crate without hesitation, would move to the next steps of further lifting, light movement, and then carrying through the room and hallway.

Picking up and Holding Behavior

An x-ray behavior was our initial goal and the motivation to successfully move Yin to the lobby and onto a table to participate in training sessions. By this time, Yang had completed the x-ray behavior, as well as an additional vaccination behavior, and had moved on to starting an adorable fish retrieval for educational presentations. We were excited by Yin's progress and moved forward with not only the x-ray behavior but also with the vaccination behavior in a L-shaped chute on the same table in the lobby. Both boys completed these medical behaviors successfully, but we knew Yin needed more changes from us in regard to continue ambassador work.

As mentioned before, Yang would reach up to us when our arms were offered. It felt very comfortable. But, we could not continue to interact with Yin in the same way that we interacted with Yang. How could we create a pick-up behavior that was voluntary and offered Yin a clear choice? Reaching our arms down towards him had a lot of history and would work against us in terms of progress. We brainstormed a way for him to walk towards us.

The table in the lobby offered a height advantage in shaping these behaviors. The body shape of an otter is very long

as well as flexible. Instead of reaching down towards him, we imagined him molding to our body along our arm and shoulder. Kneeling and squatting on the ground, I could bend my left arm, rest it on the table parallel to the front of my body to create a chute that was about the same width as Yin's body. This freed up my right hand to guide and reinforce with fish chunks. After reinforcing Yin with a couple bites on the table, I assumed the mentioned position and reinforced him every time he came near my arm. Initially he was reinforced in the general vicinity, but as he became more confident, he was only reinforced for entering the chute. As the duration in the chute increased, I reinforced closer and closer to my left bicep. Once a hand was offered on my bicep, I reinforced, and then once both hands were placed there, I reinforced again. To continue the behavior, a second person was brought in so that they could prompt further positioning with their hand moving over my left shoulder. To re-set Yin, I could cue him to exit the chute.

As this was not an ideal or natural body position to pick up an animal from a table, we proceeded in approximations of the primary trainer's body standing up. We found that as each repetition was completed, my left arm was straighter and moving closer to the side of my left body. Yin's body in turn was also moving to standing on his back two legs. We reinforced Yin for positions where both of his hands rested on my upper bicep and shoulder. In addition to this, we reinforced for his belly facing my front as well as any climbing and movement of his back legs towards my body. Once the climbing was consistently reinforced, we realized that Yin needed more support from my left arm, so we approximated the size of the chute to a smaller width where it now rested on Yin's right side. The positioning we found was ideal as my left hand could lightly cup his voluptuous right butt cheek. From here, we reinforced Yin for remaining in the chute and I lightly moved my arm against his body and cupping his toosh. If he remained here, we continued moving forward with further arm movement. Here, we reincorporated the climbing and the second person aided in this by using their treat hand to call him further up. The small steps of climbing paired with the arm squeezes and cupping created the perfect arrangement. As we continued shaping the behavior, we found that Yin's back left foot played a vital role in indicating whether he was confident in moving forward. This foot was the last behavior offered before a pick-up was possible. He could not lift his back-right foot off the table simultaneously as he would lose balance despite the human arm positioning. Once he consistently lifted his back-left foot up onto my body, I cupped his toosh again but added small lifts off the table. After this was reinforced a few times, Yin offered the behavior repeatedly and the movement between trainer and animal became less robotic and more fluid. The lifting height increased and eventually the second trainer was faded out. Since I was now only slightly squatting down, I could now reinforce Yin for remaining in position when I stood up to full height and then taking slow steps to reinforce him for each step I took away from the table. I found that Yin would sometimes push against my body initially and lean back towards the table when I started stepping in the other direction. At this point, I immediately walked back towards the table and allowed him to walk away. From here, I would re-cue a pick up and reinforce him at the last point of success. Once established, I would then move forward to more stepping and walking. Eventually, I was walking around the lobby with Yin in my arm while he ate his reinforcers intermittently.

Once this behavior was solid, our vision for Yin's future grew. It now seemed possible that Yin could attend a program

successfully and be held this way. We generalized the pick-up to different scenarios to continue offering Yin more choices in interactions with his trainers around his house and away from it as well. This included shaping the pick-up with Yin walking on the ground and walking out of his crate in new areas, such as the lobby and the van.

To pick him up from the otter room floor, we began by having the primary trainer kneel down and mimic the arm chute from the table setting. The difference being that the behavior was shaped from the ground up and Yin was reinforced for climbing up my thigh and hip, over part of my belly, up towards my shoulder and into the arm chute. This behavior had very few approximations as both human and animal could quickly apply the same mechanics from an already established behavior. Eventually, we could comfortably move from the otter room to the lobby without carrying a crate. This application of the pick-up only took two sessions to shape.

Picking up from the crate turned out to be the hardest behavior to work through so far. Here, the trainer was squatting slightly in an awkward way but was angled a hair to the right so that Yin could move into the left arm chute. This required extensive climbing from Yin as the arm did not reach into the crate at all. A second person was again incorporated to aid in reinforcing upward movement. This took about a week to complete in the lobby on the table as Yin showed more hesitation in this application versus the other. But once we moved into the van to imitate a program, we had to take more steps back than ever before. Although the pick-up mechanics were strong, the history of being in the van in a crate and away from the building heavily influenced Yin's present behavior. This took a couple weeks of work as we had to gain back trust that we had previously lost in these same environments over the last year and a half. Again, the back-left foot played an important role in determining whether Yin was willing to follow through with the pick-up. It was an indicator to the trainer to take the next step if it was lifted. This process included many small approximations as well as many repetitions. We saw that he needed a bigger reward for a pick-up in the van vs. a pick-up in the building.

After weeks of work together as an otter team, we were now driving to different locations in the zoo to imitate a program with Yin. We visited our administrative building and other offices where he could see small groups of zoo staff. This helped mimic environmental changes he would experience attending a program. Thus, by changing the setting we were able to generalize the behavior even further (Chance, 2006, p. 303, 305). Yin successfully attended a program in December 2015. We saw further success in passing off all of his stationing behaviors to multiple people as well as his pick-up behaviors to two other trainers.

Conclusion

We recognize that continuing to work with Yin as an ambassador will always be an ebb and flow of behavior. Some days his motivation is very low and he will explore for long periods of time instead of going into his crate. On days like this, it is not beneficial to take him on a program when the diet reinforcer value is so low. In regard to program behaviors, we limit Yin's trainers to only 3 staff members who have the strongest relationships. This allows us to maintain our set criteria. To set

Yin up and ourselves, for more success, we always bring him along as an extra animal. This further alleviates any pressure for participation. That way, if Yin decides not to come out, we have another animal to utilize as a second option. We resist the urge to create a tense environment where we feel that Yin has to come out in order for ourselves to feel successful.

The change in our otter routine led to more opportunities for both individuals. We even applied the home station and crating behavior to Yang so that we could further solidify consistency within our team. There was a newfound interest in working with the otters and we have incorporated newer staff into the fold. Roughly 10 people can comfortably take Yang with them on a program and the same staff can also cue Yin to station, shift and crate. Yang still attends far more programs than Yin, but that's ok. We now look at Yin's progress and successes separately from his brother and have seen strides in his behavioral changes. Yin engages guests during tours at the building frequently and still attends the occasional program. We have seen an increase in relaxed behaviors from Yin such as attempts to groom our arms while being held as well as rolling in our laps while socializing. These adorable behaviors are a gateway to better connect with our guests, and Yin and Yang's roles as ambassadors offer a platform to engage the public on issues like water pollution, exotic pet ownership and animal training. Did I mention how cute they are?

Special Thanks:

Wouter Stellaard
Kaylee Maple
Whitney Marker
Shawn Brehob
Suzi Rapp

References

Chance, P. (2006). *Learning and Behavior: Active Learning Edition* (5th ed.). Belmont, CA: Thomson Wadsworth.

Friedman, S.G. (2012, September). Back in the Black. *Bird Talk*. Retrieved March 28, 2018, from behaviorworks.org

The Quarantine Experience

Nicki Boyd

Associate Curator of Behavior Husbandry

Quarantine can be one of the most stressful times in an animals' life. As we constantly look for ways to improve welfare of animals in managed care, quarantine should be no exception. With thoughtful considerations of risk assessment, behavioral history, social structure, and enrichment experiences, animal care staff can create behavioral goals and work closely with veterinary and hospital keeper staff to reduce any unnecessary testing or putting them in a completely sterile and isolated environment for a minimum of 30 days. With access to documents like Animal Data Transfer forms and Enrichment Data Transfer forms ahead of a shipment, a thoughtful behavioral plan can be formulated. Pre-shipment testing can often preclude the need for lengthy quarantine times or timing with con-specifics or bringing a buddy up for social species like birds, hoof stock and primates. The Association of Zoos and Aquariums (AZA) Behavior Advisory Group (BAG) is coming up with best practices and behavioral and welfare considerations that will be shared in this paper. As we continue to strive for the best welfare for animals in our care quarantine does not have to be that stressful, isolated, sterile process we have followed for so many years. With animal care and veterinary care working closely together, this is one more area that can be a priority for welfare improvements for animals in managed care.

Quarantine is often a very stressful situation for animals. These animals have been removed from their known habitat and possibly companions and shipped, which can mean many hours in a crate driving or flying, only to show up in a new place, usually a hospital, with strange people and unfamiliar surroundings. As animal care professionals there is a move to improve the welfare during the quarantine experience. This paper will discuss the many options to make this a less stressful smoother transition into a new life that many AZA facilities are implementing. For sustainable populations reducing collection burdens on habitats, moving is a normal part of the process. Over the years, a variety of ways ensure information sharing keeps these animals life history preserved and passed on. One of the best documents for capturing animal information is in the American Association of Zoo Keepers (AAZK) Animal Data Transfer Form (ADT) and Enrichment Data Transfer Form (EDT). At the San Diego Zoo and most Association of Zoos and Aquariums (AZA) facilities those items are mandatory for all shipments and are sent ahead of the shipment.

This is the first step in establishing a smoother transition. All animal care involved in caring for the quarantine animal should read through the ADT/EDT and note what the animals know behaviors are, social status, diet, trained behaviors and enrichment preference and restrictions are. This form should get sent to as many as possible. Often the hospital keepers might get this but sometimes they do not make it on grounds. At the San Diego Zoo, not only does it get passed on to grounds animal care staff but our hospital keepers have created their own mini ADT called the San Diego Zoo Hospital Animal Housing form for

quarantine to show diet preferences they observed, how they liked to be fed, personality profile and any other observable information that might be helpful for the keepers on grounds.

The ADT/EDT and natural history are used to set up the quarantine habitat. No longer is the sterile hospital room environment necessary. Yes, quarantine serves a great purpose to clear animals of disease; if they have something that is detected it is easier to clear and disinfect a sterile habitat. But now zoos are considering the wellbeing first, and making sure there are digging, climbing, hiding and foraging opportunities. This is a lot of work, but well worth it to improve the welfare of the animals.

Training was often thought impossible in a 30-day quarantine (which is also a random amount of time being challenged). We are finding with the ADT that trained behaviors often can be re-established within a few short days of settling in. Remember, most animals would be adapting and learning each day in the wild; they have their own levels of intelligence and survival. Training in quarantine is not only possible it reduces the stress level and allows animal care staff to collect information such as weights, agility, visual assessment, diet consumption and helping ease in crating. Often scale and crate are the two priorities. If possible, other behaviors are added in. Targeting of course is a great way to shape these behaviors through successive approximations and can allow an animal to be moved around toward scales or crate so establishing or re-establishing target is a first step. Often even hand injections might be possible, if needed, but it's also possible that the pre-shipment exam that would be done for national shipments might preclude the need for another anesthesia during quarantine.

Training goals and involvement from the staff who will be taking care of the animals in the future is also a priority. The ADT/EDT can be sent from the curatorial or veterinary quarantine coordinator to a list of people who will be involved: a behavior husbandry manager, enrichment coordinator, leads, supervisors, and most importantly the keeper or trainer for the animal on grounds. The keeper should help when appropriate and draft training goals for the hospital keepers to focus on. As directed by the quarantine veterinarian, a protocol to allow animal care staff from grounds to visit and build a relationship with their future animal is key. This allows for a smooth transition to moving into the new habitat, having a trusting relationship to shift and train for animal care staff managing them on grounds.

At the Safari Park the hospital keepers created a resource with pictures of various habitats, this allows them to share and recreate ideal set ups without having to reinvent the wheel each time. There are files of pictures for various species. They have found fake plants can also be great hides and be disinfected and used again and again. It captures the substrates, shelters, plants and pools used. These are very helpful and now are being shared with our sister facility, the San Diego Zoo.

Veterinarians are working with each other and evaluating the risk versus benefit for animals going through quarantine. Here are a few case studies highlighting some considerations adopted at the San Diego Zoo

Maned Wolf: Brought in a new pair for a breeding program. Due to their skittish nature and the information on risk from their pre-shipment exam they were moved directly into the old empty maned wolf habitat. This not only let them settle into their long term home but allowed the exhibit not to remain empty for a month or longer. The keepers began creating a relationship with the animals and training crate and other medical husbandry behaviors.

Black Crake: This bird is known for its long toes and need for marsh lands. We found quarantine caused a lot of foot problems after about 2 weeks. Our vets found a way to get all the information needed to release them on grounds by 14 days and completely avoid the foot issues that had plagued us with this species in the past.

Lemurs: We recently opened several habitats, which meant bringing in and quarantining several different species of lemur. When introducing a Sifaka pair, we timed their quarantine for them to arrive on the same day; this not only allowed this social animal some companionship but they bonded over the need to rely on each other for security during this new transition in their life. Their jumping ability was considered when setting up their quarantine habitat with large stalks of bamboo wedged like trees in the square quarantine rooms. The keepers got creative with feeding on metal skewers hanging from the ceiling so they could forage throughout the day. Scales were strategically placed to allow weighing and the animals quickly got acclimated to their new temporary home and began to thrive.

The Zoological Society of London has been training animals in quarantine for a few years now. They show faster recovery, lower stress, lower respiration rates, and ease in transition to new habitats and keepers. Disney's Animal Kingdom puts about 70% of their bird and mammal shipments straight into their new habitats, 25% go through a modified quarantine of a few days to two weeks, and about 5% go through the traditional 30-day quarantine. Their reptiles usually have 45% go directly into the collection 5% do a modified quarantine and 50% go through the standard quarantine of up to 90 days.

Other facilities have also done some great changes in a positive direction. The Behavior Advisory Group (BAG) of AZA has collected information from many facilities on a survey sent out and will be offering resources for institutions that want to continue to improve welfare for their quarantine needs.

Quarantine doesn't have to be the black hole of welfare in animal's lives. There are many veterinarians and animal care professionals working to create best practices for improving the quarantine experience. Thirty days was a designated time to allow for tests and information to be collected, but if clear and healthy, 30 days may be too long. Certainly, there are Center for Disease Control (CDC) regulations that must be followed and often treatment of sick animals that develop during quarantine that might even extend their time, but more and more times can be shortened, better exchange of information and consistency with a quarantine policy can help make this a more positive and helpful transition in an animals life.

What the Flock? Balancing Guest Experience with Animal Welfare.

Rachel Salant, Animal Care Manager- Ambassador Animals & Behavioral Husbandry
Regina Smith, Animal Keeper- Ambassador Animals
Woodland Park Zoo, Seattle, WA

Woodland Park Zoo's expanding Ambassador Animal program took on a new species in 2017 - Chilean flamingos (Phoenicopterus chilensis). In 2016, eggs rolled off nest mounds resulting in two birds needing to be hand reared. By November, WPZ managers decided that the pair could fill a role as Ambassadors. The only housing option was to keep them as a pair in the flamingo holding barn behind the exhibit- a space that is half concrete/half grass with no pool or water feature. We quickly decided the best thing for their welfare was to integrate them into our exhibit flock of 38 birds, which would provide them with social interaction, naturalistic substrate, and water features. We developed an experimental plan to train the two chicks a recall in order to voluntarily call them off exhibit to join Ambassador Animal keepers on walks around the zoo for daily educational up-close experiences. The birds were taught this recall using krill and walks around zoo grounds as reinforcers. No weight management was used to create motivation, and at no time were we to physically retrieve the birds if they chose not to leave the flock. Commitment to one or two sessions per day for a year and effective cross team collaboration and communication has allowed us to finally have an ideal situation: two Ambassador flamingos that live on exhibit and can choose whether or not they participate in programs.

Flock Background

In 2008, Woodland Park Zoo opened a new Chilean flamingo (*Phoenicopterus chilensis*) exhibit with 34 birds. Between 2010 and 2015 all offspring that were produced were incubated and reared by the flamingos. In 2016, two chicks successfully hatched from artificially incubated eggs that rolled off of nest mounds and were subsequently hand reared by keeper staff. WPZ's Facebook community voted to name the chicks Paco and Pluma. The current flock consists of 43 birds.

Empathy Grant Background

In 2015, Woodland Park Zoo received a large privately-funded grant to grow the Ambassador Animal program to include the goal of fostering empathy for animals in our guests, specifically school-age children. Our preliminary data indicate that natural-history facts alone are not sufficient to provide guests an optimal learning experience. In the age of smartphones and other electronic media, where people have instant knowledge at their fingertips, we developed a strategy of empathy-building techniques based on research and best-practices to encourage our guests to see themselves in the animals and be more likely to act on behalf of the environment.

According to *Best Practices in Developing Empathy Toward Wildlife* (Seattle Aquarium, 2007), **empathy** is a stimulated emotional state that relies on the ability to perceive, understand, and care about the experiences or perspectives of another person or animal. Like other emotional responses, empathy is developed over time and reinforced through interactions with the world. Some basic empathy building techniques for the presenter include:

Use personal pronouns and individual names.

Model empathetic attitude and empathetic behavior- show that you care and that welfare is

your primary concern.

Draw attention to the animal's perspective.

Choose information with an eye to what we have in common with that animal, or what we would find emotionally compelling. Make sure the information is accurate.

Tell a story. Avoid dry-run downs of facts.

Some basic empathy building techniques for the animals include:

Animals should show agency, and should be seen acting of their own free will rather than being compelled (even by obviously gentle means).

Animals should show emotion.

Animals should interact. When animals voluntarily interact, either with each other or with humans, they show both agency and emotion in a way our species can readily empathize with (Seattle Aquarium, 2017).

Historically, the zoo's Ambassador Animals did not consist of more than some common snakes, lizards, invertebrates and small domestic mammals. Part of this new empathy initiative allowed us to grow the diversity of our animals and work with new individuals and species. We needed to get creative in order to get kids not just up closer with animals, but seeing animals act in a natural way under stimulus control so that it could be predictable and interpreted. As stated above, getting up close and seeing animals act on their own is important for the empathy side of things, but on the behavioral husbandry side of things, it is very important to us that if we go down this road with a wider variety of species, we want the animals to have as much choice and control as possible in these situations.

Our Ambassador Animal holding facility (freshly renovated and updated with grant funding) is located off-exhibit in a central location of the zoo and is managed by one animal care team. The flamingo exhibit is located across the main loop path, but is managed by a completely different animal care team and keepers. Despite the renovations to the holding facility, we did not gain any sort of enclosure that would be appropriate to house the two hand-reared flamingo chicks at Ambassador Animals. They would need to continue to live separately in the flamingo holding barn that is primarily managed by a different team. Feeding and cleaning was taken care of by them; somehow we needed to work out a system where training could be done by us.

Housing Considerations

While Ambassador flamingos are not uncommon in the AZA community, we were not sure how realistic or sustainable it was to embark on this with just two separated individuals. The most successful facilities with Ambassador flamingos tend to have a separate Ambassador flock of more than two individuals living in their own space.

While the zoo was interested in having Ambassador flamingos and capitalizing on the fact that we had two birds being hand reared, we did not have a place to house them. The flamingo barn is an off exhibit space that has a 25' x 13' concrete floor barn and a 25' x 10' grass area. There is no water feature to bathe in except their rubber water dishes that are primarily used to drink from. The flock has only used this space on the rare occasion of severe cold weather or for housing birds that needed daily medication, so it was easy to house the chicks there while they were being hand raised. It quickly became apparent that housing them in this area long term was not going to be an option for maximizing welfare, but we still didn't have separate housing. What the flock to do?

Diet Considerations

Given the nature of this type of training and behavior modification, we want to draw attention to the fact that all flamingos have access to food ad-lib: Mazuri Flamingo Complete Diet is available 24/7, even during the training process. Krill is not a

regular part of flamingo diet at WPZ, so we were able to use that as training treats to supplement the diet of these free fed birds. While weights were monitored to track and ensure healthy growth of the chicks, the adults in the flock are rarely caught up for weights, nor are they scale trained. At no point did we need to manipulate the weight of Paco and Pluma to encourage motivation to participate.

Early Training

Ambassador Animal keepers took on the primary responsibility of providing the 8- and 10-week old chicks (Paco and Pluma) daily exercise walks to begin assessing what type of programming would be sustainable, successful and enjoyable for a flamingo.

Several other AZA facilities mentioned a key to success of working with their separate Ambassador flock was capitalizing on the birds being hand raised and imprinted on people. Naturally, the tendency of young, hand-raised birds is to "flock" with people. However, one facility cautioned against relying solely on human socialization for the life of the birds. Once they sexually matured, they were less interested in following people for the sake of following people. Our team decided we would condition an auditory recall stimulus (bell) from the start, even though the chicks were still young enough to want to follow their human flock mates. We initially started using the bell during the walk and would periodically reinforce with bowls of thawed krill. Based on the bird's behavior, we found the walk itself, as well as the krill, to be reinforcing.

Keepers *initially* tried to train the auditory recall stimulus in a similar way we typically start to train A to B behaviors with our mammals that participate in our small stage venue- by ringing it continuously throughout the walk. When flamingos and keepers would stop to interact with zoo guests and have some krill, the recall bell would stop and restart when the walk began again. Keepers quickly found this method cumbersome with bowls of krill and annoying due to hearing the bell too much. Paco and Pluma never really seemed to associate the recall bell with the walk either. At this point we found ourselves wondering how we make sure that the recall has meaning.

December and January in Seattle are among our coldest months. The icy stretch happened that winter just as we began to rethink how we were going to make the bell have meaning. The chicks could not go out for walks under any of the following conditions: temperatures less than 32 degrees Fahrenheit (0 degrees Celsius), if there was any ice on pathways, and if ice melt was present on the pathways (even if there was no ice and temperatures were OK). For about six weeks, Ambassador keepers were not able to take the flamingos out for walks on a consistent basis and did all of the sessions in the holding barn. We were able to hone in on making the bell have meaning by doing short A to B's across the length of the barn and reinforcing each A to B with some thawed krill in warm water. Before long, both Paco and Pluma had figured out that if they came toward the keeper ringing the bell they would get access to the krill bowl. On days that we were able to take them out on grounds for a walk, we did not use the recall or the krill during the walk, but did additional A to B sessions with the bell and krill in the barn. By February 2017 were we able to ring the bell and have the birds walk around obstacles in the barn or come in from their small outdoor yard into the barn to get their krill before every walk.

During this time, we worked toward establishing all of the behaviors we thought we might need once we started the introductions to the exhibit flock. In late September 2017, after the bulk of our summer programs were done, we created a training plan and presented it to the bird team to start the introductions to the exhibit flock. The bird team had some legitimate concerns about the flock's safety: the flock is weary of people moving toward them (the flock consistently moved away from keepers entering to service the exhibit) and there was a fear that the flock would become stressed at the sight of the Ambassador keepers entering the exhibit daily. Both teams agreed to proceed with the introduction given this one rule of engagement: Ambassador keepers don't go past the bottom of the "ramp." Ever. This includes any instances where Paco and Pluma did not respond to their recall while on exhibit.

The "ramp" is a small soil incline pathway with exhibitory rock work, tall grasses and bushes on either side that

stretches between the exhibit and the gate to the holding barn's yard. These space constraints put on the Ambassador team were awesome because it ensured we had to properly train the recall or risk "losing" Paco and Pluma to the flock; this was a challenge and risk we were willing to take.

Flock Introductions and Additional Training Work

For the initial introductions, Ambassador Animal keepers were paired up with one of the lead bird keepers who assisted with all introduction sessions. This partnership was critical to the process since he was one of the main keepers who hand reared Paco and Pluma, he frequently does the husbandry in the flamingo unit, he understood our goals with the birds, was motivated to help us be successful, and he could help communicate with the other bird keepers on his team who may have had questions or concerns about this unique process.

The first step was to bring Paco and Pluma approximately half way into the exhibit and stay with them, while the flock was in the farthest third of the exhibit (the flock chose to be there because they saw us coming). After 10-20 minutes, a keeper in the flamingo holding yard would ring the bell, and Paco and Pluma (along with their 2-3 person keeper "flock") would move off exhibit to receive their bowls of krill before going out for a walk on grounds. At first, we noticed Paco and Pluma were nervous about walking both onto and off of exhibit and keepers needed to encourage them both ways. After a short time both birds would easily walk onto exhibit, but still struggled to walk back into their holding space.

The keepers then started backing off the exhibit (up the "ramp") as Paco and Pluma were encouraged to venture farther into the exhibit on their own, potentially getting closer to the adults, before being recalled after approximately 15-20 minutes. The birds were recalling to where the keepers were standing on exhibit (at the bottom of the "ramp") but were still showing latency when keepers started approximating themselves back up the ramp towards the holding barn.

After about 12 sessions, Paco and Pluma were becoming very comfortable on exhibit and were starting to intermingle with a few older hand reared birds. Keepers had successfully approximated themselves all the way up the "ramp" but got stuck at the approximation where they were standing at the top of the "ramp" to the entrance of the holding yard for the recall. When keepers tried to recall them after 20 minutes, both birds showed latency in coming off the exhibit. Keepers had to move a quarter of the way or more back onto the ramp to get Paco and Pluma to respond to the recall.

The team talked through how to proceed with the training at this point. Paco and Pluma were showing signs that they would choose to spend more time on exhibit if we allowed it, and they were not motivated to come back into holding. Also, when on the "ramp" into or out of the exhibit, both birds continued to show discomfort in this section by flapping and attempting to avoid this area. It was decided that this section of the ramp needed to be desensitized and time was needed to build up more positive associations with this area before going to the next step of giving Paco and Pluma more time with the flock. Over the next several weeks Ambassador keepers did at least one session each day of A to B's on that stretch of ramp, and over time Paco and Pluma became more comfortable moving through this section. They now walk calmly on their own both on and off exhibit, and this section of ramp is no longer an issue. We now felt confident giving Paco and Pluma more time on exhibit with the flock.

In November 2017 the Ambassador Animal team came up with our final flock introduction plan- one that was somewhat unconventional. On November 14th we released Paco and Pluma onto the exhibit at the end of the day for the entire night. The next morning, as soon as the Ambassador keepers came in for the day, we recalled them off of the exhibit and had them spend the day in the barn and holding yard.

It should be noted that the diet bowls on exhibit are located in the middle of a shallow pool. Because Paco and Pluma did not have access to a water feature in their barn and did not grow up around water (they tended to avoid even puddles on walks) we were not sure that they would be able to access the food bowls on exhibit right away. Because of this, our early

morning recalls after the first few nights out on exhibit were also potentially capitalizing on the fact that they might be hungry first thing in the morning. After the first successful recall off exhibit after their first overnight with the flock, Paco and Pluma spent the day in the barn with food bowls. They were then released back out with the flock at the end of the day. We repeated this process, progressively moving their first morning recall later and later in the day. This plan gave Paco and Pluma increasing time with the flock each morning.

Within a few weeks, both teams agreed leave the boys on exhibit 24 hours a day. Within a few days Paco and Pluma were each observed bathing in the large pool and eating from the food bowls in the small pool. Ambassador keepers weighed the birds weekly when they recalled off of the exhibit before their walk to make sure that they were maintaining their weight. Ambassador keepers started varying the times of the morning and afternoon walks to keep it unpredictable, and began working toward ultimately recalling the birds while being out of their line of sight.

Final Outcome

Currently Ambassador Animal keepers continue to do between one and two flamingo walks per day for up-close guest experiences. We are able to employ empathy messaging best practices by talking about the choice Paco and Pluma have to come out and participate in these interactions, their individual personalities and how guests can relate to them in addition to general natural history information. Paco and Pluma generally continue to choose to participate with the recalls off of the exhibit and always enjoy their walks on zoo grounds. They often choose the walk over the krill as their choice reinforcer. We have seen that one or both birds occasionally choose not to participate, in which case we simply take the bird that has opted in. They continue to surprise us- just when we think they're not going to participate because we chose to come at a time where they are in the middle of eating, preening or bathing, they will stop what they are doing and come join us.

Lessons Learned

The Ambassador Animal team has had the opportunity to work through many different challenges while working on this project for the last 18 months.

We were able to work with another team of keepers and managers that we usually don't work closely with. It gave the Ambassador Animal team the opportunity to share our passion for behavioral husbandry and how it improves animal welfare with a group of keepers that were unsure of our "big personalities" and extroverted ways. The experience also pushed our team to grow in accountability- the bird keepers learned to trust that we were going to do exactly what we said we were going to do. Throughout the first year, we often saw other keepers and managers pausing along pathways to observe how we interacted with Paco and Pluma, and we were happy demonstrate the birds' physical and mental welfare is always our top priority. We knew we were doing a good job when the lurking stopped, but we are always happy to have others along. The more the merrier!

We learned how important it was that we try to be as similar and consistent as possible amongst different trainers. Whether it was how we were recalling the birds or how the keepers were positioned while walking the birds around zoo grounds to maintain good manners (to avoid potentially problematic behavior like running ahead of us), consistency and good communication amongst the team is key.

The recall off exhibit is a trained behavior. Even though these hand-reared birds are still young and have not reached sexual maturity, Paco and Pluma discriminate between people. It is important for each keeper to spend positive time building relationships with Paco and Pluma because if the behavior breaks down, we need to fall back on our relationships with the birds to rebuild the behavior. After about a month of recalling the birds off of the exhibit, we realized that we hadn't spent any time simply hanging out with the birds. Instead of sending them directly back onto the exhibit after a walk, we decided to offer the birds a chance to hang out with us (preen our hair, get a hug, play with our shoelaces) before opening up the exhibit gate, which is now common practice.

"No thanks" doesn't necessarily mean "NO!" The flamingos have total choice on whether they come off of the exhibit or not. There is absolutely nothing we can do to go physically retrieve, manipulate or herd them off if they are past the "ramp" on exhibit. If we have a session where only one or neither bird recall to us, we analyze what competing reinforcers are happening at the time. Has the flock recently had their feed pans refreshed? Is the flock preening? Sleeping? Bathing? Is the Coscoroba swan (*Coscoroba coscoroba*) blocking the ramp? Are the birds heavily molting? Is the sun shining for the first time in weeks? Are there four inches of snow covering the path out of the exhibit? When we know that one or both of the birds had said "no thanks" to one or more previous sessions, we put forth extra effort to find a time that would be more likely to work for them- perhaps before the bird keeper services the exhibit in the morning. Or perhaps taking the time to monitor the flock throughout the day for a time when Paco and Pluma are naturally next to the ramp so that choice of coming to the top of the ramp is easy for them.

"Failure" is OK. We were willing to risk "losing" Paco and Pluma to the flock for the sake of trying to see if this could be done. We had support for this idea all the way up through curatorial staff. The pressure to have these flamingos become Ambassadors did not stand in our way of taking a risk to ultimately do what is best for Paco and Pluma's long term welfare.

Conclusion

As a cool side effect of working in the flamingo exhibit, we are closer to getting a couple of the more curious older birds coming to a bowl of krill at the bottom of the "ramp." The Ambassador Animal keepers have permission from the bird team to opportunistically reinforce any random flock members that are curious and choose to come over and participate. This could potentially lead to getting voluntary weights on other birds in the flock.The flock is generally more calm and less stressed around keepers now and don't move to the far end of the exhibit upon our arrival. Because we didn't know what we didn't know, anything was possible!

We think the success of this partnership has positive implications for Ambassador Animal welfare in general and in the future. While we can never take Paco and Pluma off-grounds for any sort of programming due to quarantine issues and the fact that they live on exhibit, we have unlimited options for on-grounds programming: weddings, birthday parties, picnics, on-grounds media appearances, daily walks around zoo grounds and stage show appearances are all possibilities. They have inspired us to rethink about how we can use what we've got to give animals in our care the best life possible while maintaining our ability to provide new, unique and impactful guest experiences.

References

Seattle Aquarium (2007). *Best Practices in Developing Empathy toward Wildlife*. Unpublished manuscript.

San Diego Zoo Global's Ambassador Cheetahs (*Acinonyx jubatus*): Training, Welfare and Their Role in Conservation

Kelly Salamone, Jessica Meurer, and Kyle Legoll

San Diego Zoo

San Diego Zoo Global (SDZG) utilizes ambassador animals to fulfill our mission to connect our guests to wildlife in fun and engaging ways. We currently house over 400 ambassador animals (mammals, birds, reptiles and insects) at SDZG, 13 of which are cheetahs (Acinonyx jubatus). In 2016 we completed 11,390 programs, many of which featured our cheetah and dog duos. Interest in ambassador cheetah welfare led to offering increased opportunities of choice and control in training, and a critical examination of the relationship with the domestic dog (Canis lupus familiaris) companions. SDZG evaluates welfare based on our five "Opportunities to Thrive" which is grounded on Brambell's (1965) five freedoms. Welfare research with off-exhibit breeding cheetahs has shown that behavioral diversity can be an indicator of welfare, and personality may affect stress levels shown through fecal glucocorticoid metabolites. In 2017 trainers began working with 0.2 cheetah cubs and 2.0 domestic dogs. A training management program was enacted to increase the ambassadors' choice and control as well as to challenge trainers to increase opportunities for positive reinforcement through advanced operant training techniques. Research was conducted starting in February 2017 investigating cheetah (ambassadors, exhibit and breeding) and companion dog welfare at SDZG. This included behavior observations, fecal glucocorticoid metabolite assessment, cheetah personality surveys, detailed keeper records, and a general population survey. This paper describes new methods enacted with the ambassador cheetah and dog training system at SDZG. Additionally, it describes the development of the welfare research project and results gathered to date.

Introduction

San Diego Zoo Global (SDZG) utilizes ambassador animals to fulfill our mission to connect our guests to wildlife in fun and engaging ways. We currently house over 400 ambassador animals (mammals, birds, reptiles and insects) at SDZG, 13 of which are cheetahs (*Acinonyx jubatus*) along with their nine domestic dog partners. In 2016 we completed 11,390 programs, many of which featured our cheetah and domestic dog (*Canis lupus familiaris)* companions. The first cheetahs arrived at SDZG in 1970, and began the cheetah reproductive behavior research project. Ten adult cheetahs were purchased in Southwest Africa and 2 five-acre enclosures were constructed at the San Diego Zoo's Safari Park (San Diego Zoo Global, 2015). On November 22nd, 1970, the first three cheetah cubs were born (San Diego Zoo Global, 2015).

The first ambassador cheetah, Willie, came to the zoo in 1978. Followed in 1980 by one of the San Diego Zoos' (SDZ) most famous ambassador cheetahs, Arusha. He was born at Wildlife Safaris in Oregon where Dr. Laurie Marker, founder of Cheetah Conservation Fund, suggested to introduce Arusha to a domestic dog companion based on her own success. Anna, a golden retriever, was chosen and the duo was the start of our companion dog program at the zoo. This pairing was so successful that as we

acquired more ambassador cheetahs, they were often paired with domestic dogs. In the early 1990s the SDZ received two male ambassador cheetahs, Kimbunga and Chobe, who were introduced to a companion dog, Jessie. Kimbunga and Jessie lived together full time while Chobe, who had to undergo medical treatments, went on walks with all three but lived alone. In 2000, Karoo and her companion dog Sven Olaf arrived at the zoo. This was shortly followed by the birth of Kubali and Majani at the Cheetah Breeding Center at the SDZ's Safari Park. Kubali and Majani were hand raised in the Children's Zoo Nursery and introduced to their companion dogs Bear and Clifford. After about 6 months, Majani and Clifford were moved to the Safari Park where they helped start the ambassador program there. Karoo, Kubali and Majani were the first cheetahs to be run off leash on a lure course in front of guests. Cheetah Run Safari is now offered daily at the SDZ's Safari Park. Since the early 2000s, ambassador cheetahs with and without companions have been added to our family at SDZG. The SDZ's Safari Park houses seven ambassador cheetahs: four ambassador cheetahs live with their own companion dog, two ambassador cheetah males live together in a coalition without a companion dog, and one ambassador cheetah sees a companion dog during the cheetah run programs, but doesn't live full time with the companion dog. The SDZ houses six ambassador cheetahs: four ambassador cheetahs live with their own companion dog and two ambassador cheetah cubs are being introduced to live together with the occasional companion dog exercise sessions.

Ambassador animal welfare research has become a priority of many zoological facilities. Research has evaluated the affect handling time and environment has on ambassador animal welfare (Baird, et al., 2016). A variety of welfare research has been completed on cheetahs, however, very little has included ambassador cheetahs. SDZG evaluates welfare based on our five "Opportunities to Thrive" which is grounded on the five freedoms (Brambell, 1965; Thorpe, 1969; Spedding, 1993). Interest in ambassador cheetah welfare led management and staff to develop a training plan which would offer increased opportunities for choice and control. Simultaneously, a critical xamination of the relationship with the companion dogs resulted in an organization-wide cheetah welfare research project, which examines all of our cheetah management techniques at SDZG. In November of 2016 two female cheetahs were born at the SDZs Safari Park. The cubs were not needed for breeding and it was decided that they would become ambassadors. With these two cubs, management staff decided to use a new plan that would be based on increasing choice and control in training sessions and minimizing aversive stimuli. The knowledge that female cheetahs will live together for upwards of two years before separating to find their own, but often overlapping territories (Wachter, et al., 2018), led management to decide to keep the female cubs together, and introduce two domestic dog companions, Elvis and Murray, to the group. The desire was to have a fluid family group where all four animals could live together, or any combination could be made depending on the animals and program needs. This plan was malleable and depended on the behaviors of the animals. For instance, if a time came where it seemed the cheetahs were unable to continue living together and were ready to separate, this would be done and the individual cheetahs would continue their relationships with their companion dogs.

One method used to study cheetah stress levels is analyzing fecal stress hormones and comparing that to other variables such as behavioral observations. Stress is not inherently bad; small to moderate amounts of stress can be beneficial and would naturally occur in the wild; however, high and prolonged stress can have negative affects (Yerkes & Dodson, 1908; Lahey, 2004; Gazzaniga, Ivry, & Mangun, 2009). Studies with cheetah at the SDZs Safari Park Cheetah Breeding Center found that cheetahs

with higher behavioral diversity had lower levels of fecal glucocorticoid metabolites (FGM), a stress hormone. (Miller, Pisacane, & Vicino, 2016). Personality research has also been established with the SDZ Safari Park Cheetah Breeding Center cheetahs, showing the components "Aggressive" and "Interactive" had a positive correlation with behavioral diversity, and males displayed higher levels in these components. However, cheetahs that had successfully reproduced scored higher on the component "Unsociable" and displayed higher fecal glucocorticoid metabolite levels. Hand reared individuals showed lower scores on "Tense -fearful" and "Aggressive" (Razal, Pisacane, & Miller, 2016). Baird et al. (in review) found that cheetahs with insecure/tense personalities had significantly higher fecal glucocorticoid metabolite levels when on exhibit. This may lead to the understanding that personality can affect stress levels; therefore, management choices should be made with breeding needs and personality in mind. With this knowledge, animal care staff reached out to our partners at the SDiZ's Institute for Conservation Research. A research project was designed based off of the original research of Baird et al. (in review). The main difference in our project was to include the companion dogs in the research. The ultimate goal is a better understanding of cheetah welfare at SDZG and to compare the results of the two research projects with cheetahs at other facilities.

Training and Research Questions

Training: How do we increase choice and control in training sessions and management with ambassador cheetahs while meeting the demands of program goals?

What are the basic training structures for developing ambassador Cheetahs and Dogs?

Welfare Research: Is there a correlation between positive and negative indicators of welfare and management strategies in Cheetahs at San Diego Zoo Global?

How do different social groupings affect positive and negative indicator of welfare of Cheetahs at San Diego Zoo Global?

Materials and Methods

Training Program

There have been many pairings of cheetah and dog over the 30 plus year history of the SDZ's companion program, singletons raised alone, family groups of only cheetahs, two cheetahs that shared the same dog companion, and the most common pairing of one dog to one cheetah for their lifespans. A unique objective with Tombi-Jeanne, Ilangha, Elvis and Murray was to achieve a fluid family dynamic. A group mentality would allow complete freedom in pairing them. As long as each cheetah tolerated the social dynamic, there would be the ability to allow interactions for all combinations, for the duration of their lives. This would be the first time at our facility that two dogs and two cheetah littermates would potentially spend their lives as one family unit. The plan was to mimic the cheetah's natural social dynamic by keeping it as fluid as possible while maintaining familiarity and instant recognition of both dogs and cheetah.

Ilangha and Tombi-Jeanne were born at the SDZ's Safari Park cheetah breeding center, and were pulled into human care

within a few hours due to maternal negligence. They were slated to become ambassadors, so nursery staff immediately began desensitization, counterconditioning of handling the cubs, and increased the positive neutral relationship between animal care staff and the cubs. Basic training began as soon as the cubs were eating solid foods. Six primary trainers were selected to begin the training process in order to maintain consistency among the two cheetahs. Each trainer was provided opportunities to interact, feed and train either cub, which we hoped would lead to an increased ability to generalize across trainers during sessions.

Operant conditioning thru positive reinforcement and a continuous reinforcement schedule were utilized for every interaction. (This was the goal of every future training session unless stated otherwise). There were differences in our training plan with Ilangha and Tombi-Jeanne compared to our previous ambassador cheetahs. First, the bridge was changed from a clicker to a verbal "Good" due to concerns of the clicker as a distraction to guests during presentations. Second, prior to Tombi-Jeanne and Ilangha, the introduction of the collar occurred during basic training at the nursery shortly followed by leash training, thus allowing earlier incorporation of cheetah ambassadors into education programs. This approach inherently allowed for more possibilities of negative reinforcement created by tension on the leash especially with training an individual in its early stages of development. The new main focus was to use positive and minimally aversive forms of training methods by increasing choice and control in training sessions. This would hypothetically reduce the occurrences of incidental negative reinforcement and mitigate aversive stimuli or stress. In order to increase choice and control, we refrained from putting a timeline on their training progression and heavily reinforced the cheetahs' initiative and attitude during training sessions. This was done by keeping behavioral momentum, continuous success while gradually increasing criteria, at all times even if just reinforcing any indication of the animal's choice to participate. Behaviors considered as participation included eye contact, recall, purring, and willingness to approach trainer. Behaviors that displayed increases in confidence such as approaching novel items or situations were reinforced. If a cheetah was not demonstrating willingness to participate there was no punishment. For example, if a cheetah left during a session, the trainer would simply wait for the cheetah to refocus and positively reinforce the attention. Before each session, antecedent arrangements were assessed to increase the success of the session. If the cheetahs' attention duration decreased in previous sessions, trainers would proactively shorten our training time for the following session to keep the cheetahs' attention and end under stimulus control. Overall, trainers predicted that allowing the cheetahs increased control over their environment would create more reliable and consistent behaviors.

Since there was no timeline for the cheetahs to be leash trained, the crate training was a plausible way to allow us to desensitize and counter condition them to as many situations as possible. Training began by feeding the cheetahs in the crate with no door attached. Eventually criteria increased and each cheetah became very comfortable spending extended durations both alone and together in a single crate. Due to the crate training success, more opportunities to counter condition the cheetahs to numerous environmental stimuli including exposure to an array of animal's sights, sounds, and smells were afforded. The duration of crate sessions were gradually increased to mimic the amount of time the cheetahs would be crated for their 45 minute transfer to the SDZ. We hypothesized that this early exposure would make the transition to the zoo, and ultimately most future

experiences, less novel and potentially less stressful for the pair.

Once trained behaviors were reliably performed, trainers switched from the continuous reinforcement schedule to an intermittent reinforcement schedule. However, when new behaviors were introduced and learned, trainers would start on a continuous reinforcement schedule. Once trainers established a consistently reliable training progression, more complex behaviors were introduced and increased criteria in basic behavior duration. For instance, trainers increased duration and distance from the cheetahs when they stayed on station as well as adding a voluntary nail trim which utilized two primary trainers at the same time. Upon satisfactory progression of these behaviors, collar and leash training began. Due to the constraints of the program's full contact conditions, the training of the collar and leash would be necessary. We hoped that their positive reinforcement training history would provide a stable platform that would potentially limit negatively reinforcing stimuli when on leash. Counterconditioning was utilized to teach the cheetahs there was the potential for tension when on leash.

Dog awareness and socialization training began at the SDZ Safari Park nursery with dog walk-by's and "howdy's" or protected contact interactions in which the dog and cheetah were able to see, smell and hear each other without coming into physical contact. This process was different from previous introductions, because multiple dogs were used for socialization not just the dogs that would live with the cheetahs. This was done to generalize dogs as positive not just an individual animal. Once the cheetahs arrived at the zoo they were provided ample time to acclimate before introducing their potential companions. Once the cheetahs were acclimated to their new environment, dogs were reintroduced starting over with walk-bys and protected contact howdy's, increasing to supervised play sessions with the dog under control and the cub's free range.

The philosophy behind this approach was to develop ambassadors who were simultaneously confident in their independence and able to thrive in various social dynamics. This could include participating in sessions alone, with another cheetah, with a dog, or as a group. We hoped to maintain family group dynamics that would provide excellent opportunities for physical health (play behaviors, exercise, walks) and social well-being, (mimicking family dynamics, grooming, calling, and resting near each other). The early stages of introductions were promising; Elvis was particularly well suited for interacting with both cheetahs at the same time. Murray was progressing steadily but was more excitable and needed to take a slower approach to being introduced. We eventually made progress to the point where all four individuals were interacting in a common space with trainer supervision and the dogs were no longer on leashes. This social dynamic was brought to an unexpected halt when Tombi-Jeanne experienced a trauma that resulted in her passing away. It was decided that Elvis would stay with Ilangha as he had formed a stronger relationship and Murray would be adopted by a zoo employee. Ilangha and Elvis have continued with their training and have successfully integrated into our education programs.

Welfare Research

The welfare research project consisted of two phases. The first phase was a 5-month fecal collection period from February 2017 through June 2017. Only four animals were included in this initial segment, 0.2 cheetahs, Ilangha and Tombi-Jeanne, born in November 2016, and 2.0 companion dogs, Elvis and Murray, brought into the zoo in January 2017. The initial collection period was created in order to hormonally monitor the cheetahs and dogs before, during, and after the introduction of the companion dogs. Animal care staff collected daily fecal samples on all four animals. Due to the 0.2 cheetahs living together and the 0.2 dogs living together, one cheetah and one dog was given non-toxic glitter with their food in order to correctly identify whose feces was whose. The samples were frozen and then delivered to the SDZ's Institute for Conservation Research where they were analyzed.

The second phase of the research project was considerably larger in scope. This included almost every ambassador, exhibit, and breeding cheetah at San Diego Zoo Global (n =21). This phase included behavior observations, fecal glucocorticoid metabolite assessments, personality surveys, animal care records, and general population surveys, all described below. This portion of the research was completed July 1st, 2017 through September 30th, 2017.

Behavioral Observations

Each cheetah was observed 10 times over the three month research period. The observations were 30 minute intervals with 1 minute scans between the hours of 7:00AM and 4:00PM. Exhibit and breeding cheetahs were observed directly by trained volunteers. However, due to the close spacing in the ambassador areas, video recordings were taken and then watched by the volunteers. Behavioral data was then analyzed by the SDZ's Institute for Conservation Research.

Fecal Glucocorticoid Metabolite Assessment

Animal care staff collected fecal samples every other day for the three month research period. These samples were sent to the SDZ's Institute for Conservation Research to be analyzed for fecal glucocorticoid metabolite levels.

Personality Surveys

Animal care staff were asked to submit a survey that evaluates the personalities of cheetahs they work directly. The surveys are currently being analyzed by the SDZ's Institute for Conservation Research.

Animal Care Records

Animal care staff completed daily records that included total time the cheetahs had human contact, and what sessions and enrichment they had during the day. The records have been analyzed by the SDZ's Institute for Conservation Research.

General Population Survey

Animal care managers and supervisors were asked to complete a survey evaluating the enclosure size and general man-

agement practices of the areas. The surveys are currently being analyzed by the SDZ's Institute for Conservation Research.

Results and Discussions

Training Program

Ilangha and Elvis' behavioral repertoire includes the basic etiquette behaviors that began during the early off leash stages of their training. This is comprised of heeling alongside trainer, sitting, staying, stationing, crating, lying down, tactile desensitization and counterconditioning, and voluntary nail trim. Additionally, Elvis is trained for scent detection. Ilangha and Elvis now participate in our educational programs of various group sizes and ages, which consist of animal presentations in our show amphitheater, private nighttime events and private tours that include photograph opportunities alongside our guests. Ilangha has performed these programs alone and with Elvis. She comfortably walks on leash throughout many public and private portions of the zoo, as well as travels by crate to a variety of presentation locations. She is currently working on a voluntary blood draw behavior as well as a voluntary rectal temperature behavior.

As Ilangha grew older, we encountered some behavioral problems. We observed that when she approached one year of age, her interest in environmental stimuli changed. Certain objects and situations that she seemed indifferent to before, were becoming more of interest. Behaviors such as crouching, stalking and running slowly developed while on leash in certain locations and situations. These behaviors caused increased tension and pulling when on leash, and increased aversive stimuli and the need to utilize negative reinforcement. Natural regression is a common occurrence when learning new tasks. Due to the regression of some behaviors trainers relaxed criteria, and reverted back to previous steps in her training plan.

The behavioral problems observed around one year of age with Ilangha, as well as many of our cheetah ambassadors, could be due to the age that cheetah cubs would naturally become more independent from their mothers. As cubs become older (8.5-14.0 months of age), mothers decrease their vigilance and cubs notice predators at smaller distances (Wachter, et al., 2018). Typically females leave their cubs between 17.1-18.9-months old, which indicates that not only are they learning to become more alert of their surroundings, they are also developing their hunting skills (Wachter, et al., 2018).

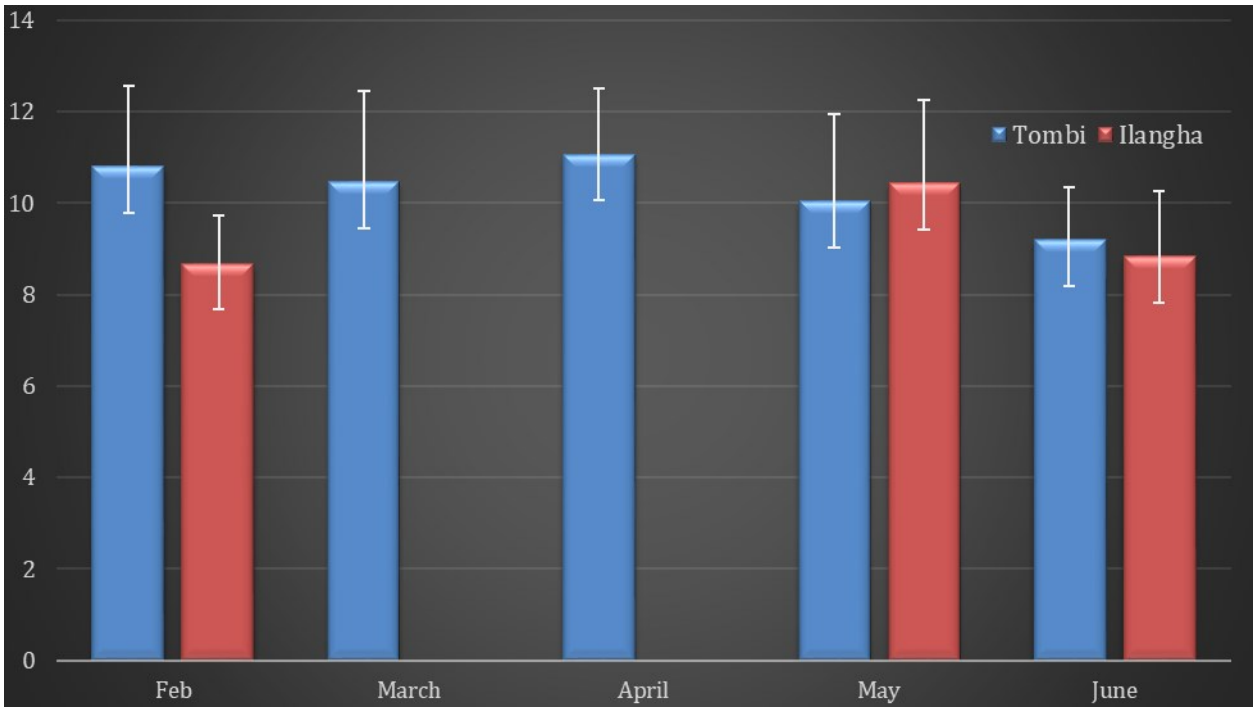
Trainers were able to increase choice and control by adopting a more fluid training timeline and adapting training to work alongside natural behavioral regression and progression throughout Ilangha's life. With these approaches employed we saw no evidence that introducing a dog companion and incorporating her into our ambassador animal program caused any amount of detrimental stress.

Welfare Research

Phase 1: Cheetah Cub and Companion Dog Introductions

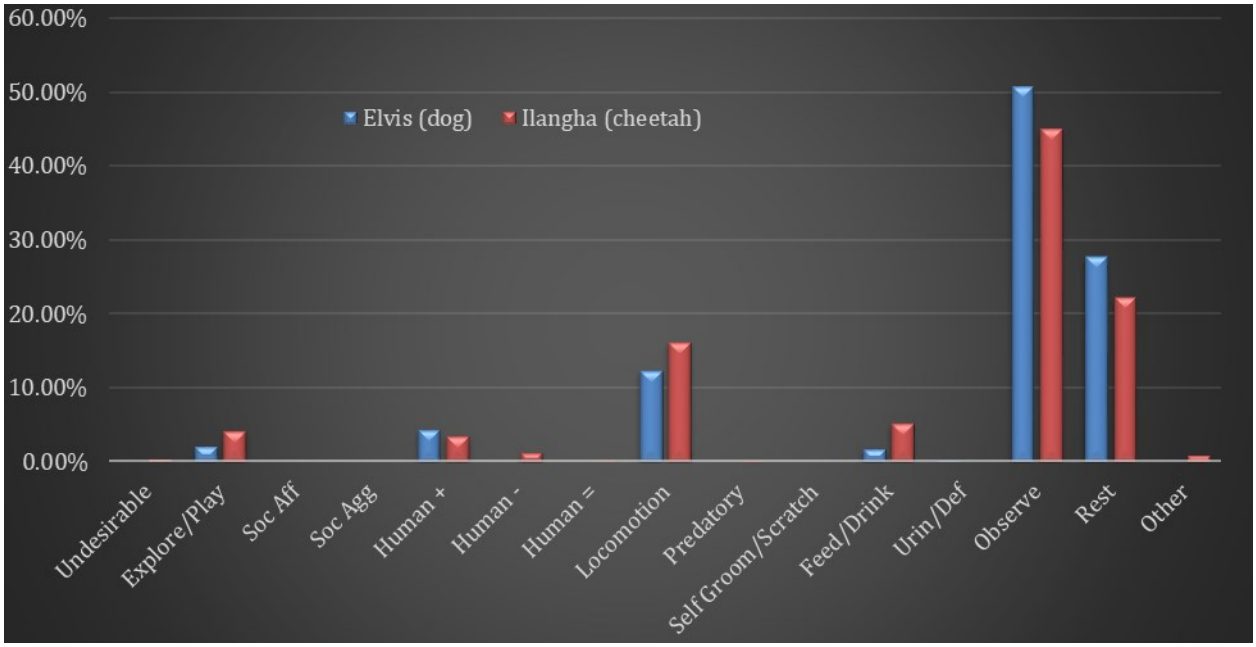
Analysis of the fecal glucocorticoid metabolite (FGM) assessment was completed in October 2017. Do to difficulties with the hormone testing process, Ilangha's March and April samples were unable to be analyzed and the samples will be re-processed with the second phase of the project. FGM results indicated a significant difference in FGM levels between the two

cheetah cubs in the first month of the research. However, by the fifth month there were no significant differences between the two individuals. We saw a brief increase in FGM levels when the cheetah cubs were moved from the Safari Park Animal Care Center to Wegeforth Bowl at the SDZ in April. The FGM levels then slowly decreased through June. Dog introductions began slowly from April to June with both Elvis and Murray. However, as time spent with the companion dogs increased, the FGM levels showed no significant changes (Graph 1).



Graph 1: Fecal glucocorticoid (ng/g dry fecal) profiles of cheetahs from pre-dog (Feb) through dog introductions (April-June).

A limited number of behavioral observations were conducted during the initial segment of research. We found that similar behavior patterns and behavioral diversity were observed in both the cheetah and companion dog. There was no significant difference in the behaviors between the cheetah and dog during introductions or after they were permanently housed together (Graph 2). The majority of behavior observed fell into one of two categories "observe", the cheetah and dog are sitting or lying down but alert, or "rest", the cheetah and dog are lying down and not alert. Previous research on human and dog companionship has shown that dogs are sensitive to human emotional cues and will adjust their behavior to align with these cues (Duranton & Gaunet, 2015). Domestic dogs' ability to take emotional cues from humans might be seen in relationships with other animals such as the cheetah, and this may be why we see similar behavioral repertoires. This may also be a factor in the success of many companion dog programs.



Graph 2: Behavioral profiles of cheetah and dog pair

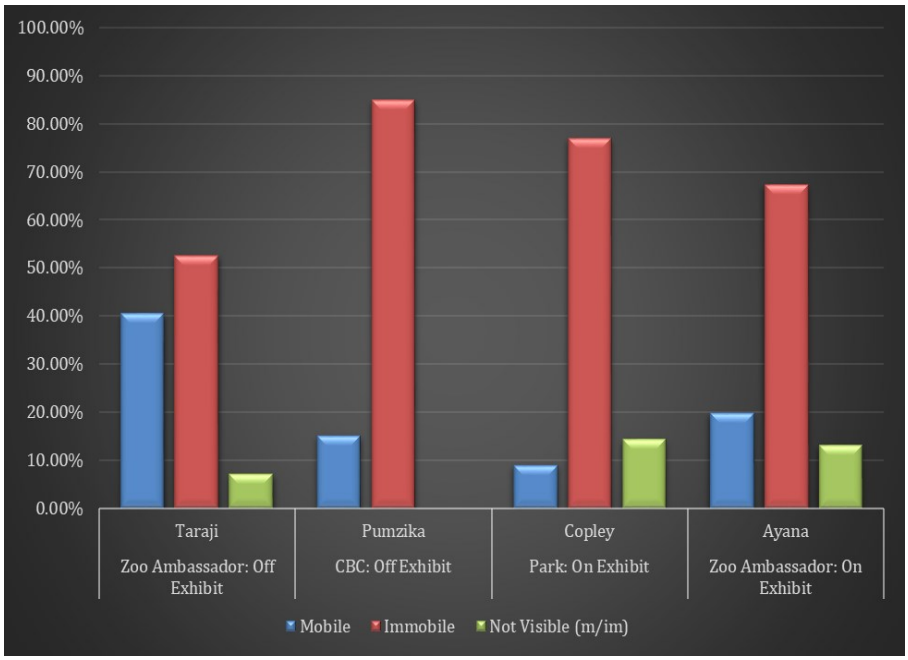
Phase 2: Assessing Cheetah Welfare across Management Strategies

The second phase of the research project had numerous intertwining parts, and the process of analyzing a majority of the data is ongoing. Fecal glucocorticoid metabolite assessment analysis will begin in April 2018, and personality assessment analysis will begin shortly after. Due to the volume of data, only a small portion of the behavioral observation data and the human interaction data has been analyzed for discussion here.

Behavioral Observations

1.3 cheetahs' behavioral observations were analyzed for the purposes of this paper. Of these cheetahs one is an off exhibit ambassador cheetah, one is an off exhibit breeding cheetah, one is an exhibit cheetah, and one is an on exhibit ambassador cheetah. These four individuals were chosen to show representation from each of the management techniques utilized at SDZG. The behaviors observed were organized into three broad categories: mobile, immobile, and not visible. Immobile was the most observed behavior set across all management styles (Graph 3). This high level of inactivity mimics wild cheetah behavior. Research has shown that some populations of cheetahs are immobile up to 88% of the day (Scantlebury, et al., 2014).

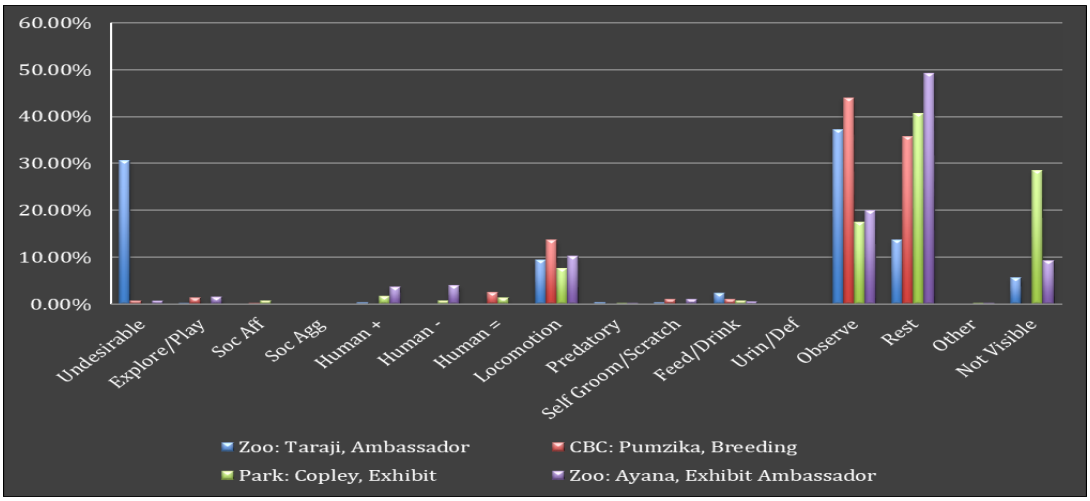
Exhibit cheetahs had higher levels of non-visible times than non-exhibit cheetahs, with the breeding cheetah having the lowest amount of time not visible (Graph 3). This may be due to the inherent structure and aesthetic of exhibits. Exhibits viewed by the public tend to have a large amount of trees, bushes, grasses and rocks. There may also be limited shade on exhibit, which would cause the cheetahs to find secluded areas to cool off during the warmer summer days when the data was being collected.



Graph 3: Percentage of time spent active vs. resting

Taraji, an off exhibit ambassador cheetah, showed significantly higher undesirable behaviors (30.69%) compared to all other management styles (Graph 4). This may explain why she was significantly more mobile (40.38%) and less immobile than the other cheetahs examined (Graph 3). After reviewing animal care records and daily logs, undesirable behavior increased on days Taraji was moved into another exhibit where a younger female cheetah had slept for the evening. The ability to smell another cheetah without being able to see it may have caused Taraji to pace at an increased rate.

Exhibit cheetahs showed negative or aggressive behaviors towards humans, while off exhibit cheetahs did not (Graph 4). This behavior is often observed in exhibit cheetahs as a predatory response when young children run by enclosures or vehicles drive past quickly.



Graph 4: Behavioral profiles of cheetahs across management techniques

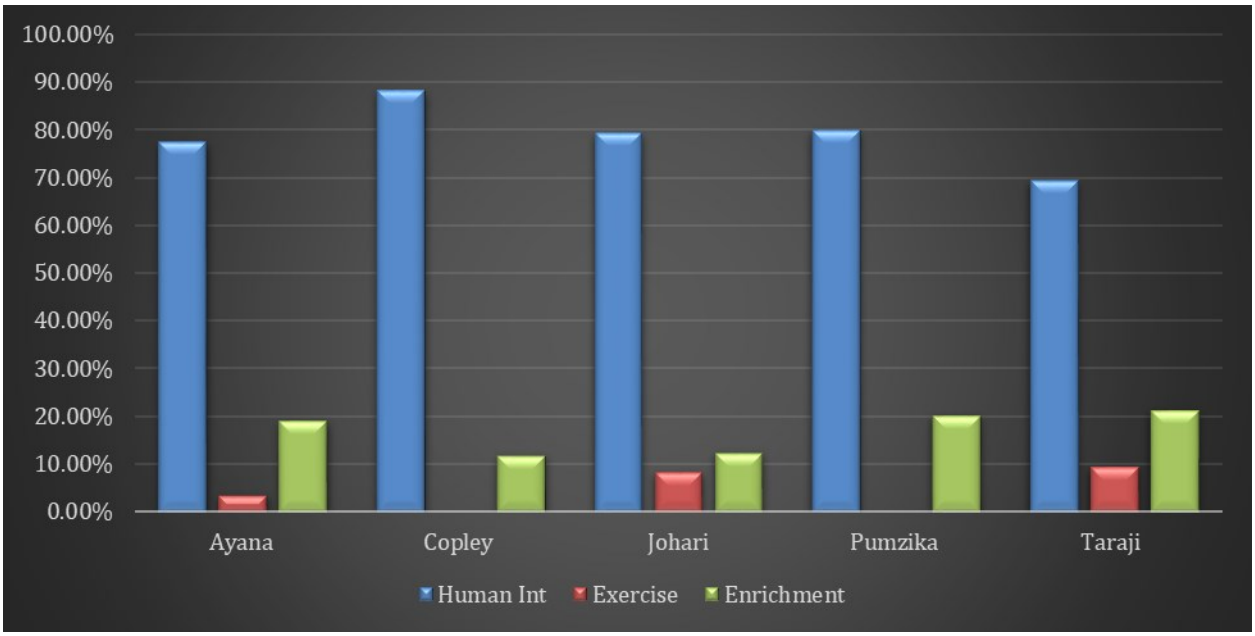
The behavioral data shown is only a small portion of the cheetahs in the full research project. Additionally, behavioral observations for the companion dogs have yet to be analyzed. Once a full analysis is run, we hope to have a better understanding of how the behavior profiles of the cheetahs and dogs correlates with hormone data, human interaction times, and personality data.

Animal Care Daily Logs: Human Interaction

Animal care daily logs were examined to determine average amount of human interaction cheetahs received during daily care. The logs included each interaction keepers had with the cheetahs, the amount of time of interactions, and if it the interaction was categorized at human interaction, exercise, or enrichment. 1.4 cheetahs were examined for the purposes of this paper, the four cheetahs that were included in the behavioral observations as well as one more ambassador cheetah from the SDZ's Safari Park.

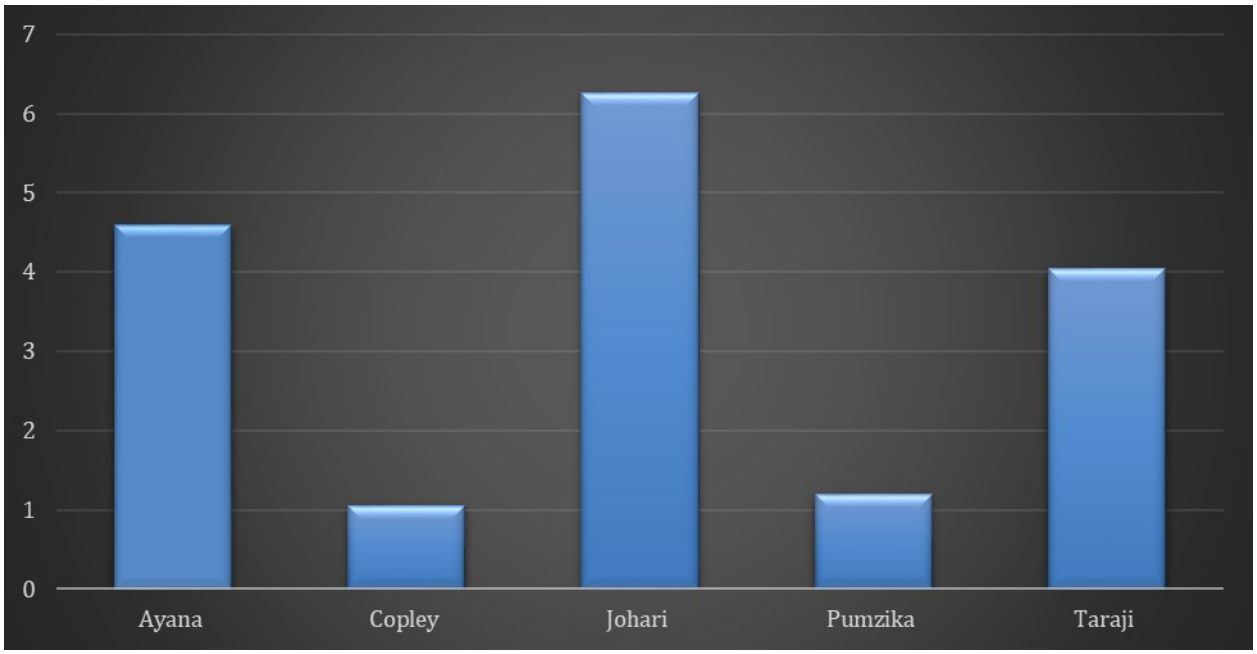
The amount of human interaction varied from 69% - 88% of sessions with the cheetahs (Graph 5). Although some of the exhibits that house cheetahs have the ability to shift cheetahs protected contact, all the cheetahs were able to be worked free contact. Additionally, every cheetah at SDZG is worked free contact a majority of the time.

Only ambassador cheetahs (Ayana, Johari and Taraji) were recorded having sessions for exercise (Graph 5). As part of our ambassador programs, our cheetahs are trained to walk on leash throughout the parks, course running, and trainer-to-trainer A-to-Bs. This allows for exercise outside of the cheetahs daily routines. The desire is to compare the amount of added exercise to fecal glucocorticoid metabolite levels, as well as added exercise's effect on behavioral profiles within the different management strategies once final analysis is complete.

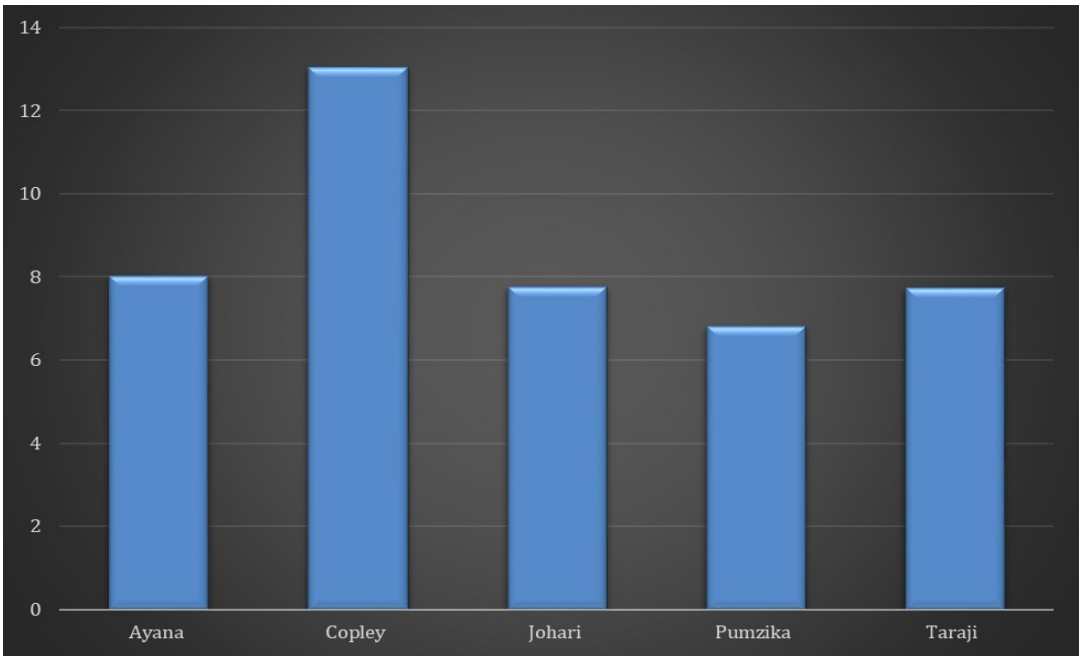


Graph 5: Daily log activity percentages

The average number of animal care interactions per day was dependent on the management technique of the cheetahs. Ambassador cheetahs averaged between four and six interactions per day, while breeding and exhibit cheetahs only averaged a little over one interaction per day (Graph 6). However, the average duration for the exhibit cheetah was the highest, 13 minutes, while all other management techniques averaged 6.8 to 8 minutes per session (Graph 7). The exhibit cheetah had the lowest number of daily interactions with the longest average of duration. This may be due to the large exhibit that needs maintaining by animal care staff. The exhibit yard is also further from the breeding center and animal care staff have to travel further to work with these animals. Therefore, it makes the most operational sense to finish all the sessions needed at the same time. The ambassador cheetahs averaged 7 to 8 minutes per session, and four to six sessions a day for a total of up to 48 minutes a day. This average has a certain amount of variance due to numerous one-minute sessions that occur to move the companion dogs in and out for their individual sessions. The longest ambassador session over the three-month research period was 122 minutes.



Graph 6: Average number of interactions per day



Graph 7: Average duration (minutes) of interactions

The data and results provided in this paper are preliminary and future analysis and papers will expand on this research. Possibly the greatest result of creating this research project has been the involvement of animal care staff in the process. Allowing the staff the resources needed to tell our story in animal welfare has created new dialog and increased knowledge that can be shared with colleagues and guests.

Conclusions

Making significant efforts to increase an ambassador cheetah's choice and control in the early stages of their training has had a positive effect on their development to date. The ability to moderate the training schedule to better fit each cheetah's natural learning curve allowed for an increase in positive training sessions and a decrease in negative reinforcement. The goal of training basic behaviors (healing) to completion before introducing potential negative stimuli (walking on a leash) created a strong foundation on which to continue with progressively intricate behaviors. The cheetah maintained an acceptable level of stress throughout the duration of the study while still progressing in training to become an ambassador for SDZG. The introduction of a dog companion and increased training criteria caused no significant increase in fecal glucocorticoid metabolite levels leading to the conclusion that an ambassador cheetah is not in an elevated state of stress due to this relationship with the companion dog. This data will become increasingly important as we evaluate our ambassador programs zoo wide.

As zoos and aquariums work to improve animal welfare, research on ambassador animals and management techniques of these programs is important in order to rely on quantitative data for creating best practices. The data obtained in this study could help provide researchers with a basic knowledge of potential stress hormone ranges in cheetahs, behavior profiles for different management techniques, personality indicators, and human interaction maximums. Knowing these welfare indicators for managed populations may become beneficial for conservation studies looking to mitigate the impact of human development on native terri-

tories, introduction of domestic livestock or pets, as well as the potential impact human presence may have on wild populations.

References

Baird, B. A., Kuhar, C. W., Lukas, K. E., Amendolagine, L. A., Fuller, G. A., Nemet, J., et al. (2016). Program animal welfare: Using behavioral and physiological measures to assess the well-being of animals used for education programs in zoos. *Applied Animal Behaviour Science , 176*, 150-162.

Brambell, F. (1965). *Report of the Technical Committee to Enquire into the Welfare of Animals Kept Under Intensive Livestock Husbandry Systems.* London: Her Magesty's Stationary Office.

Duranton, C., & Gaunet, F. (2015). Canis sensitivus: Affiliation and dogs' sensitivity to others' behavior as the basis for synchronization with humans? *Journal of Veterinary Behavior* , 513-524.

Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2009). *Cognitive Neuroscience: The Biology of the Mind* (Third Edition ed.). New York: W. W. Norton & Company, Inc. .

Lahey, B. B. (2004). *Psychology: An Introduction* (Eighth Edition ed.). New York: McGraw-Hill.

Miller, L. J., Pisacane, C. B., & Vicino, G. A. (2016). Relationship between behavioural diversity and faecal glucocorticoid metabolites: a case study with cheetahs (Acinonyx jubatus). *Animal Welfare , 25*, 325-329.

Razal, C. B., Pisacane, C. B., & Miller, L. J. (2016). Multifacedted approach to personality assesment in cheetahs (Acinonyx jubatus). *Animal Behavior and Cognition , 3* (1), 22-31.

San Diego Zoo Global. (2015). *San Diego Zoo Global History Timeline*. Retrieved from San Diego Zoo Global Library: http://library.sandiegozoo.org/history.htm#

Scantlebury, D. M., Mills, M. G., Wilson, R. P., Wilson, J. W., Mills, M. E., Durant, S. M., et al. (2014). Flexible energetics of cheetah hunting strategies provide resistance against kleptoparasitism. *Science* , 79-81.

Spedding, C. (1993). Animal welfare policy in Europe. *J. Agric. Environ. Ethics* (6), 110-117.

Thorpe, W. (1969). Welfare of domestic animals. *Nature* (244), 18-20.

Wachter, B., Broekhuis, F., Melzheimer, J., Horgan, J., Chelysheva, E. V., Marker, L., et al. (2018). Behavior and Communication of Free-Ranging Cheetahs. In L. Marker, L. K. Boast, & A. Schmidt-Kuntzel, *Cheetahs: Biology and Conservation* (pp. 121-134). London: Academic Press.

Yerkes, R., & Dodson, J. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology , 18*, 459-482.

W.T.F What's the Function

Sandy K. McPadden

Sandy McPadden Animal Behavior Consulting

In the field of human behavior modification, behavior analysts are required by their credentialing board to conduct assessments prior to initiating or even recommending behavior modification procedures. In the field of animal behavior modification, this applied methodology is not as common, especially in attempts to decrease aberrant behavior. By applying similar human behavior assessments and intervention techniques to the field of animal behavior, animal behavior management teams can draw upon decades of applied research to achieve groundbreaking advances in captive animal welfare. The future of animal behavior management is systematically identifying the function of a behavior before ever developing a behavioral intervention plan. By doing this, we will energize animal behavior management teams to take advantage of empirically validated protocols thus adhering to some of the very same ethical standards mandated for human behavioral interventions. This presentation discusses how first identifying the function of an aberrant behavior and then utilizing that same function to reinforce an alternative target behavior allows for a more effective and ethical intervention program. Furthermore, the function of escape and its relationship to the commonly utilized technique, the least reinforcing scenario (LRS), will be deeply examined. Lastly, how employing protocols used in human behavior modification and holding animal behavior management teams to those same ethical standards can benefit guest perception of animal conservation programs.

Keywords: Least Reinforcing Scenario, function

Accredited zoos state in their mission the desire to promote science-based approaches to animal management programs (Behavior Scientific Advisory Group). Supplementary animal care organizations go so far as to say that science-based assessments are a valuable tool (Mission, Vision, and Core Values), though to date, only two peer reviewed publications have discussed the use of function-based interventions, beginning with a functional behavioral assessment, in zoological settings. Respondent and operant conditioning are well utilized by professionals in zoo and aquarium behavioral management programs (Ward & Melfi, 2013; Melfi, 2013; Miller & King, 2013), but these are just a piece of the whole science of learning and behavior—applied behavior analysis. By applying assessments and intervention techniques that are "well documented and quickly becoming standard practice (Burke, Hagan-Burke, & Sugai, 2003)" in human populations to the field of animal husbandry, animal behavior management teams will be able to draw upon decades of applied research to achieve groundbreaking advances in captive animal welfare.

Applied behavior analysis. The widely agreed upon method of positive reinforcement training is derived from the science of applied behavior analysis. While positive reinforcement is an ethical and highly efficient tool being used in the

zoological field, it is only a fragment of the entire science with the remainder being left untouched. Applied behavior analysis (ABA) is an evidence-based approach to changing socially significant behaviors through the use of scientifically validated principles of behavior and learning, established approximately forty years ago (Morris, Altus, Smith, 2013). "Applied behavior analysis is concerned with producing predictable and replicable improvements in behavior" (Cooper, Heron, & Heward, 2007). There are three defining characteristics of Applied Behavior Analysis. The first being that behaviors elected for change serve an authentic purpose in the individual's life. Secondly, the behaviors chosen are observable and measureable. The third characteristic is that decisions made in relation to behavior change programs are made based on objective data collected during functional behavioral assessments (Kearney, 2007).

Applied behavior analysis places considerable focus on the management of socially significant behaviors. Behaviors of social significance have "immediate and long-lasting meaning for the person and for those who interact with that person" (Cooper, Heron, & Heward, 2007). When attempting to determine whether or not the behavior should be modified, think about the extent to which the animal's life will be improved (Bosch & Fuqua, 2001). Some considerations when choosing a target behavior would be: Will the animal encounter reinforcement after the behavior change program has ended? Is this behavior a necessary prerequisite to learn another necessary skill? Will this behavior help with conspecific relationships? If the target behavior is being reduced or eliminated, what behavior will replace it (Cooper, Heron, & Heward, 2007)? In choosing a behavior of social significance, we know that the behavior change program is contributing directly to the animal's quality of life.

Behaviors chosen to be modified must be observable and measureable. Aggression, although not a measureable behavior in and of itself, can be operationalized. For instance, a female African elephant (*Loxodonta africana)* during training sessions displays "aggressive" behaviors toward her trainer. The word "aggressive" can be isolated to plucking the barrier cable with tusks, kicking, ear flaring, and spinning toward trainer, with each of these behaviors being observable, measureable, and recordable. Clearly defining the target behavior "increases the likelihood of an accurate and believable evaluation or program effectiveness" (Cooper, Heron, & Heward, 2007).

Functional behavioral assessment. Arguably one of the most important steps to ethically and efficiently modifying behavior is by first identifying the function of the targeted behavior through a functional behavior assessment (Day, Horner, & O'Neill, 1994). "If an intervention is implemented without proper integrity, it is impossible to determine intervention efficacy" (Gann & Kunnavatana, 2016). In applied behavior analysis, a functional behavioral assessment (FBA) is the process of observing an individual's interaction with their environment and assessing both the antecedent and consequent events. The assessment is the first in the four-phase intervention model utilized in ABA: assessment, planning, implementation, and evaluation (Taylor, 2006). In doing this, the goal is to understand whether the individual engages in the target behavior to gain access to positive reinforcement (tangible items, attention, or stimulation) or negative reinforcement (to avoid or escape aversive stimuli) (Gann & Kunnavatana, 2016). A behavior assessment done thoroughly will give behavioral husbandry staff "a picture of variables that increase, decrease, maintain, or generalize the behavior of interest…consequently, subsequent interventions can be aimed more

directly and have much better chance of success" (Cooper, Heron, & Heward, 2007). By first conducting an FBA, true evidence-based scientific methods can then be utilized to develop and continually evaluate behavior change procedures. Information for FBA's can be gathered from existing records, interviewing those who work with the individual, direct observations, and through the experimental method, i.e. the functional analysis (Gann & Kunnavatana, 2016; Kearney, 2007). By first identifying the function of a behavior, animal care staff will be able to develop functionally-equivalent interventions matched to the target behavior (Wacker et al., 2013, Iwata et al. 2000) thus reducing aberrant behaviors more quickly.

Functional analysis. The functional analysis has shown an estimated 90% efficacy in reducing problem behaviors in defined human populations (Wacker et al. 2013). Because a "behavior's function is found in the consequences that reinforce it" (Umbreit & Ferro,2014), an experimental procedure that can isolate variables like the functional analysis (FA) is ideal for determining the function of a behavior in the applied environment. "Functional analysis methodology is a powerful assessment tool for identifying contingencies that maintain a wide range of behaviors" (Iwata et al. 2000). While functional analyses are primarily used in human populations, the FA has been performed successfully in applied settings (Cooper, Wacker, Sasso, Reimers, & Donn, 1990; Northrup et al., 1991) with non-human primates while on exhibit (Dorey, Rosalez-Ruiz, Smith, & Lovelace, 2009, Martin et al., 2011). It is typical, when working with humans, for a board-certified behavior analyst (BCBA) to perform the functional analysis, though individuals with no prior clinical experience can reach 95% efficacy in as little as 2 hours of training (Iwata, 2000).

There are currently four commonly recognized functions of behavior: attention seeking, tangible seeking, automatic reinforcement, and escape/avoidance. The functional analysis is conducted in separate sessions throughout the day or spanning numerous days. This multi-elemental design affords the animal care staff an opportunity to break the FA into manageable sessions while simultaneously controlling for one function at a time. The standard functional-assessment generally consists of four conditions: control, contingent-attention, alone, and contingent-escape (Iwata et al., 1994), but adaptations can contain as few as three conditions (Cooper, Wacker, Sasso, Reimers, & Donn, 1990; Northrup et al., 1991) or as many as five conditions, to include tangible seeking (Dorey, Rosalez-Ruiz, Smith, & Lovelace, 2009, Martin et al., 2011). During the control session, preferred activities and social attention are provided non-contingently, while no demands are placed on the animal. The target behavior is ignored. In the contingent attention session, attention is withheld. The target behavior is met with attention from the keeper in the form of verbal reprimands. With the alone condition, the environment is bare and the target behavior is ignored. In the escape condition, demands are delivered and the target behavior is met with a break from the task at hand. During the tangible condition, a toy is given to the individual and taken away. The target behavior is met with the toy. Each condition contains the potential reinforcer for the targeted behavior and the sessions are rotated in a way to pinpoint exactly which condition reliably produces the targeted behavior. These conditions are replicated and recorded to ensure efficacy.

Once completed and the function has been identified, a functionally-equivalent intervention can be developed. Functionally-equivalent interventions utilize the same function that is currently maintaining the problem behavior, and used instead to

reinforce an alternative socially significant behavior (Cooper, Heron, & Heward, 2007). For example, functional analysis completed on an olive baboon (*Papio anubis)* displaying hair pulling and hand biting identified the function of her self-injurious behaviors (SIB) as attention-maintained. The animal care staff did not intentionally reinforce the SIB through attention (attention was given as statements of concern and reprimand), but it maintained the behavior nonetheless. Because the function was successfully identified through the functional analysis, the intervention consisted of differentially reinforcing an alternative behavior (lip smacking) with attention from her animal care team. The end result was the SIB decreasing to under 1% (Dorey, Rosalez-Ruiz, Smith, & Lovelace, 2009, Martin et al., 2011).

Least Reinforcing Scenario In zoological and aquarium settings, the least reinforcing scenario (LRS) is used during training sessions as "a consequence for an incorrect behavior" (animal training philosophy) to operate as an extinction procedure (Scarpuzzi, Lacinak, Turner, Thompkins, & Force, 1991). Without first determining the function of the undesirable behavior prior to delivering the LRS, there is a possibility of reinforcing behaviors rather than decreasing their likelihood in the future under similar circumstances. "…the effectiveness of extinction in an applied setting depends primarily on the identification of reinforcing consequences" (Cooper, Heron, & Heward, 2007).

Public perception After viewing animals exhibiting aberrant behaviors, zoo guests stated that they were less likely to return (Miller, 2011). Using function-based interventions effectively decreases aberrant behavior and this can have substantial effects on guest perception. With some of the public's objections to animals in captivity, scientific data collected on improving welfare can potentially serve as a buffer (Hack & Miller, 2016; Kutska, 2009). The behavior analyst certification board mandates that when credentialed professionals develop a behavior change program they must "conduct current assessments prior to making recommendations" (Professional). Holding animal husbandry teams to the ethical standards set for practitioners working with humans can help the public's perception of captive animal care.

Animal keepers and trainers in zoological fields are utilizing ABA principles with great success in their daily routines. Expanding the tools used to include assessments and function-based interventions will push the field of animal husbandry into incredible advances in improving animal welfare while simultaneously decreasing aberrant behaviors. Determining the function of aberrant behaviors prior to developing an intervention program will increase both the efficacy and efficiency of behavioral husbandry programs. In utilizing function-based interventions, we will begin holding animal care staff to the same expectations of those behavioral colleagues serving human populations.

References

Animal Training Philosophy. Retrieved from https://seaworld.org/animal-info/animal-infobooks/animal-training/animal-training-philosophy

Bailey, J. B. (2015). How to Think Like a Behavior Analyst: Understanding the science that can change your life. S.l.: ROUTLEDGE.

Behavior Scientific Advisory Group. Retrieved from https://www.aza.org/behavior-scientific-advisory-group

Bosch, S., & Fuqua, R. W. (2001). Behavioral cusps: A model for selecting target behaviors. Journal of Applied Behavior Analysis, 34(1), 123-125.

Burke, M. D., Hagan-Burke, S., & Sugai, G. (2003). The Efficacy of Function-Based Interventions for Students with Learning Disabilities Who Exhibit Escape-Maintained Problem Behaviors: Preliminary Results from a Single-Case Experiment. Learning Disability Quarterly, 26(1), 15.

Cooper, John O, Heron, Timothy E,. Heward, William M. (2007). Applied Behavior Analysis. S.l. Pearson.

Cooper, L. J., Wacker, D. P., Sasso, G. M., Reimers, T. M., & Donn, L. K. (1990). Using parents as therapists to evaluate appropriate behavior of their children: Application to a tertiary diagnostic clinic. Journal of Applied Behavior Analysis, 23 (3), 285-296.

Day, H. M., Horner, R. H., & Oneill, R. E. (1994). Multiple functions of problem behaviors: Assessment and intervention. Journal of Applied Behavior Analysis, 27(2), 279-289.

Dorey, N. R., Rosales-Ruiz, J., Smith, R., & Lovelace, B. (2009). Functional Analysis And Treatment Of Self-Injury In A Captive Olive Baboon. Journal of Applied Behavior Analysis, 42(4), 785-794.

Gann, C. J., & Kunnavatana, S. S. (2016). A Preliminary Study in Applying the Function-Based Intervention Decision Model in Consultation to Increase Treatment Integrity. Education and Treatment of Children, 39(4), 445-466.

Grazian, D. (2015). American Zoo: A Sociological Safari. PRINCETON UNIVERSITY PRES.

Hacker, C. E., & Miller, L. J. (2016). Zoo visitor perceptions, attitudes, and conservation intent after viewing African elephants at the San Diego Zoo Safari Park. Zoo Biology, 35(4), 355-361.

Iwata, B. A., Wallace, M. D., Kahng, S. W., Lindberg, J. S., Roscoe, E. M., Conners, J., Worsdell, A. S. (2000). Skill acquisition in the implementation of functional analysis methodology. Journal of Applied Behavior Analysis, 33(2), 181-194.

Kearney, A. J. (2007). Understanding Applied Behavior Anaylsis: An Introduction to ABA for Parents, Teachers, and Other Professionals. London: Jessica Kingsley Limited.

Kutska, D. (2009). Variation in visitor perceptions of a polar bear enclosure based on the presence of natural vs. un-natural enrichment items. Zoo Biology, 28(4), 292-306.

Martin, A. L., Bloomsmith, M. A., Kelley, M. E., Marr, M. J., & Maple, T. L. (2011). Functional Analysis And Treatment Of Human-Directed Undesirable Behavior Exhibited By A Captive Chimpanzee. Journal of Applied Behavior Analysis, 44 (1), 139-143.

Melfi, V. (2013). Is training zoo animals enriching? Applied Animal Behaviour Science, 147(3-4), 299-305.

Miller, L. J. (2011). Visitor Reaction to Pacing Behavior: Influence on the Perception of Animal Care and Interest in Supporting Zoological Institutions. Zoo Biology, 31(2), 242-248.

Mission, Vision, and Core Values. Retrieved from https://theabma.org/documents/

Morris, E. K., Altus, D. E., & Smith, N. G. (2013). A study in the founding of applied behavior analysis through its publications. The Behavior Analyst, 36(1), 73-107.

Northup, J., Wacker, D., Sasso, G., Steege, M., Cigrand, K., Cook, J., & Deraad, A. (1991). A brief functional analysis of aggressive and alternative behavior in an outclinic setting. Journal of Applied Behavior Analysis, 24(3), 509-522.

Professional and Ethical Compliance Code for Behavior Analysts. Retrieved from https://www.bacb.com/ethics/ethics-code/

Scarpuzzi, M., Lacinak, T., Turner, T., Thompkins, C., & Force, D. (1991). Decreasing the Frequency of Behavior through Extinction: An Application for the Training of Marine Mammalas. IMATA 19th annual conference.

Taylor, R. L. (2006). Assessment of exceptional students educational and psychological procedure. Boston: Allyn and Bacon.

Umbreit, J., & Ferro, J. B. (2014). Function-Based Intervention. Remedial and Special Education, 36(2), 89-93.

Wacker, D. P., Berg, W. K., Harding, J. W., Derby, M. K., Asmus, J. M., & Healy, A. (1998). Evaluation and Long-Term Treatment of Aberrant Behavior Displayed by Young Children with Disabilities. Journal of Developmental & Behavioral Pediatrics, 19(4), 260-266.

Wacker, D. P., Lee, J. F., Dalmau, Y. C., Kopelman, T. G., Lindgren, S. D., Kuhle, J., Waldron, D. B. (2013). Conducting Functional Analyses of Problem Behavior Via Telehealth. Journal of Applied Behavior Analysis, 46(1), 31-46.

Ward, S. J., & Melfi, V. (2013). The implications of husbandry training on zoo animal response rates. Applied Animal Behaviour Science, 147(1-2), 179-185.

Training voluntary blood draw with a diabetic White-Cheeked Gibbon (*Nomascus leucogenys*)

Sara E. Gonzalez, Senior Wild Animal Keeper
WCS- Bronx Zoo

The Bronx Zoo houses a pair of white-cheeked gibbons (Nomascus leucogenys). In 2014, our male gibbon, Milton, was diagnosed with diabetes. The first attempt to manage Milton's diabetes involved dietary changes and oral medication; however, these treatments were unable to effectively control his diabetes. Because Milton had a strong injection training history, the decision was made to start daily insulin injections. Insulin treatment required close monitoring of Milton's blood glucose levels which was initially achieved by training Milton for both urine testing and blood glucose testing with a glucometer. Although both of these methods provide useful information about Milton's glucose levels, a larger blood sample would allow veterinarians to evaluate changes in his glucose levels over time and modify his treatment plan accordingly. We began training Milton for voluntarily blood draw in April 2015, and had our first successful blood draw in May 2016. This presentation will outline the steps we took to train the blood draw behavior and the challenges we faced along the way. One of the major challenges was designing an appropriate blood sleeve for Milton. Not only did the sleeve need to accommodate Milton's long arm and fingers, it had to be modified multiple times in order to position Milton's arm in a way that would allow easier access to his vein. Training this complex behavior has allowed us to obtain regular blood samples, which has enabled us to better monitor Milton's health, evaluate the efficacy of his treatment, and improve his overall quality of life.

In 2009, Jungle World at the Bronx Zoo received a 12-year old male White-Cheeked Gibbon named Milton, from Smithsonian's National Zoo in Washington, DC. When he arrived he was housed with Christine, Jungle World's female White-Cheeked Gibbon. In 2012 he fathered a daughter, Quy, with Christine. On 26 January 2014 keepers noticed Milton was urinating frequently, and afterwards he would have urine dribbling. Milton was immobilized on 4 February 2014 for diagnostics. While immobilized he was given a full body exam. The veterinarians ran his blood work, took radiographs, collected a urine sample and did an abdominal ultrasound. He was examined for possible prostate issues, Urinary Tract Infection, and diabetes. On 6 February 2014 Milton was diagnosed with diabetes.

The two types of monitoring options that were first used for tracking Milton's glucose levels were urine glucose testing and blood glucose testing. When Milton began to have urinary issues he was trained to urinate on cue; this behavior was captured (Photo 1). The behavior required him to come to the cage front and produce the sample outside of the cage so that the urine strip could be put right into the stream; this is the cleanest sample that can be collected. Urine glucose testing is the easiest and least invasive method, but the test has a low sensitivity. This option made it hard to tell how the disease was progressing once he would hit that threshold. Milton's urine glucose levels have always been very high, meaning that his kidneys are not disposing of glucose the way they should. With blood glucose testing, a glucometer gives a more sensitive reading. Glucometer training began in December 2014.

Originally it was difficult to get the lancet to pierce Milton's fingers since they were so callused from brachiating. Using the lancet on the sides of his toes proved to be the best site for blood collection (Photo 2). The most challenging part of the behavior was obtaining enough blood for the meter to read. The reason that this was especially challenging was be-

cause Milton's toe had to be squeezed a good amount to pool the blood for collection (Photo 3). Given his diabetes Milton becomes dehydrated and this makes it hard to get a glucometer reading since his blood has a hard time pooling. Dehydration is caused by constant urination due to the kidneys trying to flush out glucose and ketones. However, the glucometer result is only a snap shot of the measurement of glucose in the blood, and glucose levels change a lot over the course of a day. With glucometer readings a blood glucose curve was created to try to get an idea of Milton's blood glucose trend.

The first thing that the veterinarians had us do was change Milton's diet. With this diet change a lot of the high sugar items were removed from his diet, which was a challenge since he is a frugivore. Any fruit or vegetable that he would receive would have to be low on the glycemic index. The two types of treatment options offered by the veterinary staff after diet change were oral medication and insulin injections. Oral medications were the easiest option to try to deal with his diabetes. The three oral medications that he received were Glipizide, Acarbose and Metformin. Glipizide is used to help the pancreas produce insulin. Acarbose is used to stop the intestines from absorbing glucose. Metformin is used to help the liver process glucose.

After trying different monitoring options, the veterinary staff felt they were not getting the results they needed. Milton's blood glucose values were consistently reading HI on the glucometer, indicating that the oral medications were still not controlling his diabetes. In a normal non-diabetic human a normal range is 70-120 mg/mL. Milton was reading HI which meant his blood glucose was higher than 750 mg/mL. This is when the veterinarians decided it was necessary to start him on insulin injections. Training Milton for daily insulin injections began on 10 April 2015.

Several steps had to be taken to ensure Milton's compliance with daily insulin injections. He would need to reliably accept daily injections; missing a dose of insulin can result in a spike in his blood glucose. He was trained with daily saline injections for five months with a 29.5 gauge, ½ inch long 10cc needle, and syringe. During these five months he regressed with his injection behavior and had to be re-trained with a blunted needle, then just sticking him, and then back to saline injections. Daily injections also required alternating injection sites, which would help with compliance. Milton had previously been injection trained only on his right hip. He was then trained to receive injections in his left hip, left shoulder (Photo 4), and right shoulder. In September 2015 the decision was made to begin insulin injections. For two weeks leading up to the beginning of his insulin injections he received saline injections as if it were to be the insulin; we gave the same amount of saline that he would receive of insulin with alternating injection sites. Milton's first dose of insulin was given on 14 September 2015.

After insulin was started, the amount of glucose in Milton's urine was lower but still present, and we began to get ketones in his urine more frequently. His glucometer readings were still reading HI and he was already getting all of the oral medications that he could receive. Given this information the veterinarians asked if getting a larger blood sample was possible. A larger sample would allow the veterinarians to look at a number of different things. They would be able to look at Milton's overall health, like the functions of his internal organs, and they would be able to see his blood glucose curve over time. Which would allow them to evaluate how well his diabetes was being controlled and determine if changes needed to be made to his treatment plan. After discussing the idea of getting a larger blood sample with managers and trainers it was decided to try training Milton for voluntary blood draw so that he would not have to be continuously immobilized for a simple blood test. Blood draw training began in April of 2015.

The initial design for the blood draw sleeve was a shortened PVC tube to encourage Milton to reach through (Photo 5). The PVC has a port cut into it to access the vein and a bar at the end for Milton to hold on to during the blood draw. The first step was for Milton to learn to put his arm into the sleeve. Ordinarily Milton putting his hand through the cage front is a highly discouraged behavior, so he had to learn that it was okay to reach his arm through the cage front as long as it was through the sleeve. A shorter sleeve was used first so that it would not be as intimidating for him and it was easier for him to be reinforced for reaching in. Initially we tried to get him to rotate his hand for the reward through the sleeve. This method did not work, and he would only partially rotate his hand (Photo 6). To teach Milton to rotate his hand a new target stick was introduced. This stick would then be the bar that would sit in the sleeve. His natural reaction was to target the bar with his palm facing down and

at first he would only touch the end of the bar. The bar then had to be rotated horizontally for him to grip the bar over-hand. The challenging part was getting him to rotate his hand palm side up so that his vein could face up for the veterinarian to gain access to it. We learned that he would rotate his hand if the bar was below his body (Photo 7). Anytime he targeted the bar with a rotated hand, palm side up, he was then "jackpotted." The bar was moved higher and higher on the mesh until it was at the same level as the sleeve. If his hand was not rotated palm side up the bar was moved down until he did the correct behavior, he was "jackpotted" and the bar was moved up once more. Eventually the bar was placed in front of the short sleeve for Milton to grab through the sleeve (Photo 8). The verbal cue is "Sleeve" and the visual cue was tapping the bar. This step came surprisingly quick to him. Milton was now able to reach through the sleeve and grab the bar with a rotated hand.

Once Milton was reliably grabbing the bar on the outside of the short sleeve the full sleeve was introduced. The initial design for the full sleeve had the bar sitting inside of the PVC tube. The sleeve had to be a small diameter to keep his arm close enough to the port for the veterinarian to access his vein. With the sleeve being a small diameter it did not leave him with enough room to fit his very long fingers around the bar (Photo 9), so modifications were made. An extension to the outside of the sleeve was added allowing the bar to be outside of the PVC pipe so that Milton could grasp the bar properly (Photo 10). The new extension offered a few different options for bar placement. The height could be adjusted and the distance between the bar and the sleeve could be adjusted to help with the positioning of his arm. The extension also helped him to pull his arm further into the sleeve. Having the bar on the highest position helped to pull his arm closer to the blood draw port (Photo 11). Once his arm placement was known the blood draw port was cut into the PVC.

The next step after having Milton grab onto the bar through the sleeve was to add a second person (Photo 12). Throughout this process different keepers were brought into holding to play the role of the veterinarian, which got him used to seeing different people. The second person would touch his arm, so that he would be more comfortable when the real veterinarian came. The second person would eventually use a blunted needle on his arm. For the blunted needle practice the same set up was used that the veterinarian would use; a blunted butterfly needle, tubing, and syringe. Red paint was added to the tubing so that it would be most like an actual blood draw and as few things as possible would be novel to him when it came time to do the real thing. The time for this behavior was extended up to three minutes. The criteria for the behavior was for him to continue to hold the bar while being touched or poked until he was bridged. Throughout the behavior he was constantly being rewarded both verbally and with treats. Milton was bridged at the end of the behavior, then he would remove his arm from the sleeve, and receive a "jackpot" from both the trainer and the veterinarian. On 4 January 2016, it was the first time we tried to get blood with a true needle. On 11 January 2016, it was the first time a flash of blood was seen in the tubing. After about 13 months, on 12 May 2016, we got the first blood sample on which the veterinarians were able to run tests. The veterinarian was surprised that the blood vessel was right under the skin and the time there was a flash of blood she must have gone right through the vein .

As with many behaviors there were a bumps in the road and a few modifications were made. Milton's hair had to be trimmed from the area that the veterinarian was going to draw blood (Photo 13). This allowed the veterinarian to better feel his vein. This was done with a small set of beard trimming scissors through the blood draw port. Clippers were tried first but he did not like the noise. Using the scissors was just like the touch behavior. Lidocaine began being used on Milton's skin at the blood draw site. This was started because he would react when the needle was repositioned and the Lidocaine helped him to tolerate the repositioning. Using the Lidocaine was tricky because Milton dislikes any wet sensation. This behavior was trained using Ultrasound gel. Eventually he allowed the gel to be rubbed into his skin. The veterinarian suggested having the second person stand on a milk crate to get above the blood draw port; doing this allowed the veterinarian to look down into the port and better visualize the vein. Giving Milton "jackpots" was hard because of his dietary restrictions. All of his treats had to be low on the glycemic index and it was taken from his daily allotment of fruit, which is 125g. On actual blood draw days extra fruit was kept on hand just in case it was needed. The fruit that worked the best for us was cantaloupe, honeydew, strawberries and pear. On actual blood draw days he was also allowed ⅓ of a banana. While training the blood draw behavior Milton learned what turned into his "More" behavior. For this behavior we would ask Milton to better extend his arm. There were times that his arm would be in the

sleeve for a while and his hand would become lax and he would let go of the bar. When asked for “More” he would grab back onto the bar. Using this behavior helped because he would re-set himself without taking his arm out of the sleeve, this was especially important when he would still have the needle in his arm. The “More” behavior also carried over to other body part presents. For example when asked to “Open” his mouth and he would only partially open his mouth, asking for “More Open ” he would open his mouth wider.

Looking back on everything that we did with designing the blood draw sleeve, a modification I would make for the future would be to make the part of the sleeve that goes onto the cage mesh clear. Doing this would allow Milton to see what was happening on the other side instead of him having to look over the metal plate, which can change the positioning of his arm. We now draw blood from Milton about every two months. Right now we are in the process of passing off the behavior to another trainer and a second veterinarian. Our next goal is to train our female White-cheeked Gibbon for voluntary blood draw in case it is ever needed in the future.

"Owl" Do It! Training Owls with Different Individual Histories

Cathy Schlott, Christa Gaus, Jenny Walsh

National Aviary

The National Aviary's trainers have had the opportunity to work with nine different species of owls, many with different backgrounds. We have used hand raised, parent raised, and non-releasable wild owls for programming. We have also had success breeding our Ambassador Eurasian Eagle Owls and have had the opportunity to hand-raise several for other zoos to use as ambassadors. While every animal is an individual regardless of species, there are two things that are essential to a successful animal ambassador program: having the right animal for the job and a solid positive reinforcement based training program.

To talk about training ambassador owls, one must first define a few things. According to encyclopedia Britannica, imprinting, in psychobiology, is a form of learning in which a very young animal fixes its attention on the first object with which it has visual, auditory, or tactile experience and thereafter follows that object (typically the parent). According to the Collins English Dictionary, hand rearing occurs when an animal is looked after by a person, rather than by its mother, when young. There are ways to hand rear an animal and not have it imprint, but often times if you are not deliberately taking steps to prevent it then hand rearing can cause imprinting. For example, using puppets to feed helps animals or raising an animal with a conspecific can help to avoid imprinting on people. For this reason, imprinting and hand rearing are by definition two different things.

Hand rearing can have benefits. It allows trainers to better desensitize an owl to various environmental stimuli that can help give them more confidence as an ambassador as well as ensure survival of offspring should a parent begin to fail at raising them. However, there are also cons to hand rearing. Hand rearing can lead to imprinting on people, can cause aggression, and in some instances hinder the animal's ability to successfully breed in the future. One thing that can help to prevent some of the cons is to hand rear owls together.

Hand rearing an owl is not enough to make a good ambassador animal. The first few hand raised owls the National Aviary worked with were not as desensitized to the daily environmental stimuli they came into contact with. These owls were not successful in an ambassador program.

Boo, a barn owl, was hand raised at another facility where he was off exhibit and received no formal training. At about 6 months old he arrived at the National Aviary, lived off exhibit, and was not worked with for another 6 months. Though he would step up voluntarily, he would not sit comfortably for equipment. We tried to crate train him to have him on a table with no equipment, but he was not comfortable around people or new surroundings so it was decided to send him to another facility where he could live on exhibit.

Whisper, a barn owl, arrived into quarantine at 2 weeks old. While in quarantine, trainers immediately began spending time training her to be comfortable on the glove while walking around. While this was successful in quarantine, once out and able to be in front of people and go to new places, the comfort level on the glove decreased. In front of people and in new places, the bird would bate. Even trying to desensitize the owl to people around in a crate was unsuccessful. Flight training was attempted as well, but despite doing flights well in an area with no audience, audiences were still a big challenge. Since the goal with Whisper was to be able to glove work and shows with a large audience, it was decided to not use her as a program animal.

Denver and Attie are burrowing owl siblings that hatched at the National Aviary. They were hand reared together while in an exhibit window and started training as soon as soon as they were fully feathered and ready to fly. They were taught basic behaviors like flying table to table, going in and out of a crate, and walking through a tube to showcase their burrowing behaviors. They did very well with basic training as well doing behaviors in front of people. However, one area that was missed while training these birds was desensitization to a video screen. Our show space utilizes theatrical lighting and a large video screen so ambassador animals need to be acclimated to this key component of our programming. Denver, as a whole, was very successful and did adjust to the screen with some extra time being trained to be comfortable with light changes and video. Attie, however, had

several setbacks throughout her training. Her biggest hurdle was a large photo of another burrowing owl on the screen. Several weeks were spent reinforcing her in front of the photo on the screen, including reducing the size of the photo and gradually increasing the size until it was taking up the whole screen. While both owls were hand raised in the same way with each other, one had more challenges than the other and we have learned that the desensitization process was more helpful than hand-rearing alone. Now, when the National Aviary hand rears owls, we spend a lot of time desensitizing them to a variety of situations from a young age. We expose them to people, videos, music, traveling in a car, and any other situations that we think they are likely to encounter as an ambassador. Generally, we have found that the more things you desensitize them to at a young age, the more success you have when working with them later.

In addition to hand reared owls, we have had equal success working with several non-releasable wild owls. Desensitization with these owls can take longer for several reasons. Their first interactions with people were associated with medical treatments and the owls have not experienced all the day-to-day activity that an animal raised in a zoo environment would encounter. Some non-releasable owls can be successful as an animal ambassador while others may not be. The key is tailoring the training plan for the individual to increase the chance of success.

The National Aviary has recently worked with four non-releasable Eastern screech owls, each with different back stories:

Oakley was hand raised, but was not imprinted. He was very aggressive toward the glove when trying to step up. We changed his training plan to having him hop to the glove for food but once on the glove, he continued to be aggressive toward the glove. After 6 months of training, it was decided that Oakley would not be a successful ambassador owl so he was sent to another facility.

Cypress was hand raised and very comfortable around people. He was very quick to glove train and was very comfortable doing classroom work and being in front of large crowds indoors. However, the first time he was taken outdoors for a class, he would not eat and was very nervous. We learned that we needed to spend more time desensitizing him to outdoor areas. Since spending time working with him outside, his comfort level outdoors has increased but more time will be needed to fully train him outdoors.

Ash is a wild, parent reared Eastern screech owl with an eye injury. He had no training prior to his arrival at the National Aviary. He responded very well to positive reinforcement training and steps up very confidently. The primary difference in working with him compared to an imprinted screech owl is his limited vision, and the need to offer him reinforcement from the side with his sighted eye.

Cedar is an imprinted, non-releasable owl. He was used at his prior facility for programs, but was not trained using positive reinforcement. He was very fearful of people and of the glove. Initial training began with just getting him comfortable eating in front of us. To get Cedar to come to the glove, he is asked to hop to it for a piece of food instead of stepping up to it. At the beginning of his training, we asked him to hop to a glove that was not worn by a trainer. Once he would sit on an "empty" glove, we introduced hopping to a glove worn by a trainer.

Through working with these screech owls, we were able to tailor a training plan that was successful for 3 of the 4 individuals. The 3 birds that worked well for us are solid ambassador animals now and will crate, sit on the glove in multiple environments for crowds of all sizes and will even transfer on and off a visitor's glove for up close encounters.

The National Aviary also has three Barred Owls as part of our ambassador animal collection. All three are wild reared and came in with various injuries. Due to their history in wildlife rehabilitation, all three birds were initially very fearful of people, so their earliest training was simply getting them to eat in front of a trainer and gradually moving closer to them as their comfort level increased. Once the birds were eating with a trainer standing next to them, we could begin the process of teaching them to step up. Since they were more nervous of people we decided to have them come to the glove by hopping to it. We slowly built confidence by feeding them on the glove within their enclosure before taking them out to new environments. Because we opened a new owl exhibit in the fall of 2017, we had to move 2 of the owls into this exhibit (Othello and Rossi). We are hoping that spending time in this outdoor exhibit may help desensitize them to people and many environmental stimuli. We chose the two owls who were going on exhibit based on how they were progressing with their training. We are looking forward to seeing how these two birds progress when they come off of exhibit and resume training as animal ambassadors.

We chose to continue working with the third barred owl, Anne, as she had been progressing more quickly with her training than the two male owls. We have taken her training steps very slowly and she now does well on the glove in the areas that she sees regularly. She is also going into a crate and going to new places so we can continue to desensitize her to other areas, especially outdoors. She has done a few small education programs and encounters and we are continuing to build her confidence in this role. Throughout the training process we have had to take some steps back to desensitize her to things like clap-

ping and video screens. We know her sensitivities and take those into consideration as we progress with her. Since she is a more sensitive animal, we are careful to limit the number of handlers who work with her until she is very solid in each new situation. As she gains more confidence, she is making strides in new situations, has started working for additional trainers, and is looking like she will turn out to be a solid education ambassador!

The National Aviary is also home to a pair of breeding, ambassador Eurasian Eagle Owls. These birds have produced 9 chicks over the course of the past several years, several of which have since gone on to other facilities to become ambassadors.

Pumpkin was the first Eurasian eagle owl chick we hand raised from hatching and she was the only chick in her clutch, so she was raised with no other owls. Her training during her first year focused on sitting on the glove for educational programs. She did not get any experience flying for food or running into a crate. For this reason she never really learned to move and work for food. Once we began to train her for flying, it was very difficult. She was not confident and also struggled with the concept of needing to move away from people to get food. Today, Pumpkin's job is to be a glove bird, although she is trained to step in and out of a crate and travels to schools and other offsite programming with confidence.

Eight chicks have hatched since Pumpkin and all of them were hand raised from hatch with a sibling. In addition to the advantage of living with another owl, we used our experience working with Pumpkin to modify our training plans for these owls. At 6 weeks we began glove training, and at 8 weeks we began flights and crating so they learned at an early age to move to earn their food. While training these behaviors, the birds were being desensitized to different environments, large groups of people of all ages, multimedia, outdoors, different spaces, loud noises, etc.

Owls are habitual which you can use to your advantage. Training the staff that work with each bird to follow a consistent, strict set of criteria while cuing, crating, and stepping up the same way can set a reliable pattern. We have found over the years while working with birds from a variety of backgrounds that consistency while training is just as important, if not more important, than how each owl was raised.

AN APPLE A DAY KEEPS THE DOCTOR AWAY: TRAINING A HERD OF BISON FOR MEDICAL CARE

Tiffany Laracuente
Salato Wildlife Education Center, Kentucky Department of Fish and Wildlife Resources

Salato Wildlife Education Center is the only wildlife center run by the Kentucky Department of Fish and Wildlife Resources. Staff care for a wide range of Kentucky native wildlife from snakes and fish, to raptors, bears and elk. One prominent and popular animal is the herd of 1.3 American Bison (Bison bison). Historically, this herd is very skittish when trying to apply fly spray, ivermectin or any medical care. This resulted in at least one bison developing hot spots that were hard to treat every summer. Starting in February 2017, we created a training program for the bison. Now all four bison willingly come up to a station for training fly spray and ivermectin. In addition, two of the bison are trained for injections. Summer of 2017 is the first year that none of the bison developed hot spots. We have also been able to train the bison for the public and use the training as a way to help educate. This presentation/paper will outline the steps taken from the beginning to where we are now. Moreover, we will go over all the herd and individual challenges along the way.

Introduction

When you think about Kentucky, you think about bluegrass, horses, the Kentucky Derby and bourbon. However, no one really thinks about the Kentucky Department of Fish and Wildlife Resources (KDFWR). We may be a small-town state but we do amazing things. We created NASP the National Archery in Schools Program, which in now an international program that everyone even those with disabilities can take part in. We also have the leading Mussel Conservation Lab in the world. They were able to take a species with only 1.3 individuals left and now have 1,000s of individuals that they are putting back out into streams. We have reintroduced Elk into the state from zero in 1997 to over 11,000 last year, making Kentucky the largest elk herd east of the Mississippi. KDFWR receives no money from the state's general fund- the agency's funding comes from the sale of hunting and fishing licenses, boating registration fees and federal grants based on the number of licenses sold in the state. KDFWR also runs an education center at headquarters in Frankfort, Kentucky. Salato Wildlife Education Center is the only place that exhibits only Kentucky native wildlife. Before I started at Salato, there were no animal enrichment or animal training programs, most of animal care were people who did not believe in such things. With a staff of one branch manager, three full time educators, one animal care supervisor, four animal care staff and three to five seasonal staff- time is rare. We are a small facility that sees over 50,000 guests during our nine-month season. Nevertheless, we make an impact in educating people about what people will see here in Kentucky and what people can do to help take care of what is here in their own backyards.

Now after a couple years we have grown, and we do some cool things. Our bobcat willingly takes an injection. Our groundhog has only been under anesthesia once (for her spay) because all of her medical care is done through training. Animal care is still on the fence about training but when they came to me at the end of 2016 about working with the bison, I was ecstatic. I took this as a challenge to hopefully win animal care over to my enrichment and training side. Another part of the challenge is that although I have worked with and trained birds, primates, bears, cats, pinnipeds, I only briefly worked with hoof stock in 2005/2006 and never trained hoof stock. This was also an opportunity not only for me to grow but to grow our programs for the public. The public complains that our bison tend to like the back of the field where they do not get a good view of the herd. Train-

ing our bison was going to help us better take care of them medically but also give us an opportunity to better reach and educate the public.

History

Our herd is made up of one male and three females with an occasional calf that is sold off. Our big male bison and head of the herd is King. We received in him 2005, making him about 13 years old. Our oldest female bison and next in the hierarchy is Queen. We have no records on when we received her (some of our old records are not good enough or missing). We have only in the last three years had one of our seasonal staff create a database for our collection. Queen is old, she is showing age, more prone to limping and is not calving as often.

Our other two females were received in 2016 when they were two years old. Number 24 is next in the hierarchy and number 19 is the low girl in the herd. For the first part of training in 2017, we did have a male calf, born late fall 2016 to Queen but thankfully, he was auctioned/sold off mid-year when he was big enough to leave. I will mention this calf a little in training but we do not include him in our herd. You will notice we did have names for a couple bison but not for all because our stance is that we do not have any official name for any of our animals since they are all wild animals and names tend to lean people towards pet like attitudes. It is our way of teaching that these animals do not make good pets and should never be pets.

Kentucky summers do get hot and with the heat comes flies and hot or blood spots on the bison. Historically it was difficult to apply fly spray on the bison to help with the flies, but even more difficult to then apply any treatments for the hot spots. The bison recognized and disliked the fly spray sprayer and disliked being sprayed. It was also difficult at times to separate the calves off from the herd to send off. This is why we decided to train the herd to help better manage them and improve their welfare.

Working with a Herd

Before even starting, we had a non-ideal set up. We only have two trainers, Dane and I, for four to five bison that we can only train two times a week in a couple fields. We are unable to separate the individuals so we can work them individually. So, our biggest starting hurtle was to figure out how we could work with each of them but not struggle with hierarchy. On January 24th 2017 we started with buckets of apples and our whistles. After just a couple training sessions of whistling and feeding/tossing apples at them they started running to us for training—the herd was hooked. We started out with a call of "apples" a word not normally used and not a name. Nowadays, we do not use the cue "apples" very often because they recognize the truck, the two trainers and the target signs; all add up to meaning it is training time.

Once they were hooked, we introduced our first target, a crown for King. While researching what bison could and could not see we found nothing on what colors bison could see. What we were able to find was bison could make out shapes/silhouettes, thus came crown, circle, square etc. Since King was the head of the herd we wanted him to go to his target and stay, letting us then work with the other bison. Another hope was to then be able to move the targets to where we needed those individuals. We did not require King to stay right at the target. We gave him some wiggle room around the target. He is about 2000 lbs., not a small individual. At this point we can hand feed King and #24 and we found we can quarter the apples. This set up was working so we decided to introduce the water bottle to start squirting water on them.

The first-time water came out of the bottle all five bison took several running steps back. Then King came right back to us. We had done something scary but he still trusted us. From the beginning, whenever the animal stepped away because of something scary, if they came back we rewarded them. And eventually if something is scary they started to take smaller steps away. Eventually they did not step away anymore. With the water bottles, we started getting them to come and touch the bottle, then do a small squirt next to them and slowly work closer to them. Now we can squirt three of the four bison with no stepping away, although #19 likes to take a couple steps back but then walks right back (she is fine with the water near her, just not touching her yet). We can at times even get the bison to drink from the water bottles.

At the end of February last year, things were going well. We decided that since King is doing really well with coming to

his target, to add more targets—a circle for Queen and a square for 24 and 19. We did decide to remove Queen's target and add it back in later. The day we added the extra targets I was floored at how much we had been able to communicate with the bison. When King came up, he stopped several yards away and visibly looked at all three targets. When Dane, my other trainer, called him over to his target, King went and stayed by it. Once training was over, we opened the gate and shifted them over to the other field. Everyone went over immediately, except King; he would not move. I went over unclipped his target and literally had to walk his target over to the other field for him to shift over. We have never been so happy that an animal comprehended then we were at that moment.

We took Queen's target away; it didn't seem to help or work at the moment. So we split the bison into two teams. King and Queen on the crown and 24, 19 (and the baby bison before he left) on the square. It took us a couple training sessions to figure out the right distance to be apart so that Queen would stay at her target and not bother or displace the others. The answer is about 3 to 4 fence posts away. By mid-May we successfully applied ivermectin to all bison and are successfully applying fly spray to them.

By the end of May we introduced what we call the pokie stick or our mock jab pole. With what we learned from the water bottle, we started by getting them to touch the stick with their noses first and then worked on getting to touch their shoulder. This worked great and we were able to push in with a nail by July with King, 24 and the baby.

A couple side notes on the pokie stick and bison herds: First, during the summer, male bison will sometimes split with the herd, which our male will do. So King saw the pokie stick two times and then split from the herd; he refused to come to training for over a month. He was usually near by but not with us. His first training session back with us was in July and it was like he was watching and listening the whole time. He knew exactly what to do with the pokie stick. He touched it with his nose and then allowed us to touch his shoulder with it. Second, we found they do not mind being touch on their left side but no matter how many times we try (we still try) to get them desensitized on the right side, they refuse. It is each individual in our herd where we can touch left but not touch the right side. We are ok with it but find it interesting.

July was an interesting month. The baby bison got really demanding. He was pushing all the other bison, except King, out of the way for training. Thankfully he was auctioned off and gone by the end of July, and thankfully Queen only missed one training session due to his departure. I was excited for baby leaving because it meant that we could work more with #19. She was the bottom of the herd and was very shy and we were unable to work with her much with the baby taking all the attention. One way to get around some of the issues we had would have been to have one trainer per bison but with our staffing, only Dane and I train the bison.

At this point, we thought training was going well enough to start training in the front of the field for the public. We also thought it would be good to mix things up for the bison. The difficulty though with the front of the field is the change of ground level at the fence. In the back the ground is flat so we stand at the same level as the bison; in the front, the ground dips down at the fence line to where we have to kneel down to be face level with the bison. We make it work. When we train up front we try to pull a volunteer or educator to talk with the public while we train; otherwise we train and then go and talk with the public. People love it and are always so interested and amazed at what we are able to do with the bison.

At the end of September, we reintroduced Queen's target because she started to walk over and push #19 and #24 out of the way. Queen has become our wildcard, we never know what mood she will be in that day for training until we start training. She is an old bison, so we give her some room to be her.

In December, we started to move #19 and #24 around King and Queen. We call them over, give them a couple apples then move their target to the other side of King and Queen and have them walk around King and Queen. We found that though #19 is shy, she is really good at moving with the target. She is coming up and eating the piece of apple with my hand a couple inches away but refuses to eat the apple from my hand. We are ok with that as long as she does everything we need her to do.

The only time that this was an issue was in January when it snowed a couple inches. Every time I tossed an apple to her, it disappeared into the snow. None of the bison were happy that day and many apples were lost. Great at everything else, #24 was a little slow about going around King and Queen but got the hang of it if I tossed apples along the way.

January was our first attempt at opening the gate and trying to shift only one or two individuals through. King and #24 stayed with their targets, Queen went straight through ignoring us, #19 went through but came back to us. If we had more apples and a third person to work our gate we would have successfully separated Queen from the herd. With working them more we have found we can get King and Queen to stay still with their targets and then #19 and #24 are good at moving. So at this moment, if we need to separate the herd we start in the field where we need King and/or Queen in and then shift all the others over. We set our training up for success. Now all we need is a gate that will work for us.

Where We Are Now

One of our first years that none of our bison developed a hot spot was 2017. It was the first time we were able to monitor our bison closely throughout the year. We are at the point that I would be up for giving shots or separating any bison if we had the need. Currently we are experiencing something new- King is over-eager for apples (actually pushing on our wire fence) and is asserting his opinion and will more. He is massively shaking his head at things he does not care for. This is something we see occasionally with our female #19 when she is shy and does not want to eat apples from our hands or be close to us. With research we have found head shaking is done when bison feel you are too close and when males are aggressive and fighting each other. We are in the process of trying a couple different things at the moment to calm him down, which seem to work. One thing I am doing when working with him is instead of hand feeding each piece, I throw a couple pieces on the ground that way he sees the apples on his side of the fence and not on our side of the fence. We hope some of these adjustments help communicate to them that, “Yes we hear you, we understand, let us try this other way to get the same outcome we need.” We have had a number of training sessions with the public watching. People are amazed at what we are doing and how well the bison respond. People are learning, they absolutely love it, they ask when we will be training again, and they are coming back for it. The comments, questions and awe kids express are worth all the time we have spent with the bison. Think about it: if the public and future generations are not awed and educated at a level they understand and that catches their interest about our animals, then what future do we have?

Bringing the Pelicans to the People: Providing a Personal Piscivore Presentation

Traci Schneekloth
San Antonio Zoo

The San Antonio Zoo has one of the largest bird collections in the United States. There are several mixed species aviaries and open-air habitats within the zoo and most of them have some form of water flowing through them. The largest of these exhibits is a central open-air habitat called Big Lake. The Big Lake exhibit houses Caribbean Flamingos, American White Pelicans, Brown Pelicans, East African Crowned Cranes, Moluccan Radjah Shelducks, Bar-headed Geese, Magpie Geese and a Black Necked Stork.

In 2014, the Aviculture staff cared for the flock of American White Pelicans on the lake by feeding them fish off the shore while they swam in the water. There is a natural Egret rookery over the lake and surrounding areas and Egrets commonly will swoop down and steal fish from the water. The pelicans receive a vitamin in a fish every day and feeding them in the water made it difficult to ensure each pelican got the supplement regularly.

Animal Care Specialist, Traci Schneekloth, devised a plan to get the pelicans up out of the water and onto land to make feeding time easier and more manageable for them. Pelicans are extremely skittish and run back to the water if anything startles them. Using very small approximations, Traci would sit on the beach and wait for the pelicans to come to the shoreline where she would throw them fish just within reach. Each day she would back up a step. The pelicans eventually couldn't reach the fish in the water so they started coming up on the shoreline.

Traci began kneeling during feeding sessions, and then squatting, and slowly started to stand. Each time she changed positions the birds would typically become afraid and back up or head back to the water. In time, they seemed to understand that the risk was worth the reward and would stick around for mealtime. After about 8 months of these sessions, the pelicans were brought all the way to the entrance gate of the exhibit. The entrance is directly across from the Zoo's Carousel and a major pathway for guests.

Training the pelicans went from a husbandry related task to becoming a way to teach people about very misunderstood birds. Traci began feeding the birds to the side so that she could talk to guests and answer questions. The birds became more comfortable each day. She began taking interns and co-workers in to assist with the feedings, and while the birds stood very far away, they eventually became comfortable enough to get closer.

In 2015, the Aviculture department received a flock of Brown Pelicans that contained individuals from all over the Gulf Coast. The birds had been rehabilitated and deemed non-releasable after sustaining injuries in the wild. The pelicans were introduced to the existing flock of American White Pelicans and, while they didn't seem to enjoy each other's company, slowly started to realize the routine at feeding time. Within a few days, most of the Brown Pelicans were coming up to see where the food was coming from.

Having 2 native species of pelicans really seemed to get guests interested. Many zoo guests had seen Brown and White Pelicans at the coast and wanted to see them up close. A keeper chat was developed to educate guests more efficiently. Keepers discussed things like hollow bones and how much the birds weighed, breeding combs on the beaks of the White Pelicans, the difference in how the two species hunt and nest, and how feeding them on land was helping to ensure they each got their vitamins every day.

The pelicans began to be so comfortable with Traci that she was able to start doing beak touches. On several occasions, she has been able to grab birds when noticing an injured foot, injured wing, and one pelican that did not receive its quarterly dewormer with the rest of the flock.

Big Lake's pelicans are rounded up 4 times a year to receive a dewormer, a weight check, and a wing trim (if needed). Since the Brown Pelicans all have wing injuries, dewormers have been given successfully in the fish at feeding time. This has cut down on the stress of catching the birds up and has also been able to ensure they get their medication.

In the future, the Aviculture department plans to scale train some of the braver pelicans and start training wing touches for voluntary wing trims.

This husbandry training goal turned into a success not only for the birds and staff but also for guests. Guests that were afraid of birds at the beach are now becoming inquisitive and fascinated by them. Several guests have said that they hadn't noticed the birds on the lake before and now stop by at feeding time each day they visit the zoo.

The pelican feeding has been featured on the zoo's Facebook page and has receive a lot of media attention. The Zoo has also been able to spread the word about wild bird rehabilitation and what guests can do to ensure they don't leave fishing line behind and drive carefully when boating on the water. Animal Care staff has also been able to educate guests about what not to feed wild birds and have been able to answer questions about all of the birds on the lake, especially flamingos (a favorite). Keepers are able to show guests what is fed to all the different birds and what they can feed to birds when they visit the beach or parks.

Education is at the forefront when it comes to modern day zoos and the Pelican Animal Chat has helped to insure guests are leaving the Zoo with more knowledge each day!

Interspecific Socialization between Beluga Whales (*Delphinapterus leucas*) and Pacific White-Sided Dolphins (*Lagenorhynchus obliquidens*) in a Zoological Setting

Philip Waugh, Sophia Snell, Jordan Greene
SeaWorld San Antonio, San Antonio, Texas

At Beluga Stadium in SeaWorld San Antonio, we have the unique opportunity to incorporate multispecies training into daily interactions. We care for beluga whales (Delphinapterus leucas), Pacific white-sided dolphins (Lagenorhynchus obliquidens), and six species of macaws. We have been able to introduce the majority of our animal population to one another. The process began by creating a plan based on behavior modification techniques, ontogenetic characteristics and repertoires of each animal. In addition to conditioning multispecies interactions, we have observed interspecific relationships that appear to have an unconditioned reinforcing value. While continuing to develop multispecies interactions, we hope to utilize both conditioned and unconditioned relationships as reinforcement and enrichment.

Key Words

socialization; beluga; dolphin; *Delphinapterus leucas; Lagenorhynchus obliquidens*; multispecies

Introduction

Interactions between heterospecific cetaceans in their natural habitat have been reported between many different species (Corkeron, 1990; Sheldon, Baldron and Withrow 1995; Weller et al., 1996; Herzing and Johnson, 1997). Heterospecific interactions between individuals sharing a habitat can be categorized as positive (*mutual*; beneficial to both species, *commensal*; beneficial to one species while the other remains unaffected) or negative (*predatory/parasitic*; beneficial to one species while the other is harmed) (Deakos et al., 2010). Multi-species groups of animals are typically described to have some evolutionary benefit and therefore some functional explanation for their association (i.e. foraging activity or protection from predators) (Whitesides, 1989; Heymann and Buchanan-Smith 2000), but may also be described by overlapping habitats (Stensland et al. 2003).

Interspecific interactions between cetaceans in a zoological setting have not been thoroughly documented in the form of published research. A multispecies habitat between a beluga whale (*Delphinapterus leucas*) and bottlenose dolphins (*Tursiops truncatus*) yielded results suggesting that interspecific socialization can influence the vocal repertoires of the animals (Panova and Agafonov 2017). Here we explore interspecific interactions between beluga whales and Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) in a zoological setting.

Background

The beluga whale is an arctic and sub-arctic cetacean typically found in large social groups of up to 100 individuals (Brodie, 1971; Kleinenberg et al., 1969; Sergent, 1973). They are opportunistic foragers, and often consume invertebrates and small schooling fish. As a species, beluga whales exhibit "flight" responses to novel stimuli as a survival mechanism. This prey response allows them to escape the grasps of their predators, which include the killer whale (*Orcinus orca*) and polar bear (*Ursus maritimus*). In contrast, the pacific white-sided dolphin is a small, athletic species of dolphin found in the North Pacific Ocean. They are predatory animals that hunt in groups using cooperative hunting techniques (Walker et al., 1981). Very few physical similarities exist between the beluga whale and Pacific white-sided dolphin. It was our hope that their tendency to thrive in pods would aid our goal of fully integrating our preexisting social groups.

Beluga Stadium, SeaWorld San Antonio

Since 1988, a variety of species has been housed at Beluga Stadium. Beluga Stadium at SeaWorld San Antonio is currently home to nine beluga whales, five Pacific white-sided dolphins, and eight macaws, of six different species (*Ara ararauna, Ara chloropterus, Anodorhynchus hyacinthinus, Ara macao, Ara militaris, and Ara rubrogenys*). There are over two million gallons of salt water in seven pools that are connected by gates (Figure 1). Many of the pools exhibit a variety of lengths, widths and depths.

Prior to the integration of the two pods, the current group of beluga whales and Pacific white-sided dolphins had some limited experience interacting with one another. These interactions occurred through gates and through an environmental barrier made of a net-like material that acts as a divider between four of the seven pools. This "net wall" allowed visual and auditory communication to occur between species; however, these brief interactions were the only form of interspecific exposure for many of the animals. Most of these interactions consisted of vocalizing and group swimming, without any observation of aggression. If multi-species interaction involving the current Beluga Stadium population occurred outside of these examples, it usually involved select individuals in specific settings until 2017.

Interspecific Interactions at Beluga Stadium

In Beluga Stadium's early history, interactions between a variety of cetacean species were commonplace. However, many of the individuals in the current population were not present during this period. For a majority of the current population, previous multispecies experiences were limited to short-duration interactions in specific contexts. These multi-species interactions would often begin and end in a predictable context, usually during public shows, and typically under stimulus control of a trainer. They also occurred as a by-product of moving belugas through a group of dolphins (or vice-versa) during the changing of social groups or during closely monitored and well-planned sessions involving both species.

In 2017, a new goal arose at Beluga Stadium – create a fully integrated, multi-species pod consisting of beluga

whales and Pacific white-sided dolphins. For the purpose of this process, the level of integration is determined by the behavior emitted by each animal and full integration is achieved when animals in a multispecies setting emit behavior consistent with behavior emitted in a single species setting. Ultimately, the combination of the two single-species pods into one behaviorally stable, singular, heterospecific pod would ideally occur more often than having the two separate pods.

This multi-species pod goal was driven by the core value of SeaWorld's Animal Husbandry Department: to create dynamic, engaging, and enriching environments for all animals in its care. Our objective has always been to enhance the lives of animals by creating complex and original forms of mental and physical enrichment. A series of park, staff, and environmental changes led the conclusion that creating a multispecies environment would be the best way to provide our animals with a new level of enrichment and interaction. Initiating this process allowed Beluga Stadium to continue upholding SeaWorld's long heritage of providing excellent animal care through variety and change.

As there is a paucity of research published on the implementation of multispecies habitats in a zoological setting, we embarked on our behavioral integration plan with the knowledge of the history of Beluga Stadium, the experiences of other species in other facilities, and the histories of the animals in our care (Appendix 1).

Methods

The process of creating the singular pod began in January of 2017. We initiated the process by selecting individuals based on their history with multispecies interaction, as well as their individual behavioral characteristics (Appendix 1). Because the inherent reinforcing or punishing value of the other species to each individual was unknown, the beginning candidates were animals that had previously maintained calm and predictable behavior in the presence of extremely novel or slightly aversive stimuli. The animals we predicted to exhibit the most desirable behavior included beluga whales Martha (M_{DL}), Oliver (O_{DL}), and Samson (S_{DL}), as well as dolphins Catalina (C_{LO}), Betty (B_{LO}), and Hailey (H_{LO}).

We began sessions with groups of the previously mentioned belugas and dolphins in adjoining pools (Figure 1). We opened and closed the gates between the adjoining pools without shifting the animals into the same pool. After establishing this consistency and observing the behavior of each individual, we proceeded to add previously chosen individuals of one species to the group of previously chosen individuals of the other species. We were able to pair primary reinforcement with the presence of the other species in hopes that we would alter the reinforcing value of multispecies environments. Our aim was to build reinforcing relationships between each animal and decrease any aversion to the other species. We hoped to create an environment in which each multispecies interaction provided as much behavioral success and stability as a typical conspecific interaction.

During this step, trainer interaction was very important in order to communicate clear criteria for the duration of time for each session. By creating a clear and predictable context for each session, the animals were able to anticipate their return to a single-species environment. By communicating the criteria of time, we were able to begin approximating the duration of each

session. After success was consistent at this stage and longer sessions were frequent, we began to end trainer interaction and remove ourselves from the environment for short, predetermined amounts of time. We predicted this stage would hold notable change for many of the animals, as they were now able to engage one another without stimulus control from a trainer. Similar to previous stages, it was necessary that we approximated the length of these sessions, as trainer absence allowed for a wider range of social interaction between each species.

In the beginning, we predicted that primary reinforcement with multispecies interaction would be necessary for creating the foundation of the new interspecific relationships. We also predicted that, as time went on and their relationships became mutually reinforcing, primary reinforcement would be necessary at the end of these interactions when the animals would move to single-species pools. We recorded the individuals used and any behavior of interest that occurred during the time under trainer control, as well as the time not under trainer control and we modified the following sessions based on these observations.

After the original candidates began to show consistent behavioral success in a multispecies environment, the other members of each pod were slowly introduced in hopes that observational learning would occur. By eliminating any novelty or aversive value for the original candidates, we predicted that observational learning would occur for the next group of candidates and the innate flight response of the beluga whales to a novel or aversive stimulus would decrease. The relationships built between the original candidates could be used as a behavioral tool to build relationships with the next group. Sessions were conducted as described above.

Results

From December 7, 2017, until February 17, 2018, we recorded the social groupings created during each multispecies interaction (Table 1). Before this time, we noticed a few improvements in the stability and predictability in the behavior of individuals during multispecies interactions. Because of this, we felt that this would be a time of great change for the pod and detailed behavioral records were kept. The information recorded (Table 1) exhibits multiple behavioral changes that occurred within the pod.

As predicted, a majority of the original group of animals (M_{DL}, O_{DL}, S_{DL}, C_{LO}, B_{LO}, H_{LO}) did aid in teaching other members of the pod to exhibit desirable behavior. Unexpectedly, H_{LO} proved to be less reliable than the other members of the dolphin pod. Because of this, there is a gap in her participation from trial 8 until trial 23 (Table 1). This gap allowed the other members of the pod to build interspecific relationships before her future reintroduction.

Around 85% of all trials involved either M_{DL}, O_{DL}, or S_{DL}, while 80% of trials involved C_{LO} or B_{LO}. Not only did these animals provide success and stability more often than the other animals, but their presence seemed to actually improve the behavioral success of the other animals. For example, I_{DL} is a dominant male with a tendency to show less behavioral success and stability during times of change or in the presence of novel stimuli. Because of this, 81% of trials involving I_{DL} also

involved either M_{DL}, O_{DL}, or S_{DL}. Similarly, C_{LO} and B_{LO} were not removed from trials until trial 19 due to their tendency to engage belugas in a positive and desirable way. Because of their effect on the rest of the pod, this group of five animals (M_{DL}, O_{DL}, S_{DL}, C_{LO}, and B_{LO}) became known as "Stabilizing Animals."

In contrast, combinations of typically reliable animals created unsuccessful interactions similar to those created by H_{LO}. For example, C_{LO} was selected for 57% of trials. C_{LO}'s high selection rate was based on her desirable behavioral reliability. However, C_{LO} participated in multispecies interactions with A_{LO} during trials 5, 6, 7, 9, 10, and 11, but after trial 11 the pair of C_{LO} and A_{LO} were not involved in multispecies interaction again except for once in trial 22 (Table 1). The combination of C_{LO} and A_{LO} with beluga whales did not exhibit behavioral success due to the positive relationship between C_{LO} and A_{LO}. Group behavior formed between C_{LO} and A_{LO} and created very little desirable interspecific interaction. After trial 11, the decision was made that the pair would not interact with beluga whales until each individual had time to construct more consistent, positive, and independent interspecific relationships. A_{LO} could eventually experience observational learning by being in the presence of C_{LO}, but the relationships between C_{LO} and the beluga whales would need strengthening to a point where it could nearly match the reinforcing value of the relationship between C_{LO} and A_{LO}.

The relationship between O_{DL} and b_{LO} is inconsistent in terms of behavioral success, but has recently displayed a unique behavioral consistency. O_{DL} was present for 100% of interspecific interactions involving b_{LO}, however M_{DL} was present for only 55% of these interactions. Ontogenetic factors may have played a role in this percentage gap. M_{DL} is a fully mature adult female beluga. O_{DL} and b_{LO} are both considered juvenile-adult males, so their stage of life may have aided in their compatibility. However, after seven trials, this relationship exhibited an unexpected and highly notable milestone. O_{DL} and b_{LO} began displaying sociosexual behaviors that became consistent events in their interactions. This behavior was absent for the first six trials, so it is assumed that the value of their relationship has changed in a way that has triggered behaviors that are frequent between males of the same species (Hill et al. 2015). It is assumed that these interactions are reinforcing and, more notably, these interactions are ones that are typical for males that share one single pod. This was noted as an important milestone in the integration of these two species.

Discussion

Our original goal of creating a cohesive, interspecific pod between beluga whales and Pacific white-sided dolphins has so far been successful. However, our integration of the two separate pods is ongoing. Through our trials, we learned more about our individual animals in the context of multispecies interactions, and were able to apply this knowledge to concurrent interaction trials. We expected reinforcing relationships to form between each animal and that it would not take long before each animal was emitting consistent behavioral success.

There were, however, unpredicted factors and variables that occurred throughout the process. The way in which we approached each session began to shift. For some animals, primary reinforcement was necessary in the active desensitization process. For others, habituation occurred naturally as the time they spent together increased. By removing the trainer stimulus from the environment, it allowed the animals to focus entirely on the other species. Because spending time in the presence of another species

without trainers seemed to aide in decreasing the novelty factor, we began to allow the animals to spend time alone in the same environment before we initiated trainer control in the following session. When these animals were allowed social interaction prior to initiating a new session under trainer control, behavioral success during the following session seemed to improve. As previously mentioned, this approach worked for only a few of the individuals.

As each individual reacted differently to the new social interactions, many of the new relationships and habits formed during the process became highly beneficial for the other goals of Beluga Stadium. We did not predict that the relationships that formed would soon become everyday tools for reinforcement, enrichment, variability, and function.

Several results were surprising. We expected certain individuals to exhibit behavioral success, when in fact they consistently exhibited undesirable behavior. H_{LO} was predicted to be a consistent candidate for multispecies interaction, though she created inconsistent and unsuccessful sessions when in interspecific environments.

Another unexpected result was the previously mentioned combination of C_{LO} and A_{LO}. As a group, undesirable behavior was frequent. Individually, C_{LO} and A_{LO} were very strong candidates for multispecies work and continued to exhibit desirable behavior in the multispecies context when they were not with the other.

Additionally, we observed the relationship of O_{DL} and b_{LO} grew to the point of socio-sexual interaction and altered our predetermined goals for these animals. The data in Table 1 displays alterations in our behavioral approach due to these reoccurring behavioral events that were mostly unexpected. As semen collection for artificial insemination is a behavioral goal for both males, their relationship became a tool for training this important behavior and became a new and vital part of the training process.

We encountered several other unexpected and positive results from animals in different stages of life, some with no previous history of multispecies interaction. One unexpected result was the relationship that formed between two heterospecific animals S_{DL} and C_{LO}. They formed a positive relationship quickly and this relationship appeared to have an inherently reinforcing value. S_{DL} and C_{LO} exhibited behavior very similar to the behavior they exhibit when in the presence of conspecific animals with which they have a long, reinforcing history. The playful behavior emitted by S_{DL} when in the presence of C_{LO} was very similar to the playful behavior emitted when S_{DL} is paired with a conspecific, $O_{DL,}$ who is relatively close in age. The playful behavior emitted by C_{LO} when in the presence of S_{DL} was very similar to the playful behavior emitted when C_{LO} is paired with her conspecific, A_{LO}. Despite the gap in age and the difference in stage of life, playful behavior was frequently observed and the relationship became increasingly reinforcing for both individuals. Contrary to the relationship that held an immediately reinforcing value, many of the relationships developed slowly.

Conclusion

The continuation of interspecific socialization at Beluga Stadium brings endless possibilities to our facility. Not only do we consistently utilize multispecies training in our new show, during daily husbandry and learning sessions, and as enrichment and reinforcement post-session, but we also plan to expand our animals' repertoires to include team-contingent multispecies behavior and in-water trainer interactions. Furthermore, we believe that multispecies training provides substantial enrichment to all of the animals in our care. Social enrichment occurs through the introduction of each individual animal and is ongoing as the relationship changes to obtain a reinforcing value. Interspecific interaction appears to be both physically and mentally stimulating for both species, and the value of this social enrichment seems to be rivaled by few environmental enrichment devices or behavioral enrichment sessions. We have witnessed animals of differing species model each other's behavior including both vocalizations and physical activity levels. As interspecific training continues, we look forward to strengthening of our enrichment program by use of multispecies interaction.

Based on our results, we are confident that further application of our integration methods will lead to a fully incorporated interspecific pod. We will continue to monitor the formation and alteration of interspecific relationships between pod members. As some members of our pod have yet to be introduced to one another (combinations of Cr_{DL}, b_{LO}, In_{DL}, and K_{DL}), we will use previously established Stabilizing Animals to facilitate their introduction. Although it is impossible to predict the nature of each relationship shared between any combinations of animals, it is our hope that the data we obtained and the experiences we have seen during these stages will help us to be successful in creating one cohesive multispecies pod.

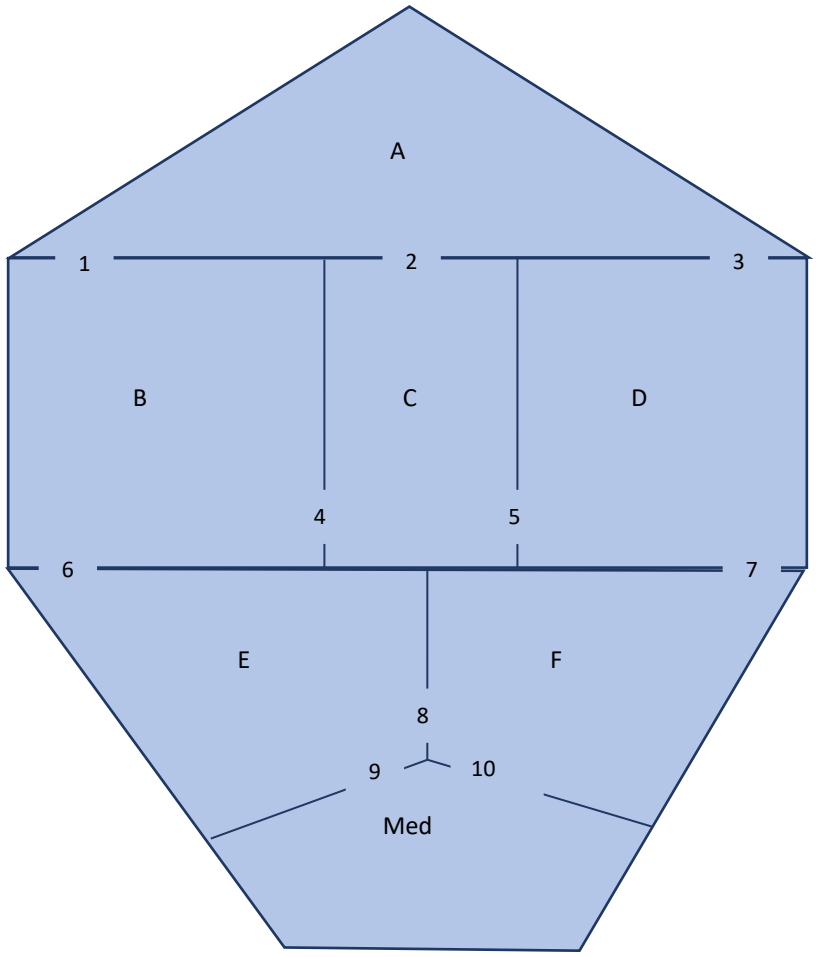
Tables and Figures

Table 1. Animals used in multispecies interaction sessions by date. Individuals with names in white boxes indicate beluga whales, and those in black boxes indicate dolphins (See Appendix 1 for more details on individuals).

Date:	Natasha	Imaq	Kenai	Luna	Martha	Oliver	Samson	Catalina	Avalon	Betty	Hailey	Bolt
12-7	X	X			X	X	X	X		X	X	
12-7						X	X	X			X	
12-8		X				X	X	X				X
12-8			X	X	X				X	X	X	
12-8					X	X		X	X			
12-9					X	X		X	X			
12-10					X	X	X	X	X			
12-14						X	X			X	X	
12-14		X	X	X				X	X	X		
12-16					X	X	X	X	X			
12-21			X	X	X			X	X			
12-22		X			X	X	X	X				
12-27			X	X			X			X		
1-3		X				X	X	X		X		
1-3						X	X	X		X		
1-5						X	X	X				X
1-10		X	X	X	X			X		X		
1-12					X	X	X	X				
1-12						X	X		X			
1-12		X			X			X				
1-13			X	X						X		
1-13						X	X	X	X			
1-15					X	X		X			X	
1-18						X	X		X			X
1-18	X	X								X		
1-18			X	X				X			X	
1-19					X	X		X				X
1-19		X					X		X		X	
1-19	X									X		
1-26					X	X				X		
2-2						X	X			X		X
2-3					X	X	X				X	X
2-5		X			X	X					X	X
2-15					X	X	X		X			X
2-17		X			X	X					X	X

Date:	Natasha	Imaq	Kenai	Luna	Martha	Oliver	Samson	Catalina	A
12-7	X	X			X	X	X	X	
12-7						X	X	X	
12-8		X				X	X	X	
12-8			X	X	X				
12-8					X	X		X	
12-9					X	X		X	
12-10					X	X	X	X	
12-14						X	X		
12-14		X	X	X				X	
12-16					X	X	X	X	
12-21			X	X	X			X	
12-22		X			X	X	X	X	
12-27			X	X			X		
1-3		X				X	X	X	
1-3						X	X	X	
1-5						X	X	X	
1-10		X	X	X	X			X	
1-12					X	X	X	X	

Figure 1. Aerial view of the pool configuration at Beluga stadium. Pools labeled with letters, gates labeled with numbers, solid lines indicate walls dividing pools. Wall traveling from gate 6 to gate 7 is net wall.



Appendix 1. Descriptions of each individual animal housed at Beluga Stadium.

Name	Species	Age	Sex	Description
Crissy (Cr_{DL})	*Delphinapterus leucas*	32	F	Finds visual enrichment reinforcing, hyper-reactive to novel stimuli. Previous interspecific experience.
Imaq (I_{DL})	*Delphinapterus leucas*	33	M	Dominant male of beluga pod.
Innik (In_{DL})	*Delphinapterus leucas*	<1yr	M	Curious, models behavior of other animals.
Kenai (K_{DL})	*Delphinapterus leucas*	1.5	M	Energetic, establishing non-maternal relationships within pod.
Luna (L_{DL})	*Delphinapterus leucas*	18	F	Trainer interaction is greatest reinforcement, behaviorally consistent. Minimal previous interspecific experience.
Martha (M_{DL})	*Delphinapterus leucas*	32	F	Behaviorally consistent, "stabilizing animal." Previous interspecific experience.
Natasha (N_{DL})	*Delphinapterus leucas*	39	F	Hyper-reactive to novel stimuli; often displaces subdominant animals.
Oliver (O_{DL})	*Delphinapterus leucas*	10	M	Trainer interaction is greatest reinforcement, reaching sexual maturity, "stabilizing animal."
Samson (S_{DL})	*Delphinapterus leucas*	4	M	High-energy, finds most novel stimuli reinforcing, developing behavioral foundation, "stabilizing animal."
Tyonek (T_{DL})	*Delphinapterus leucas*	<1yr	M	Rescued calf from Alaska, developing behavioral foundation.
Avalon (A_{LO})	*Lagenorhynchus obliquidens*	19	F	Behaviorally consistent, frequently solicits trainer interaction.
Betty (B_{LO})	*Lagenorhynchus obliquidens*	39	F	Dominant female of dolphin pod, trainer interaction is highly reinforcing, "stabilizing animal." Previous interspecific interaction experience.
Bolt (b_{LO})	*Lagenorhynchus obliquidens*	6	M	Dominant male of dolphin pod, energetic, reaching sexual maturity.
Catalina (C_{LO})	*Lagenorhynchus obliquidens*	24	F	Behaviorally consistent, trainer interaction is most reinforcing, "stabilizing animal."
Hailey (H_{LO})	*Lagenorhynchus obliquidens*	18	F	Finds novel behavior and learning reinforcing, attentive. Minimal previous interspecific interaction experience.

References

Brodie, P.F. (1971). A reconsideration of aspects of growth, reproduction, and behavior of the white whale (*Delphinapterus leucas*), with reference to the Cumberland Sound, Baffin Island, population. *Journal of the Fisheries Board of Canada*, 28, 1309 -1318.

Corkeron, P.J. (1990) Aspects of the behavioral ecology of inshore dolphins *Tursiops truncatus* and Sousa chinensisin Moreton Bay, Australia. In. The Bottlenose Dolphin (Ed. By S. Leatherwood & R.R. Reeves), pp. 285-293, Academic Press, San Diego, CA.

Deakos, M.H., Branstetter, B.K., Mazzuca, L., Fertl, D., Mobley Jr., J.R. (2010) Two unusual interactions between a Bottlenose dolphin (*Tursiops truncatus*) and a Humpback whale (*Megaptera novaeangliae*) in Hawaiian waters. *Aquatic Mammals*, 36, 121 -128.

Frantzis, A. and Herzing, D.L., (2002) Mixed species associations of striped dolphins (*Stenella coeruleoalba*), short-beaked common dolphin (*Delphinus delphis*), and Risso's dolphins (*Grampus griseus*) in the Gulf of Corinth (Greece, Mediterranean Sea). *Aquatic Mammals*, 28, 188-197.

Herzing, D.L., and Johnson, C.M., (1997) Interspecific interactions between Atlantic spotted dolphins (*Stellena frontalis*) and bottlenose dolphins (*Tursiops truncatus*) in the Bahamas, 1985-1995. *Aquatic Mammals*, 23, 85-99.

Heymann, E.W. (1990) Interspecific relations in a mixed-species troop of Moustacehs tamarins, *Saguinus mystax*, and saddle-back tamarins, *Saguinus fuscicollis* (Platyrrhini: Callitrichidae), at the Rio Blanco, Peruvian Amazonia. *American Journal of Primatology*, 21, 155-127.

Hill, H.M., Dietrich, S., Yeater, D., McKinnon, M., Miller, M., Aibel, S., and Dove, A. (2015). Developing a Catalog of Socio-Sexual Behaviors of Beluga Whales (*Delphinapterus leucus*) in the Care of Humans. *Animal Behavior and Cognition*, 2, 105-123.

Kleinenberg, S.E., Yablokov, A.V., Bel'kovich, V.M., and Tarasevich, M.N. (1969). *Belukha. Opyt monograficheskogo issledovaniya vida (Belugs, Targeted Investigation of the Species).* Moskow, Russia: Nauka.

Panova, E.M., and Agafonov, A.V. (2017) A beluga whale socialized with bottlenose dolphins imitates their whistles. *Animal Cognition*, 20, 1153-1160.

Sergeant, D.E. (1973). Biology of the white whales (*Delphinapterus leucas*) in western Hudson Bay. *Journal of Fisheries and Research Board of Canada,* 30, 1065-1090.

Sheldon, K.E.W., Baldridge, A. and Withrow, D.E. (1995) Observations of Risso's dolphins *Grampis griseus* with gray whales *Eschrichtius robustus*. *Marine Mammal Science*, 11, 231-240.

Stensland, E., Angerbjörn, A., and Berggren, P. (2003) Mixed Species groups in mammals. *Mammal Review*, 33, 205-223.

Walker, W., Leatherwood, S., Goodrich, K., Perrin, W., Stroud, R. (1981) Geographical variation and biology of the Pacific white-sided dolphin, *Lagenorhynchus obliquidens*, in the north-eastern Pacific. *Dolphins in the Ocean*, 441-465.

Weller, D.W., Würsig, B., Whitehead, H., Norris, J.C., Lynn, S.K., Davis, R.W., Clauss, N., Brown, P., (1996) Observations of an interaction between sperm whales and short-finned pilot whales in the Gulf of Mexico. *Marine Mammal Science*, 12, 588-594.

Whitesides, G.H.(1989) Interspecific association of diana monkeys, Ceropithecus diana, in Sierra Leone, West Africa; biological significance or chance? *Animal Behaviour*, 37, 760-776

Choices at 65 Miles Per Hour: Training a Cheetah to Retrieve a Running Lure

Whitney Marker
Columbus Zoo and Aquarium

When the Heart of Africa region opened at the Columbus Zoo, our Animal Programs team had the opportunity to train and present a "cheetah run" behavior. This allowed us to provide enrichment and stimulation for our cheetahs while using this impressive behavior as a vehicle for conservation education. As we dove into the logistics of training our diverse collection of free contact cheetahs, we explored how much voice each animal had in their experience. Upon completion of chasing a toy along our lure system, our cheetahs had a variety of choices they could make as to where to go and what to do with the lure. No matter what their choices were, we trained each one to trade out the high value lure for other reinforcers.

The following year, a 6-week-old male cub, Kvamme, joined our program after previously being mother-reared and his unique history, behaviors, and relationships with our trainers caused us to consider a different training plan. Previously, our trainers would walk towards Kvamme to trade out the lure; however, we opted for a change - the cheetah placing the lure in a predetermined location and walking towards the trainer for reinforcers.

This paper discusses training a retrieval behavior with a cheetah, the process of chaining the behavior to our "cheetah run," the value of addressing the individuality of each cheetah, and the impact the behavior had on our connection to the audience thus allowing Kvamme to play an active role in the conservation of his species.

Introduction

The wild population of cheetah (*Acinonyx jubatus*) has experienced a dramatic reduction in the past century (Weise et al. 2017). Much of this is due to habitat loss, conflict between humans and wildlife, and the illegal pet trade - problems that have humankind at the core (Nyhus et al. 2018). Due to this, many conservation organizations have called for the need for solutions to involve not only local populations but also the global population. Fortunately, cheetahs are a charismatic species and are represented in many zoological institutions, which provides animal care professionals the opportunity to connect zoo-goers to this species and inform the public of conservation challenges and potential solutions.

At the Columbus Zoo and Aquarium, our mission is to lead and inspire guests by connecting people and wildlife. In the Animal Programs Department, we work with a wide variety of animals as ambassadors for their species in order to create unique opportunities for the public to engage with wildlife. These interactions include school presentations, behind-the-scenes tours, and shows on zoo grounds. By utilizing this wide range of opportunities to see animals and showcase their natural behaviors, we are able to create meaningful experiences that inspire our guests to join us in our conservation efforts no matter how big or small.

Our Cheetah Program

Some of our most popular ambassadors in our Animal Programs Department are cheetahs. For many years, we have hand-raised and trained cheetahs as part of our presentations. When the Heart of Africa region opened several years ago, it offered additional opportunities to connect our zoo guests to cheetahs on a larger scale. Our ambassador cheetahs are now viewable in an exhibit yard as well as in an area called the "Watering Hole."

The Watering Hole is a rotational exhibit which many different species throughout the day. At varying times, guests can view silvery-cheeked hornbills flying overhead, aardvarks foraging for food, warthogs wallowing in the mud, spotted hyenas sleeping in the shade of a safari vehicle, and black-backed jackals cleaning up anything and everything left behind. This area is also the setting for our highly anticipated "cheetah run." The cheetah run presentation allows trainers to engage our guests with the cheetah's impressive speed and agility as well as present information on cheetahs, their status in the wild, the conservation projects the Columbus Zoo supports, and how our zoo guests can get involved with these efforts. By featuring three cheetah run presentations every single day, we are able to reach hundreds of thousands of people in a single season.

The Cheetah Run

Our cheetahs run a horseshoe-shaped course around the circumference of the Watering Hole. Although this shape does not necessarily allow the cheetahs to reach top speeds, it enables them to reach very high speeds on the two straight-away portions as well as display their amazing agility around the turn while offering greater visibility for the entire audience. We use an open-loop lure system and our cheetahs ultimately get to catch the lure on each run. Usually, this is at the end of the course but occasionally our cheetahs manage to catch it early. The ability to catch the lure reinforces the running behavior as well as encourages some natural hunting behaviors. This allows our guests the opportunity to see exactly how a cheetah in the wild goes about catching their prey. We often see our cheetahs reach out and swipe at the lure first and then grab with their mouths and lay down to rest with their catch.

When we initially trained our cheetah run, we began with four adult cheetahs and two cubs. The challenge was to find an item to use as a lure that the adult cheetahs would be interested enough in to chase but that could also sustain being dragged along a long running track and around pulleys and tight corners. Eventually, we discovered a fluffy string ball that appealed to all of our cheetahs. With our adult cheetahs, we reinforced interest in the toy and shaped the behavior of chasing after it. Now, we are able to introduce the toy to our cheetah cubs early in the developmental process and encourage interaction and chasing from a very young age. As they mature, their opportunities to play with this lure only occur during training or running sessions and for a brief period therefore helping to maintain the high value of the item.

Now that we had a lure item that piqued the interest of all of our cheetahs, we could train other aspects of the running behavior chain. However, we began to see that once many of the cats caught the toy, they would lay down and proceed to gnaw on it creating the need to remove the lure from the environment shortly after the completion of the run and a brief rest period. By removing the toy from the environment, it was not only safer for our cats to avoid ingestion but also created a scenario where they were ready to receive other cues such as shifting inside.

Our next challenge was to train each cheetah to leave the lure or to allow the lure to be removed from the environment in some manner. Once each cat had gotten the chance to lay down with the lure, we began to train the cheetahs to come towards us and leave the lure. However, most of our cats would quickly return to the lure, simply not leave the lure, or even run off with their catch, sometimes taking a nice stroll around the entirety of the Watering Hole or even running all the way back to their enclosure some 200 feet away. Our initial training solution was to cover the lure and then cue the cheetah to walk towards the shifting area. To do this, each cat was trained to let go of the lure and allow the trainers to move a metal pan towards them to cover the lure before being reinforced.

The Motivation for a Change

After our first year of cheetah runs, we added two young cubs to our program. These cubs, a male named Kvamme and a female named Kesi, were mother-reared for five weeks until their mother died at another institution. When they arrived at the Columbus Zoo, they were nearly six weeks old. They were very small with several health problems and had just begun to interact with human caregivers for the first time. Despite their young age, they were over a month older than our trainers typically begin interactions with our ambassador cheetahs. Due to this unique situation, Kvamme and Kesi formed different relationships with their trainers than our other cheetahs. They gained trust quickly with some trainers but preferred to stay quite far away from others. During these early weeks, Kvamme and Kesi were introduced to two other young cheetahs, about seven weeks younger than them, as well as the Labrador Retrievers that we pair with each of our cheetahs. While Kvamme and particularly Kesi took to their new feline friends quickly, they never formed strong bonds with the dogs. Additionally, as we trained them for programming, they proved to be less confident than their younger counterparts. Kvamme and Kesi, however, excelled at learning our run course. Therefore, these two cheetahs seemed to be the perfect tools for our running program rather than outreach ambassador work and having two cats that would be exclusively part of our daily running presentations was extremely valuable.

As Kvamme and Kesi grew, we trained them to let the lure go, allow trainers to approach with pans to cover the lure, and move towards our shift doors as with our older cheetahs. However, as time went on, we often saw they would run off as trainers approached or simply sit with the lure for an extended period of time. We began to brainstorm how we could think outside the box and make changes to address their individuality and particular needs in order to set them up for success. What could we do to increase the choices and decisions these cheetahs had after they caught their lure? After much consideration, the solution we agreed upon was to train them to pick up the lure and deposit it in a designated location before being reinforced and then shifting out of the yard. This way, no trainer would need to move towards Kvamme and Kesi immediately after the run and it would provide them a greater voice in their experience. In addition, it would provide more trainers the opportunity to build a reinforcing history with these two cheetahs.

Training the Behavior

Training began behind the scenes with Kvamme by shaping the retrieval behavior. Rather than use a high value lure, I chose another object to train the behavior before switching to the lure. Ideally, this was an object Kvamme could easily bite onto and carry with him as well as heavy enough to make some sort of noise when it was dropped into a metal bucket. The first step was finding such an object. I presented a variety of different dog toys and Kvamme presented a variety of different reactions to each one. We finally settled on a rubber toy covered in cloth as he could easily bite onto it and carry it away.

Once the toy was chosen, it was time to train him to drop the toy which, of course, began with picking the toy up. I began in a protected contact setting and reinforced any kind of interest he showed in the toy. I prompted him to interact with the toy and reinforced any interaction with his mouth. As he began to understand the key was putting his mouth on the toy, I began to reinforce small bites. Soon I was offering him the toy through the enclosure door and he was biting down and holding the toy for several seconds. From there, I increased the duration of holding the toy in his mouth.

At this phase, I could move forward with training him to place the toy in a particular location. Another trainer and I moved into the enclosure and asked Kvamme to jump up onto a small table. Using gravity to our benefit, the second trainer would offer a small metal bucket just below the table directly in line with Kvamme. When he was offered the toy, he would grab it for several seconds and drop it, causing it to fall into the bucket below. After reinforcing this several times, the second trainer held the bucket in a particular position so, if Kvamme moved and the toy did not fall into the bucket, he did not get reinforced. Soon Kvamme was making very small adjustments in his movements to make sure his toy fell into the bucket each repetition. We then made small movements in the position of the bucket before offering the toy so Kvamme would have to move further and further in order to be successful. Now that it was clear that the criterion for reinforcement was placing the toy in the bucket no matter where the bucket was in relation to Kvamme, we could move back to the ground to get distance on the behavior.

At this point, I worked on generalizing the behavior. I began to offer other toys including our designated running lure. We also had training sessions in different environments including other enclosures and various yards. Ultimately, we moved into the Watering Hole where our cheetah run presentations take place and did many repetitions of retrieving the lure from various locations.

Now began the tricky process of chaining the lure retrieval behavior to the high-energy run behavior. We had several challenges: not only would Kvamme have the opportunity to do just one repetition a day and perhaps only five repetitions a week but we were also attempting to add the retrieval to the end of a well-established behavior chain, one with which Kvamme had almost two years of history. Chaining these behaviors together would also test if the retrieval was strong enough to reinforce and maintain his running behavior since the opportunity to perform the next behavior in a chain should reinforce the prior behavior (Chance, 2003).

We began this process by asking for a retrieval after each run. When Kvamme finished his run, we would cover the lure with the pan and reinforce as usual, then offer a second lure and the bucket quite close to him. After some prompting, he would perform the retrieval, get reinforced, and then shift out of the Watering Hole. Next, we started to fade out covering the lure. Trainers would cover the lure but instead of offering a primary reinforcer, we would offer the lure and bucket. Once he was consistently retrieving the second lure, we stopped covering the first lure while he was laying with it and would cover it only after he had moved away for the second lure. After several repetitions, we were able to use the bucket as a prompt and he would grab the original lure he chased after and place it into the bucket.

At this point, we wanted to move the bucket farther from the completion of the run so that Kvamme would be more visible to our audience. During this process, we did see a breakdown in the retrieval behavior but did not experience a breakdown in his running. We saw that Kvamme was successful if the bucket was very close to him or if it was along the path he normally took home, but even adjusting the bucket slightly to the side would result in Kvamme sitting down and chewing on the lure for long periods of time. This caused us to reevaluate the plan and we tried several different solutions to give Kvamme more information.

We observed that Kvamme was most successful with the retrieval when he caught the lure early. When he was not in the area he typically finished running (where he had a lot of history laying down and waiting for reinforcers) he quickly offered the retrieval. Our initial plan was to stop his runs slightly early and then fade his finish back to the normal location. While this plan worked for some time, we saw that Kvamme again returned to long periods laying and chewing on the lure. It was time to revise our plan again.

Next, we decided to relax criteria and cover the first lure and offer the second lure again to help us clearly communicate to Kvamme that we not only wanted him to place the lure in the bucket, but we preferred that he do that quickly upon run completion and without chewing on the lure. With the use of the extra lure, we were able to increase the distance from where he finished to where he needed to go. Once we had accomplished a ten-foot retrieval into the center of the yard, we returned to using the original running lure.

Having just one repetition a day proved difficult, so ultimately, we decided to take the retrieval link out of the chain to work on it. We added extra retrieval training sessions each day in the Watering Hole to work on increasing distance to a particular location. Eventually, the bucket was moved all the way to a pile of rocks near the water where the bucket itself wouldn't be as visible to our guests and very near the trainer who was speaking for the presentation. We added this extended retrieval back to the running behavior chain and faded out the use of pans to cover to lure. Ultimately, Kvamme was able to enter the Watering Hole, show off his impressive speed along the run course, catch the lure, carry the lure to a pile of rocks about 25 feet away, deposit it there, and run towards another rock where a trainer had placed a large amount of meat as a reinforcer.

Implications and Conclusions

By allowing Kvamme to have a voice and consequently adding the retrieval link to Kvamme's shifting and running behavior chain, we were able to create a scenario that offered Kvamme more choices. Previously, the only way Kvamme could be successful was by allowing trainers to approach him and cover the lure whether that was immediately after the run or after running off to another location in the Watering Hole. Often, many trainers were met with body language that clearly communicated that Kvamme was uncomfortable in these situations. Now, Kvamme can decide when he will perform the retrieval and, through better training plans and properly placed reinforcers, we can provide the information that the retrieval will earn the reinforcers. Through offering the opportunity to make choices we are creating positive interactions (Martin & Friedman, 2013) and, by creating a reinforcing history with multiple trainers, our team is able to build more trusting relationships with Kvamme.

Furthermore, by using creativity and designing a new behavior, we were able to provide a new way to engage our guests. Over a single season, our team offers nearly 600 cheetah run presentations. Each of these presentations are unique and focus on a range of topics including adaptations, behavior, ecology, and conservation. Kvamme's retrieval behavior allows our presenters the ability talk about a cheetah's natural behaviors following the hunt as well as provides opportunities to demonstrate and explain operant conditioning. Additionally, during our cheetah presentations, the audience has great viewpoints of the cheetah during the run but following the completion of the run, the cheetah is often below the boardwalk and out of sight of most of our guests. This results in a lot of guests disconnecting from the speaker, often during the period when we address conservation issues and solutions. Kvamme now finishes his run and, after a short rest period, gets up to move back into view for the majority of the audience. This places the speaker and the cheetah in the same area of a very large space thus maintaining the connection and allowing our conservation message to resonate with our guests.

References

Chance, P. (2003). *Learning & Behavior.* Thomson Wadsworth.

Martin, S. & Friedman, S. G. (2013) *The Power of Trust.*

Nyhus, P. J., Marker, L., Boast, L. K., Schmidt-Kuntzel, A. (2018). *Cheetahs: Biology and Conservation; Biodiversity of the World: Conservation from Genes to Landscapes.* San Diego, CA: Elsevier.

Pryor, K. (1984). *Don't Shoot the Dog! The New Art of Teaching and Training.* Bantam Books.

Weise, F. J., Vijay, V., Jacobson, A. P., Schoonover, R. F., Groom, R. J., Horgan, J., Keeping, D., Klein, R., Marnewick, K., Maude, G., Melzheimer, J., Mills, G., van der Merwe, V., van der Meer, E., van Vuuren, R. J., Wachter, B., Pimm, S. L. (2017). The distribution and numbers of cheetah (*Acinonyx jubatus*) in southern Africa. *Conservation Biology*.

Combatting Inactivity in Elephants at the San Antonio Zoo

Katherine Wofford

Honors College, University of Texas at San Antonio

Gold Darr Hood, Assistant Research Professor

Department of Mechanical Engineering, University of Texas at San Antonio

Indian elephants in the wild spend a majority of their day searching for and consuming food. This endeavor takes about 19 hours of their day and inspires them to cover up to 125 square miles in their search. In captivity elephants tend to have much easier access to food, decreasing the time and effort they spend on eating. Musculoskeletal disorders caused by inactivity have led to the deaths of many elephants in captivity. To combat inactivity with the elephants in the San Antonio Zoo, we have developed a "food mobile" – the "Foobil" – to be installed in the Indian Elephant habitat in the San Antonio Zoo. The Foobil was designed to be a feeder, but also to be a challenge to the elephants as they eat. The elephants are required to interact with the device to get food from it. When installed and properly maintained, the elephants should repeatedly interact with the Foobil throughout the day, increasing the amount of time they spend eating. If the device works as intended, there will be a significant increase in the time the elephants spend eating as well as an increase in their physical activity. These results are impactful because elephants' need for enrichment is increasingly urgent as they age, and the success of this study would not only improve the overall wellbeing of the elephants at the San Antonio Zoo but may contribute to successful future enrichment efforts in other zoos.

According to a 2016 study concerning 59 mammalian species, captivity has a positive effect on the longevity of 84% of mammals in zoos. However, as seen in many studies, specifically Indian elephants (*Elephas maximus indicus*), are not one of the many species than benefit from captivity (Tidière, et al., 2016). While Indian elephants would be expected to live more than 42 years in the wild, members of the species in captivity exhibit a lifespan reduction of nearly 50%. Indian elephants are endangered, with an estimated population of 20,000-25,000. The fact that preservation attempts in zoos are potentially escalating the species decline is quite concerning (Mott, 2008).

One very important cause of the high mortality rate for captive elephants is inactivity-related stress and disease (Clubb, et al., 2009). In the wild, Indian elephants spend a majority of their day – about 19 hours – searching for food. They may cover about 324 square kilometers (~125 square miles) in their search, and they may have to stretch their trunks and maneuver their bodies in order to reach their goal (World Wildlife Fund, n.d.). This also is cognitively stimulating, as they must strategize on how to reach nutrients in inaccessible locations. Elephants in zoos are provided with easily accessible food and water, and thus

expend far less energy compared to their native environments. Similar to modern humans, they show many symptoms related excessive time standing still. In a study of 390 elephant deaths at U.S. zoos over the past 50 years, the Seattle Times found that most of those elephants had died from "injury or disease linked to conditions of their captivity, from chronic foot problems caused by standing on hard surfaces to musculoskeletal disorders from inactivity caused by being penned or chained for days and weeks at a time." Half of the observed deaths occurred before age 23 (Berens, 2012).

Humans are no different from the rest of the mammalian class in that we all need continued activity as we grow older. One 2017 study showed that environmental enrichment for rats and other mammals had a positive effect on the animals. "Environmental enrichment", or EE, refers to the improved conditions of animals in captivity, such as allowing them more space and giving them access to "objects and different spaces that facilitate exercise, play, exploration, while allowing the animals' greater control over their environment." EE has been proven in many species to heighten levels of physical activity and exploration as well as to decrease stress and anxiety on the animals (Sampedro-Piquero & Begega, 2017). This increases longevity of the animal. This idea is demonstrated especially well in Burmese logging camps that use elephants to haul trees out of the forest. These animals are only worked for six to eight hours, and then allowed to roam the forest. The elephants, though technically in captivity, maintain their longer life expectancy because they get more enrichment out of that environment than the traditional zoo habitat for elephants (The British Broadcasting Corporation, 2008).

While it may not be possible to allow zoo elephants to wander around a forest for much of their day, zoos do have the opportunity to use EE in their enclosures. In fact, the Association of Zoos and Aquariums (AZA) has a set of guidelines for "Elephant Care and Management" that any of their accredited zoos must follow if they house elephants. These ensure that elephants will be given ample opportunity for physical and mental stimulation (Association of Zoos and Aquariums, 2011).

One such AZA accredited organization, the San Antonio Zoological Society, that runs the San Antonio Zoo (San Antonio Zoological Society, n.d.), has teamed up with the University of Texas at San Antonio (UTSA) Honors College to create new enrichment devices for the three Indian elephants living at the Zoo. The goal of the project was to create new and engaging toys to install within the enclosure to benefit the elephants. The UTSA Honors College put together a class spanning two semesters specifically for the development of such toys.

The flagship toy design is called the "Foobil". It is an interactive feeder for the enclosure designed to increase the time and effort the elephants spend acquiring and consuming food. This design builds on an existing environmental enrichment with a similar concept: a barrel hanging from a zipline suspended between two poles in the enclosure. However, the elephants at the San Antonio Zoo soon figured out how to hold the barrel against one of the poles and pull the food out with little effort. One of the design goals of the Foobil was to make it more challenging for the elephants to acquire the food.

The design is very similar to that of a hanging hoop mobile; however, rather than being hung from a ceiling, the Foobil rotates around a central support pole. It is designed to install around an existing pole in the enclosure. The "hoop," called the "rotation ring," is made of 0.635cm (.25in) galvanized steel and is almost two meters in diameter (1.83m, 6ft). From the rotation ring hang three chains, each supporting a spherical module made to hold food. Each module has two holes in it: a large one at the

top for loading the module with food, and a smaller one in the side to allow the food to be knocked free. In addition to food, the modules will each contain a small, food-safe rubber ball to limit the amount of food that escapes the module. The Foobil rotation ring is to be hung about 5.18m (17ft) high, and the modules will hang from lengths of chain at about 4.27 m (14ft), just barely within reach of the elephants. Note that the height of the rotational and supporting rings is outside of the accessible range of maximum elephant height. However, the modules may be easily adjusted in height to provide versatility in extension and thus more variety in exercise.

When installed and functioning, the elephants will be able to strike the Foobil modules to knock food out of them. The rotation ring will then spin, and the modules will swing around. This forces the elephants to reach up and exert energy to find food. They will also be forced to walk around more, and spend more time getting the food out of the modules. With the Foobil's ability to rotate and swing away from the elephants, they will also be intellectually stimulated, trying to figure out how best to get the food out of the modules.

The Foobil was designed to address the concerns of the San Antonio Zoo; be an interactive feeder that will provide enrichment for the Indian elephants living there. By making it more challenging for them to get to their food, it will promote physical and mental stimulation for the elephants, thus promoting longer periods of activity, making the elephants less likely to develop the musculoskeletal diseases or stress and anxiety disorders that can shorten their lifespans. Because elephants need enrichment to remain healthy, the success of the Foobil will not only benefit the elephants at the San Antonio Zoo but may also allow for successful future enrichment efforts in other zoos.

References

Association of Zoos and Aquariums. (2011, November 11). *Elephant Enrichment*. Retrieved from Association of Zoos & Aquariums Elephant Taxon Advisory Group & Species Survival Plan: http://www.elephanttag.org/professional/professional_enrichment.html

Berens, M. J. (2012, December 1). Elephants are dying out in America's zoos. *The Seattle Times*.

Clubb, R., Rowcliffe, M., Lee, P., Mar, K., Moss, C., & Mason, G. (2009). Compromised Survivorship in Zoo Elephants. *Science*.

Mott, M. (2008, December 11). *Wild Elephants Live Longer Than Their Zoo Counterparts*. Retrieved from National Geographic News: https://news.nationalgeographic.com/news/2008/12/081211-zoo-elephants.html

Sampedro-Piquero, P., & Begega, A. (2017). Environmental Enrichment as a Positive Behavioural Intervention Across the Lifespan. *Current Neuropharmacology, 15(4)*, 459-470.

San Antonio Zoological Society. (n.d.). *About*. Retrieved from San Antonio Zoo: https://sazoo.org/about/

The British Broadcasting Corporation. (2008, December 11). *Elephants 'die earlier in zoos'*. Retrieved from BBC News: http://news.bbc.co.uk/2/hi/science/nature/7777413.stm

Tidière, M., Gaillard, J.-M., Berger, V., Müller, D. W., Bingaman Lackey, L., Gimenez, O., . . . Lemaître, J.-F. (2016). Comparative analyses of longevity and senescence reveal variable survival benefits of living in zoos across mammals. *Scientific Reports volume 6*. doi:10.1038/srep36361

World Wildlife Fund. (n.d.). *Indian Elephant*. Retrieved from World Wildlife Fund Web site: https://www.worldwildlife.org/species/indian-elephant

Adapting to Work with a Giraffe Who is Averse to Touch

Amber Howard

Zoo Knoxville

Training giraffe for voluntary hoof trims is a relatively new undertaking at Zoo Knoxville. Trainers have begun working with our 15 year old male, Rothschild giraffe, Jumbe. Historically, Jumbe has had little tolerance for physical contact, so a personalized program had to be developed to allow staff to trim his hoof. We started with Jumbe stationing at firehose straps and him willingly placing his hoof on a block. The next step included basic approximations to physically touch him. After a break from training, regression occurred in the touch and resulted in Jumbe kicking out at trainers. At this point, changes were implemented to provide a more productive training plan for Jumbe. Exhibit modification eliminated the need for firehose straps, providing safety and comfort for trainers and giraffe. Next, staff created a way to give Jumbe choices and control over the session. Through new approximations, Jumbe now initiates the touch and next approximation of the session. As we have adapted to Jumbe's needs, we have seen a more confident animal allowing increasing contact as we move forward with his training.

Introduction

Zoo Knoxville has 1.3 resident giraffe. In 2016, the giraffe care team evaluated the husbandry needs of the giraffes in order to establish training priorities. After the evaluation, the giraffe care team decided that a voluntary hoof trim behavior would be the training priority. In order to provide the highest level of care, voluntary hoof trims is a necessity. The zoo's 15-year-old, male Rothschild giraffe, Jumbe, was the first giraffe selected to begin this training. All of Jumbe's hooves were overgrown and in need of attention. The giraffe trainers wanted to give Jumbe a chance to learn this husbandry behavior for his own benefit. We spent time reaching out to other institutions that have had success in voluntary hoof trims. With their help we were able to begin planning.

The Training Process

First, a safety protocol was discussed and a training plan finalized. Firehose straps were chosen as a barrier during the initial training sessions. Firehose straps are the most commonly used barrier for giraffe hoof trim training sessions. It is a material that allows for easy manipulation when setting up and is thin enough for the giraffe to break if they were to get caught in it. Jumbe showed very little hesitation with the firehose and was walking right up to it immediately.

Training progressed to the approximation that incorporates a trainer's hand touching Jumbe's leg. Jumbe's dislike for

the touch led to trainers employing the use of a stick as a safety measure. The stick was placed across the hoof block, so when Jumbe was asked to present his hoof, his leg would bump into the stick. -The reward for this behavior became contingent on Jumbe placing his leg into the stick with his hoof flat on the block. The idea was to further develop that behavior, so that the trainer was able to hold and take the stick to his leg. Successive approximations eventually led to the trainer exchanging the stick for their hand.

After having some success trainers decided it was time to begin using a hand instead of the stick. The transition was not a problem for Jumbe. The reinforcement stayed contingent at first, but once we realized we were not making progress on prolonging the touch, trainers switched to a continuous feed. This seemed to work for a while, until Jumbe started showing a twitch in his shoulder every time the ”touch” cue was given. The twitch was an anticipation of the upcoming, unwanted touch. Jumbe began to get into a hurry when being rewarded, he was trying to get as many treats as possible before pulling his hoof away. It was then decided to discontinue the continuous feed and make the reinforcement contingent on Jumbe allowing a keeper to touch his hoof for increasingly longer repetitions. Trainers had success with this change in the training plan.

After having some success with the touch approximations, keepers decided to focus on approximating the position of the hoof block farther into the keeper space to allow for safer hoof access. While keepers focused on the position of the hoof block, Jumbe was not touched for two weeks during training sessions. When keepers resumed touch training, Jumbe kicked his back right leg out toward the keeper upon being touched. It was apparent that Jumbe regressed with this step. His motivation plummeted and, he no longer seemed trusting enough to place his hoof on the block. Jumbe also began bobbing his head whenever he approached for a session. This led to frustration for both the trainer and for Jumbe. After several sessions with no progression, trainers decided the training plan needed to be reevaluated.

Antecedent Arrangement

One issue, was the firehose straps. Jumbe was far too interested in rubbing on them and getting his head tangled in them. A new, custom made gate was designed and installed. It is a mesh, dutch styled gate, that allows for trainers to lock the top part closed and open the lower half to a desired position. With this new gate, the firehose straps were no longer necessary. The gate provided safety for the trainers and Jumbe.

Trainers began experimenting with Jumbe’s curl hoof block. The curl block was raised four inches from 18 to 22 inches. This would allow Jumbe to be more comfortable in the curl position due to his height. The ramp, which was built in to allow a comfortable place for Jumbe to rest his fetlock joint, was moved to the middle of the block. This made the location of the ramp closer to Jumbe making it easier for him to rest his fetlock joint in the proper position. The ramp also provided a specific location for Jumbe to target his fetlock joint to once he curled his hoof. A small piece of 2x4 was added to the front of the block. This addition helped catch the end of his hoof when he lifted his leg and guided his joint into a bent position as he moved his leg forward. These modifications to the hoof block allowed Jumbe to better curl on his own. Once Jumbe was com-

fortably placing his hoof into a curl position when cued, trainers moved onto the next step, physical touch. Trainers began looking for a way to give Jumbe all the choice and control over being touched in the session.

It was decided that the trainer at the hoof, would position a stick and subsequently their hand out over the hoof block prior to Jumbe approaching so he could see that if he chose to curl his hoof, he was also choosing to be touched. Trainers began holding the stick out for Jumbe to place his leg into while simultaneously curling his hoof. Through approximation, Jumbe's trainer would slowly move their hand down the stick, until their hand was held out and Jumbe would curl into it. It was decided, that under no circumstances was the trainer allowed to take their hand to him. If Jumbe showed any behavioral signs that he was uncomfortable, his trainer would remove their hand, and Jumbe would be released and recued for the curl. Trainers began using even the smallest behavioral tells, such as skin twitching, tail swishing, head bobbing, and weight shifting, as information to call hands off. The goal was to give Jumbe all the power over the session. It was also decided that the reinforcement would be contingent on Jumbe curling into the stick or hand, and would then change into a continuous feed during prolonged contact.

Opening up this line of communication really seemed to boost Jumbe's confidence during touch sessions. It was a way for him to use the smallest of skin twitch to say, "I'm not comfortable" without kicking out at the trainer. Jumbe began to trust that we would not take advantage and slowly allowed us to make prolonged contact with his leg and hoof.

Conclusion

When developing this custom made training session for Jumbe, we learned, as trainers, how to adapt to the animal's needs. Through trial and error, trainers began to better understand how to help Jumbe succeed. We have seen a more confident animal that is allowing more physical contact. It has taken over a year of training to get Jumbe to allow us to rub the front and back of his leg and clean off the bottom of his hoof. Through this entire year, trainers have been building up their relationship with Jumbe and learning to work with one another. The progress that has been made with Jumbe has been amazing and has set us up to further our training progress.

Bubba, 1.0 South African Warthog (Animal Ambassador)

Kim Hanley

San Diego Zoo Safari Park

How smart is a Warthog? The San Diego Zoo Safari Park's Behavior Department has a diverse group of Animal Ambassadors. One of those animals include a Warthog (Bubba) who has been trained to participate, voluntarily, in his husbandry and medical procedures. All through positive reinforcement training, Bubba, the warthog, participates in medical and daily care husbandry training. With his training, it reduces the stress and the need for anesthesia for simple procedures like vaccines, blood draws, x-rays, tusk and hoof trims. All of this has been successful working cooperatively with the veterinary technician staff. The trainers work with Bubba to accept these procedures with him fully awake and alert to what is going on.

Introduction

Bubba came to the Safari Park when he was just a few months old. He was introduced to a select few of trainers to start his training to become an animal ambassador. We know that they are very smart, can be a stubborn and an aggressive species. We have a total of 30 + years of training experience and we were up for the challenge. Building a relationship with him was the most important step. Going on 12 years of age, Bubba is a successful ambassador with a total of 7 trainers that work him hands on. He has 13 trainers that go in with him and clean his enclosure under stimulus control. He is worked on a harness and leash successfully in front of guests without a barrier.

Through the years we have had to give him injections. Before this training plan of voluntary injections, we had to dart him. Because we have hands on contact and a very close relationship with him, we knew the possibility of training the behavior was likely to be successful. Our Vet staff can get hands on Bubba under controlled stimulus, when on leash, to do a tactile exam. With the most recent exam, because of his age, the vet requested blood work in addition to him being due for his rabies vaccination. The vet tech that was assigned to our area came several times to get familiarized with Bubba, so that she wasn't a new person just showing up to do something bad. We needed her input for the training plan to ensure it to be safe and allow her to perform the necessary tasks. Two of the 7 trainers worked these behaviors to ensure consistency and less confusion for Bubba.

Injection Training

The training plan had to encompass safety of the veterinarian technician, had to be out his pen, and had to be in a controlled environment. We have a dog kennel that was the ideal set up. We made a "squeeze/chute" in the kennel using the side of the kennel and a ramp that Bubba uses to load in a vehicle. Bubba was on leash during the training process and the trainer was on the outside of the fence to reinforce him without him turning his body. Once Bubba was in the kennel, this behavior was protective contact. The cue we used for him to position correctly was "line up." He had to position himself in the "chute" to get reinforced at the front. Once the behavior was solid we would put him in the dog kennel and take off the leash and he had to line up on his own. He learned the line up relatively quickly. When working with a pig, reinforcement is easy because he loves his food. The behavior only took a couple weeks until it was solid. The next step was to teach the "side" behavior which was him keeping his hip close to the fence and someone touching at the same time. He wasn't always consistent with holding there so we made sure the space for his lineup had less room. During the training sessions, we would use a paper clip or pen to imitate the syringe. Our veterinary technician would come on a regular basis to be a familiar face and stand in the position where she would be giving the injection. We were able to successfully, with minimal response, give the vaccine to Bubba. From start to finish the behavior and completion of the vaccine took just a couple months.

Blood Draw Training

Like the injection training, working with the same veterinary technician, we came up with a plan that would be safe for all parties involved. The plan initially was to have Bubba laying down using an inside leg vein (medial saphenous). This would all be done in the dog kennel. The dog kennel was modified so that it had a small window that the vet tech could be outside the kennel and work on Bubba through the window. We tried a couple times with the inside leg vein, but the vein wasn't prominent enough, so we tried the outside leg vein (lateral saphenous vein). It ended up easier for two reasons, Bubba preferred to stay

standing and it helped with the blood pressure. It allowed the vein to be easier to work with. We also took him for a walk before training sessions to get his blood flowing. For the behavior, he was held on a target, in which he holds his nose to a hand in a fist. That step was relatively easy because it was an established behavior. He was lined up next to the window, so the technician could manipulate the leg needed for the blood draw. That new behavior was "touch" which encompassed the tech cleaning the area and then wiping with alcohol and drawing the blood. We took the touch in multiple steps. First was just touching the spot then progressed to wiping with dry gauze. The next step was wet gauze, then alcohol on gauze. Once he was seeming to not react to any of those steps, we started using a paperclip to hold there as a needle, which would need a couple minutes to draw the blood. We started with seconds and when we he was comfortable at 2-3 minutes, we were comfortable trying the actual blood draw. The reinforcement happened after the behavior was complete and it was a magnitude reinforcement of food! After couple months of training this behavior, we were able to successfully get a blood sample from him!

Tusk Trim Training

The tusk trim training became necessary when his tusks got too close to his face. Naturally in the wild, a warthog's tusk will break off with everyday use of them. Because of his bed & breakfast lifestyle, Bubba has no need to wear them down. When we noticed the tusks were growing too close, I suggested to work with a dremel to soften them, so the tusk might break on their own with daily foraging or playing with enrichment in his pen. With one tusk that did work. The dremel was a process of desensitization. While on his mark in his pen, where he stands for cleaning of his enclosure, cleaning his ears, and harnessing, I stood with him with the dremel. He was more reactive to the noise initially than the actual tool touching his tusk. He got used to it very quickly. Between another trainer and I, we were able to dremel weekly. With the other tusk, the dremel and natural behavior wasn't working. We talked to our veterinary staff about a piece of equipment called giggly wire. I had used this back when I was a veterinarian technician working with domestic dog's teeth under anesthesia. Our vet staff told us that is what they used on elephant tusks, so they allowed me to try it. It would have been more challenging to de-sensitize him to the wire, so we just went for it. One trainer harnessed Bubba and had leash control with him on his mark and I placed the giggly wire in place and was able to cut the tusk off. He really didn't mind it, he stayed on his mark the entire time. Once we finished, he got a magnitude reinforcement of food! Yes, there is a theme of reinforcement for Bubba.

Hoof trims

The original plan was to have Bubba standing in the dog kennel, same set up as the blood draw, allowing the technician to trim his hooves through the window. This plan proved to not work because the hoof trimmer tool wasn't able to work well through the window. Plan B was, to have Bubba do his side behavior, where he lays on either side. This was done free contact, because the kennel isn't wide enough for the pig and 2 people. While lying on his side, we can do tactile reinforcements i.e. belly rubs, which he loves, and the tech is able to trim his hooves. This was successful. This will be a continual behavior because we are able to only take little bits off at time, ensuring not to quick the vein.

Conclusion

In conclusion, Bubba the warthog has proven to an incredible student. It defiantly helped that he loves his reinforcements of food or belly rubs! The next step in his training will be to get all trainers up on these behaviors. For Bubba, it comes down to relationship with him. Since he is such an intelligent species, he can and does discriminate. Over the years only certain trainers can assist in the turnover process of getting new trainers up on him. He also is very particular who rides in a vehicle with him. The plan is to continue practicing these behaviors monthly to ensure the behavior doesn't extinguish. We are very proud that the voluntary blood draw and injection training was successful because it significantly reduces stress for Bubba. We are glad to be able to work with our veterinary staff so closely that we could avoid having to do an anesthetic procedure. Overall, working with Bubba, the warthog, has proven to be a challenge but rewarding!

Opening the Barn Doors in a New Direction

Katie Stevens
Columbus Zoo and Aquarium

The Animal Programs department took over the guest interaction element of the "My Barn" goat yard at the Columbus Zoo and Aquarium in 2014. We have grown from talking about goats to also caring for and expanding our barn collection to help convey our message, which focuses on heritage breeds.

We place an emphasis on heritage breeds and their importance by training behaviors showcasing their learning abilities, adaptations, and even historic purposes. These behaviors are showcased in our "Home Heritage" show where we introduce guests to both domestic and wild animals that call the barn home. This show focuses on our history with heritage breeds, how they are beneficial, and how wild animals also serve a purpose around a barn.

The goat yard is a guest favorite but, thanks to inspiration from the Cheyenne Mountain Zoo, the corner stone of our guest engagement are "defining moments." These are moments throughout the day that staff involves guests in unique experiences. Guests might have the opportunity to help us feed, clean or train one the of barn animals.

Guests think of zoos as focusing on the conservation of exotic species but we also want to instill in them a passion for the preservation of heritage breeds, and that by doing simple things they can help domestic and wild animals. My paper with elaborate on how we are continually changing the "My Barn" area of the Columbus Zoo and Aquarium and how these changes are engaging for our guests and staff.

Many facilities across the country have some version of a petting or children's zoo and the Columbus Zoo and Aquarium is no different. The Animal Programs staff, at the Columbus Zoo and Aquarium, was asked to take over the contact yard at the "Bob Evans My Barn" in the North America region. The contact yard, which is open daily between Memorial Day and Labor Day, consists of goats and sheep. Starting by simply talking about the goats and sheep we quickly realized that there was an opportunity to give the barn a story and a conservation message. Wanting to take the barn beyond just the contact yard we started by adding our own collection of animals, eventually focusing on heritage breeds, and adding more opportunities to get our guests and animals involved. Change can be hard, and after facing some trial and error we have seen "My Barn" grow far beyond just a contact yard.

To be more precise the staff of the Animal Encounters Village, a part of the Animal Programs department, was the group asked to take over the guest interaction part of the "Bob Evans My Barn" contact yard. The Animal Encounters Village is an area of the zoo where guests can come meet a variety of animal species in one-on-one interactions, as well as see animals perform awesome natural behaviors in our four daily shows. The "village" is also open weekends starting in March, daily Memorial Day to Labor Day, and weekends though the end of October. The Animal Encounters Village is currently closed for construction and is scheduled to reopen in the summer of 2019 as part of the new Adventure Cove. During the school year the staff switches and goes on over 200 outreach programs a year where we continue to educate the public about amazing animals and how we can help save their wild counterparts. The Animals Encounters Village staff is responsible for the daily husbandry and care of our own collection of animals, consisting of over 100 individuals and more than 70 species. The village staff also does the guest interaction aspect in the stingray touch tank known as "Stingray Bay." Needless to say this staff has done a lot of guest interactions, so it was only natural when our North America region was looking for someone to help with the contact yard that they would approach us. Prior to 2014 the contact yard was primarily staffed by volunteers, docents, and occasionally

a North America keeper, however the zoo wanted to change this and that's were we came in. With 16 goats and 12 sheep the contact yard is a busy place, and in the summer several hundred guests will pass through our double gates an hour. It is always a popular stop because guests can pet, brush, and take the ever-popular goat selfie. The first summer was a bit of a struggle, we went in not really knowing what to expect and had to hit the ground running. The main focus that summer was just the contact yard, and figuring out just what it meant to interact with guests in that setting, as well as starting to form relationships with the North America keepers who continue to do the husbandry for the goats and sheep. However our team is always asking, "what else can we do?"

The beginning of "what else" for the Animal Encounters staff was the addition of new barn animals. In the winter of 2014 we added four miniature donkeys (*Equus Asinus domestic spotted*), two Dexter cows (*Box Taurus Taurus Dexter*), a miniature horse (*Equus caballus caballus American miniature*), two silver fox rabbits (*Oryctolgus cuniculus domestic silver fox*), two tamworth pigs (*sus scrofa domesticus*) and 12 chickens (2.3 New Hampshires chickens *Gallus Gallus Domestic New Hampshire Red*, 2.3 Blue Laced Wyandotte chickens *Gallus Gallus Domestic Wyandotte Blue*, 0.1 Silver Laced Wyandotte *Gallus Gallus domestic Wyandotte Silver*, and 1.0 Orpington Rooster *Gallus Gallus Domestic Orpington*). These animals became part of the Animal Programs collection and allowed us the freedom to start doing guest interactions outside of the contact yard. This started with just simple "meet and greets" where the animals would come over to the fence line so people could meet and touch them. Guests could also watch training sessions of husbandry behaviors like hoof trims and injections. However with these new animals of course brought new challenges. At a year and a half old the two tamworth pigs each weighed over 500 pounds and their area was no longer large enough. We knew that this wasn't the best option for them so they moved to a zoo in Iowa in the spring of 2016 while we searched for the pigs that would be the best fit for both the space, and our vision for "My Barn." We landed on kunekune pigs (*Sus Scrofa scrofa kunekune*) and in April of 2016 we acquired four. Later that same year we encountered issues with the number of roosters we had in such a small flock. The original five roosters were moved out and replaced by a Silky Bantam Rooster (*Gallus Gallus Domestic*). Acquiring new animals is always a learning experience and while we faced challenges with this new collection we saw guests excited to learn about the barn additions. As we continue to grow we are focusing our attention and collection on heritage breeds, the livestock raised by our forefathers prior to the rise of industrial agriculture, and the importance of their conservation. Many heritage breeds have been on the brink of extinction and the public, including myself, haven't been introduced to these breeds or understand their value. Being smaller than the animals used in industrial farming they are easier on the environment, can live outside year round, require less food and water, and fewer antibiotics. These are just a few of the reasons why they are important and why we are excited to educate guests about heritage breeds.

Continuing to ask "what else" brought the introduction of "defining moments" and the "Home Heritage" show. Thanks to inspiration from the Cheyenne Mountain Zoo the introduction of defining moments has allowed us to involve our guests in the daily care of our animals. The goal is to do one defining moment or encounter an hour and the staff member can choose which animal they are going to involve. We have a wagon with a child-sized rake, shovel, watering can, egg basket and any other tools we might need for any defining moment the staff member may choose. Usually the first defining moment of the day is with our chickens, where guests will come into the coop with us and collect eggs, feed them, give them produce, and enrichment. Guests may also help us clean an animal's yard, while the animal is in another yard, place food, water, and enrichment in their yard, and help us shift them home. We will do our best to make sure our helper gets to touch the animal once it has shifted home, and we will talk about the individual animal and answer any questions. Guests may also get to help us train some of our animals, like the donkey behavior for the "Home Heritage" show. We also have "My Barn" guests help us make and give enrichment to the barn animals. Enrichment items may be cardboard boxes or paper bags with produce and grain, or ice treats to give the following day. These encounters have allowed us to connect guests with individual animals and hopefully give them a unique one on one experience. It is thrilling to watch a child, and even adults, be excited to help with these tasks and walk away with a smile on their face. Between defining moments we will try to do encounters. This is often bringing out a rabbit or the miniature horse for guests to touch, or feeding the kunekune pigs in the center isle of the barn to eat and meet guests. Our hope is that any encounter or defining moment leaves guests with a memory they wont forget, and instill in them an appreciation for domestic animals as well as wild.

The "Home Heritage" show allows us to teach guests about heritage breeds in a way that's both entertaining and interactive. This show, which started in summer of 2016, is in a shift way directly adjacent to the contact yard. "Home Heritage" allows the animals to demonstrate their historic purposes as well as their learning abilities. Since the yard where we do the show in is adjacent to the contact yard guests can come up and watch the show, or watch while continuing to interact with the goats and sheep, occasionally a goat will even come over to the fence line to see what's going on. The show opens with Ginny the Dexter cow ringing a bell to get the guests attention and introduce them to what heritage breeds are and why they are beneficial. Watson, one of the miniature donkeys, has been trained to wear a harness with a rope at the end. The rope then runs though a pulley, attached to a tree, and into the contact yard so we can demonstrate his strength with a guest acting as an anchor for a tug-of-war style behavior. A volunteer is also called into the show yard to help call out the kunekune pigs, who run an A to B behavior, and they get the chance to touch and feed them during the closing of the show. Not only will guests get to see domestic animals but they will also have the opportunity to meet some wild animals that would also call the barn home. Rats (*Rattus Norvegicus Domestic*) are trained to run an A to B along the fence line separating the contact yard and the shift way

where the show takes place. Peony, a striped skunk (*Mephitis Mephitis*), has also been trained to walk along side us around the shift way so people can see an animal typically considered a nuisance, and hopefully learn that they are also an important part of our local ecosystem by eating bugs like ticks. As the show has evolved we have also used a Barn Owl (*Tyto Alba*), Kestrel (*Falcon Spaverius*), and Virginia Opossum (*Didelphis Virginiana*) in the "Home Heritage" show. Incorporating wild animals in the show adds dimension and allows us to talk about the barn ecosystem and how these animals fit in to that ecosystem.

Making these changes has allowed not only the zoo to grow but also our staff. We now have the opportunity to talk to guests about many different species, including heritage breeds, and why these animals are important. We noticed that our staff had found the barn a little stagnant, but adding defining moments and a show has given us a new out look at the barn. Choosing which defining moments they want to do, and helping maintain or train new behaviors adds variety to the day. Defining moments have also allowed our staff to connect with guests in a way they couldn't at the barn previously, and for some it allows their first steps into animal training. Members of our seasonal staff have had their first training projects at the barn like helping train hoof trims or learning how to do a show behavior, which for new staff can be very exciting. All of the training sessions done at the barn are done in public view and also offers guests a unique look into our training process. By using positive reinforcement and doing training sessions with guests watching we are able to answer questions about how and why we are training a behavior.

The "My Barn " contact yard is a guest favorite and we are happy to be able to add new encounters, opportunities, and animals to make the day even more memorable. However, we will continue to push and ask, "what's next?" This summer we will continue doing defining moments, hopefully introducing some new ones, as well as adding a second "Home Heritage" show. Opening the barn doors in a new direction has given guests the opportunity to have unique moments with animals that will hopefully last a lifetime. The growth we have seen in our staff and guest engagement by adding "defining moments" and the "Home Heritage" show has made it all worth it, and we are excited to see how "Bob Evans My Barn" continues to grow.

Choice and Control Over Diet to Reduce Pacing in our Polar Bear

Andrea L. O'Daniels

Kansas City Zoo

The Kansas City Zoo is home to a 27 year old female polar bear, Berlin. Berlin typically goes through a period of seasonal pacing. It will start the beginning of breeding season in January and begin to taper off in April. In 2017 we did not see a decrease of pacing, but instead an increase of pacing in April and May. She was pacing at all times of the day and did not seem to be resting. The keeper staff began to evaluate what was causing the pacing. When asking ourselves what does Berlin want, we realized that while she wasn't consuming her entire diet every day she was very eager for lard. She was allotted 2 lbs. of lard per day and was eating it very quickly. We decided to increase her lard for 3 days to see if this had any effect on her pacing. We immediately saw a dramatic decrease in her pacing. We then decided to go a step further and try letting her choose what she wants to eat each day. Keepers evaluate on a daily basis what she prefers and make her diet accordingly. We have found that letting Berlin choose what she wants to eat each day has a positive effect on her overall pacing.

The Kansas City Zoo is home to a 27 year-old female polar bear, Berlin. She has been housed at the Kansas City Zoo since December of 2012. Over that time, Berlin has had a relatively consistent diet and has exhibited a relatively consistent pattern of behaviors. Her normal caloric intake fluctuates seasonally with daily intake ranging from 8000 calories (March) to 24000 calories (July). Over her first 4 years at our institution, Berlin has exhibited a seasonal pattern of stereotypical pacing. In January, she will start to pace on exhibit. This coincides with the start of Polar Bear breeding season. She will continue to pace into April. Sometime in April, her pacing will decrease a little, and she will spend more time playing and swimming. Pacing decreases through the summer and by September her pacing has pretty much stopped. She will continue to play and swim and will begin sleeping more through the end of the year.

In 2017, instead of seeing a decrease in pacing during the months of April and May, we actually saw an increase in pacing. Keepers observed her pacing at all times during the day. She would take short breaks to eat, swim or play, but it did not appear that she was resting except when it was dark. This was very abnormal for Berlin.

We started consistently doing ethograms with Berlin in 2017. For our ethograms we use the Animal Behaviour Pro app and do a continuous sample. We vary the length and time of day for the ethogram. The number of ethograms we do is really time dependent, we do as many as we have time for, which can vary greatly each day. The data is compiled a week at a time. Through this we can get a snapshot of how she is spending her time each day. Based on the ethograms we did for May of 2017 she was spending up to 82% of her time pacing.

While Berlin was making the choice to pace, this was not something we wanted to see. We wanted her to choose to do something other than pacing. We increased the amount of enrichment and training she was receiving with little reduction in pacing. In the past, an increase in her daily caloric intake would sometimes reduce her pacing behavior, but at this time she was not eating her entire diet so we did not think she needed a total caloric intake increase.

During this time, the only thing that Berlin was really excited about was lard. Her daily allotment was 2 lbs. per day, and she would eat that very quickly any time it was offered. We wondered if increasing the amount of lard in her diet would reduce the amount of time Berlin was pacing. We devised an experiment to test whether or not an increase in daily caloric intake from lard would have an effect on pacing behaviors, and based on the results from that initial experimental diet change we experi-

mented with additional dietary changes. The experiment we did was to give Berlin up to 10 lbs. of lard per day for three days and recorded the effects it had on her pacing. We would hand feed her all of her lard, so if she walked away before receiving the 10 lbs. we would not leave it in there for her. She would only receive what she ate by hand.

The results were immediate. The first day she ate all 10 lbs. of lard she was offered and was sleeping by the end of the day which was something we had not seen for several months. The second day she ate 8 out of the 10 lbs. of lard offered and was sleeping both in the morning when we came in and in the evening before we left. The third day she ate 4 of the 10 lbs. of lard and was again sleeping when we came in and in the evening before we left.

Based on the apparent success of this experiment, we wanted to go a step further and see if we could give Berlin more choice and control over her diet. To do this, we constructed a total diet overhaul. In addition to offering Berlin 10 lbs. of lard per day, we allowed her to choose the type of fish she would eat for the day. At the time, Berlin was getting a set amount of each type of fish per day. The new diet would have a set calorie amount for fish, but we would be able to use any type of fish to make up that calorie amount. Keepers filled out a diet log each day. They fed Berlin each morning and indicated what type of fish she preferred. Based on her choices, they then made up the diet for the next day.

In order to implement these changes there were additional dietary considerations to account for, especially regarding vitamins. It was now necessary to keep a very detailed log on what we were feeding Berlin each day, and because, vitamins are weight-based, they would have to be calculated each day. Additionally, Berlin was weighed weekly to better monitor her weight with these changes, and any further diet change would be made in 10% increments.

The change in the amount of time spent pacing in June 2017 was immediate and impressive. The ethograms that we did for June 2017 showed that Berlin spent 27% of her time pacing. This was 55% reduction in pacing from May 2017. Additionally, we have already seen some positive results for 2018. Typically her pacing would start early to mid January. In 2018 it did not start until mid February.

We have continued to modify her diet based on her preferences to give her as much choice and control over her diet as possible.

We feel that allowing Berlin choice and control over her diet decreased her pacing and increased positive behaviors. Allowing animals in our care as much choice and control in their daily lives as possible is important and this is just another example of how we can do this.

Training Based on Natural History:

Success with a Juvenile American Alligator in a Show Setting

Deidre J. Ousterhout

Zoo Atlanta

Ambassador animals have been shown to increase human learning periods, assist with information retention, and encourage learners to feel compassion and gain an understanding of wildlife (Povey, 2003). When presenters train animal ambassadors to do natural behaviors, rather than simply holding the animal, they provide the audience with an opportunity to see the animal in action, rather than just observe what it looks or feels like. Many educational programs focus on training and presenting mammals and bird species, but reptiles can be a powerful tool for education as well. This paper details the journey of training a juvenile American alligator an A to B behavior for a presentation in a 200-person amphitheater. By using the natural history of the American alligator as their guide, keepers at Zoo Atlanta created an antecedent arrangement that allowed for the successful use of operant conditioning to obtain the goal behavior.

For a species that has been on this earth for 200 million years ("American Alligator," 2008) the American alligator, *alligator mississippiensis,* once risked extinction only 50 years ago. Today, no longer on the endangered species list ("American Alligator," 2014), the American alligator still faces many challenges. Zoo Atlanta is location in the state of Georgia, a state that is familiar with alligator sightings and a zoo that is currently home to 2 crocodilian species; however, there is still a stigma that haunts the crocodilian family with news reports labeling them as killers (McLaughlin, 2016). Zoos are among the key players in public education and strive to instill respect and understanding within their guests towards all wildlife. The Ambassador Animal department at Zoo Atlanta has been able to reach a milestone in the way we impart crocodilian knowledge and respect into the guests that attend our Amy's Tree animal presentations. Our goal was to train a juvenile American alligator an A to B behavior at Amy's Tree amphitheater. This paper details our journey.

Before training we mapped out some basics: natural history, individual history, tools needed and space available. After that, we created a shaping plan that we adapted throughout the training process. Zoo Atlanta's Ambassador Animal Department had limited experience training crocodilians but all were seasoned trainers and ready for this challenge.

A single juvenile American alligator was introduced into Zoo Atlanta's Ambassador Animal collection in 2010 and was simply held in an educator's hands for presentations in our amphitheater. Due to his popularity for school and family programs, we increased our population to 0.0.3 American Alligators. Once too large for our enclosure these alligators went back to their original institution and in May 2015 Hercules, Odysseus, and Perseus joined our Ambassador team. It wasn't until almost one year later that we started a formal training program with them.

When training began, each alligators' weekly diet of Mazuri crocodile chow was fed out to them throughout the week via training sessions and/or feedings. Prior to any training, each alligator was placed in individual coolers with a few inches of water and their allotted chow diet twice a week for feeding. The first step in training was to train each alligator to voluntarily accept food comfortably from tongs. We decided that we would start offering them food from tongs while inside the cooler, since this was the location they already associated with food. At the very beginning the alligators shied away as the trainer brought their arm and tongs into proximity. Through approximations: using a combination of dropping one or two pieces of food in the water in conjunction to touching the tongs, with food in its grasp, on the surface of the water, until within the next few weeks each alligator was successfully taking all their food from the tongs without the need for the trainer to drop any pieces in the water. During this process we introduced a cue to alert the alligator that food was available by tapping tongs on the treat cup. It did not take long for the alligators to associate the taps with reinforcement and were moving towards the sound and then towards the visual cue of the tongs.

Next came the step of asking the alligators to target to the tongs in their home enclosure. Their first year at Zoo Atlanta the alligators lived in a 50 by 30 inch black tub filled with water, with a rock for sunning under a heat lamp and UV light. During the first couple months of training, they outgrew this enclosure and were relocated to a 75 by 42 inch enclosure that is on exhibit to the public. This exhibit was primarily land with a swimming tub that the three alligators could climb in and out of and was utilized as a temporary enclosure until their permanent enclosure was built. This is where preliminary of targeting took place.

With the alligators understanding that food is provided following the sound of the taps, a trainer would tap and then present the reinforcement in various locations around their enclosure, the tap alerting the alligator to the location the food would be found. The temporary enclosure, however, was not the best set up for trainer or alligator. It provided minimal space for the trainer to offer a target without reaching over of the alligator, and visibility of the alligator was difficult as they were excellent at hiding under the mulch or in the far back corner which was difficult to reach. With limited water in the enclosure the alligators were slower to participate and at times hesitant to leave the water tub. We think the natural history of young alligators, living in marshy environments to avoid predation, contributed to their hesitation to approach a target outside their water tub. Once they moved into their new enclosure which was mostly water, they moved farther and faster in response to each tap cue providing further evidence their initial response was natural history driven. Another natural history factor, was that the water allowed for easier swallowing of the dry chow. To assist the alligators, trainers would lightly soak the chow before each training session. When this step was missed, the alligators spent the majority of their time attempting to swallow the chow or go back in to the

water after each reinforcer and trainers would have to target them back out of the water for every repetition.

Another piece of alligator natural history that had to be considered for successful training was that alligators fight with one and other. Trainers utilized one of two strategies to prevent aggression among individuals: 1) introduced a differential reinforcement of an alternative behavior (DRA) by utilizing multiple trainers so that each alligator had their own cue to focus on, or 2) when multiple trainers were not available two of the three alligators were removed from the training environment allowing a single trainer to focus their attention on one alligator.

At this stage trainers noticed that the alligators were able to follow both the auditory cue as well as the visual cue of the tongs themselves. Their unique ability to localize audio cues became beneficial during A to B's which will be discussed later.

Six months after initial training the alligators were moved into their permanent habitat: 33 by 66 inch tub filled with water, with an elevated area for alligators to come completely out of the water. Custom Plexiglas windows were installed surrounding the top of the tub for security and visitor viewing. As soon as the alligators were in a larger space with more water they each appeared more motivated and confident to participate with targeting throughout their new home. The end goal of this training program was a behavior, where the alligator would voluntarily walk into a kennel. To begin this part of the shaping plan, a kennel was introduced submerged about 3 inches so the alligators could swim inside if they choose.

The first time the kennel was introduced none of the alligators participated in training or take food from the tongs when offered. The alligators appeared to be nervous for several more sessions. The kennel had to be removed after each session for exhibitory purposes so each time it was placed back into the enclosure 30 minutes before each training session.

Another factor we considered regarding their lack of participation was having been fed the day before. Natural history of alligators is such that they do not need to eat daily. (Scott, n.d.) Trainers worked through this challenge by spreading out the alligators' weekly diet into smaller feeds that occurred more often throughout the week. During the 15 months of training we averaged ten training sessions a month due to their appetite. While balancing the alligators' appetite with the number of repetitions per session, trainers also had to consider the matching law: "given two concurrently available response alternatives the relative rate of responding equals the relative rate of reinforcement." (Bourret, 2003) Meaning that the reinforcement for performing the cued behavior must outweigh the reinforcement for the alternative behavior, i.e. not participating. Balancing the alligator's naturally low appetite and the matching law was challenging as it did not provide us with many training session opportunities. It became crucial that every training session provided clear communication with the alligator as there was little room for error.

Training sessions only lasted if the alligator participated which ranged from less than a minute to near ten. When the alligator was full it was observed that they were less motivated to participate in the remainder of that session as well as, up to, the next couple of days. When this occurred multiple times, we reevaluated the frequency of sessions and how much food we

offered per session so not to accidently take a step back in their training. Training sessions were usually two to 4 times a week depending on trainer availability and alligator's motivation to participate.

The second session the kennel was introduced into the alligator's home each alligator was swimming into the kennel in response to the cue without any other prompts after a handful of approximations. The cue to enter the kennel was tapping the tongs on the back of the kennel, very similarly to how tapping the cup indicated the alligator should move toward the cup. Occasionally, rather than going directly into the kennel, an alligator would go along the outside of the kennel, in response to following the sound, where they would eventually correct themselves once the trainer tapped on the other side of the kennel. Two of the alligators also had to learn to lift their snout up over the lip of the bottom of the kennel before entering, otherwise ran their snout against the outside bottom lip. We allowed the alligators to learn on their own as there was little else we could do as training a target follow would not have been helpful for the final A to B behavior.

We hypothesize that being in a larger space with more water the alligators where more comfortable as they began vocalizing as soon as they heard the tapping and quickly swam over towards the trainer ready for their cue. Typically, when humans hear juvenile alligators vocalizing it is a distress call used to call their mother (Scott, n.d.), but due to the alligator's response and continued willingness to participate in the training session we believe the vocalizations heard during sessions were positive. They differed from the alarm vocalizations heard at times the alligators appeared to be experiencing stress.

With their success of kenneling at home, the kennel was approximated out of the water so that the alligators could swim up to it, but then had to climb/walk inside. This was an important step as the final A to B behavior was on land because our stage lacks a water feature. Once the alligators were comfortably walking into the kennel, it was time to remove the water element altogether. The first location change was in the same room, into the same size tub as their current home but lined with mulch substrate as opposed to water. The kennel was placed in the far back of the mulch tub then filled with about an inch of water. The training session would begin at home with a couple successful repetitions of going in and out of the semi-dry kennel. The door to the home enclosure was not big enough to allow the alligators to enter the kennel for safe removal from their home enclosure, so the alligator was placed into the kennel in the mulch tub by the trainer. The alligators, again were slow to respond to cues in this new environment so trainers allowed the alligator to habituate to this space for a short time before cuing a target.

Once successful, the water level inside the kennel was lowered to nearly none and we quickly saw a decrease in speed from the time the alligator was bridged (sound of food dropping into the kennel from window) to when they were actually able to locate and eat the food. Studies have found that alligators have sensors on their jaw which allow them to locate objects in water (Britton, 2012). With the water removed, the alligators were no longer able to quickly find their food, therefore lowering the value of their reinforcement and possibly even punishing the desired behavior. Benefitting from the knowledge of their natural history again, it was decided that having an alligator move into a dry kennel was not a behavior that needed to occur. It was determined that water inside the kennel was necessary for the alligator to be successfully reinforced within a proper time

frame, speed up the training session, and increase their learning period.

Kennel setup in the alligator's home habitat and mulch tub took a substantial amount of time; sometimes set up took longer than the training sessions. Due to time restrictions, and other factors, alligator training became a low-priority as we went into our busy show season. Training still occurred but focus was shifted to one individual, Perseus, who was showing the most promise. Perseus's training continued but sessions became less frequent. Rather than continuing in the mulch tub with the single kennel, where not much success of asking Perseus out of the kennel was seen, we moved to a kennel-to-kennel behavior on the floor of the room the alligators were housed in.

Starting with two kennels both filled with about a half inch of water Perseus was placed into kennel A and kennel B was pressed, facing, against the other. At first Perseus did not respond to the tapping on the back of kennel B. Approximations were used starting with cueing Perseus in-between the two kennels with a target, but he would retreat back into kennel A with his food. We then switched to a baiting strategy by dropping a couple of pieces of food through the window of kennel B (starting nearest the kennel front and working back). As soon as the food fell Perseus quickly entered kennel B to retrieve the food. It took a few approximations before Perseus finally responded to the taps at the back of kennel B and fully moved without any other baits or prompts. A few more successful repetitions followed before Perseus no longer chose to participate so the session was ended. Sessions continued throughout the following months as time was available. Kennel-to-kennel sessions continued and were sometimes relocated to the mulch tub to increase Perseus's confidence and momentum. Once he was again successful, kennel-to-kennel sessions returned to the ground in the kitchen of the Wieland Wildlife Home building and the kennels distance apart began to increase.

As the distance between the kennels increased, the greatest hurdle was creating enough confidence in Perseus for him to exit his entire body from kennel A. As we started to ask more from Perseus (entering open space) the more we needed to understand the alligator's natural history. The use of shorter distance approximations, targeting, and baiting, helped Perseus overcome his hesitation and voluntarily step out into the open. Eventually Perseus was successfully exiting kennel A when cued, and entering kennel B where reinforcement occurred once all four feet stepped inside the kennel.

Once successful at kennel-to-kennel inside a familiar space, it was time for Perseus to move his training to Amy's Tree Theater and begin his goal A to B. To begin, the same approximations were used, kennels were set up face-to-face, with half an inch of water and Perseus was placed inside. Kennels had since been modified so to have a slide door for ease of opening and closing and, most importantly, security. We began back chaining by setting up kennel B (catch) behind the scenes of the stage, same as it would be with the completed behavior, and having kennel A (release) face-to-face with the catch kennel.

Perseus's completed behavior is the following (see attached diagram): Perseus is released behind the scenes from the fake bush by a trainer. As soon as the release kennel opens, the trainer moves to the catch kennel, set up behind the

scenes and begins cueing with the tap sound. The distance from release to catch is eleven feet. In response to the cue Perseus exits the release kennel, goes through the fake bush, walks across the stage, down four steps and exits behind the log pile, into the catch kennel behind the scenes. The stairs proved too much of a hurdle for Perseus so bricks were added making two steps into four with a decreased distance between each step.

As stated above, the A to B process started with the catch kennel in place behind the scenes. The catch kennel does not move during back chaining. What does move (as Perseus progresses) is the release kennel. With each successful approximation the release kennel moves backward, toward the bush. As the release kennel moved back occasionally Perseus would stray from the path, but a simple tap on the kennel helped to orient him in the correct direction.

Once the release kennel reached the bush and Perseus was successful going kennel-to-kennel, it was important to teach Perseus to exit the bush. The bush itself was a decorated plastic trash can**,** 13.5 inches wide, with the back half cut off and attached to the stage back drop with access behind the scenes. Another hole was cut in the front on the bottom of the bush for the alligator to exit. Forward chaining was used to teach Perseus how to exit the release and walk through the bush. The release kennel was set up as it would be for the completed behavior and catch kennel placed just outside of the bush. With Perseus's progression, this time the catch kennel would be moved back but only until the steps on stage, where at that time the two chains would be combine.

Exiting the release kennel and entering the bush was another human challenge as it was difficult to see where Perseus' location and another challenge for Perseus to get accustom to. To help Perseus overcome this challenge, targeting was used to direct him out of the kennel into the bush, as well as exit the bush into the kennel/on stage.

After working with Perseus for 24 training sessions in 3 months at Amy's Tree, he was finally ready to perform the completed behavior. It took him over 30 seconds to exit the bush and he also stopped twice along the path to the catch kennel but Perseus finally had done the complete behavior. However, the goal was no yet completed because Perseus still needed to successfully do the complete behavior with a full audience in a scripted show. Within the month of July, trainers worked on increasing his speed so that he no long stopped along his path and added an audience. Now Perseus was going to Amy's Tree daily and occasionally twice a day when needed. By July 6, 2017 Perseus was doing his completed behavior in front of over 200 guests during the scripted show. By the end of the month other trainers were then being cleared to release/catch him for shows.

As new trainers ran the session we saw a slight breakdown in behavior due to the variety of tapping styles among them as well as attempting to fade out the number of taps. The number of taps was only limited slightly as we found Perseus was more successful when he could hear the direction he needed to go: technically, by definition, making this behavior more of a recall verse a true A to B as Perseus was responding to the sound cues as opposed to memorizing the actual path. Shows brought a variety of audiences and different reactions to seeing an alligator on stage. When audiences were extremely

loud Perseus would break from his path and occasionally be picked up by the host on stage to keep him from walking into the audience. When this occurred, trainers would then train him after the show with success.

With the end of show season and colder weather Perseus had completed his show season debut. He has now outgrown his home here at Zoo Atlanta and will be returning to his originating institution. We will have another opportunity to train this again with a very young alligator this spring. When looking over our experiences we found takeaways to help us be better prepared next time around:

A small amount of water in the kennel is helpful so that the alligator can use their sensory organs to locate the food quickly.

By the end of training Perseus, we had reduced the amount of water to a small metal bowl, velcroed to the far back of the kennel and the food is dropped into the bowl.

Due to alligators' directional hearing ability, trainers can help orient the alligator with precise location of the tapping.

Juvenile alligators have a natural instinct to stay hidden so smaller approximations and clear communication with the alligator is very important when asking them to step out into the open.

Over-all, it is important for a trainer to truly understand the natural history of their animal. As always, training is a study of one: however, knowing the natural history in addition to the individual history will help to create the most successful antecedent arrangement possible. With Zoo Atlanta and Perseus's success comes the success in creating a positive image for the American alligator in the hearts of Atlanteans. Though a small step, as learned through training an American alligator, it takes small approximations to create the greatest success.

References

American Alligator. (2008, February). Retrieved March 2, 2018, from https://www.fws.gov/uploadedFiles/American-Alligator-Fact-Sheet.pdf

American Alligator. (2014, March 31). Retrieved March 2, 2018, from https://kids.nationalgeographic.com/animals/american-alligator/#american-alligator-jaws.jpg

Bourret, J. (2003). Basketball and Matching Law [PDF file]. *Behavioral Technology Today,* 3, 2-6.

Britton, A. (2012). Integumentary Sense Organs. Retrieved 20 December 2016, from http://crocodilian.com/cnhc/cdb-gb1.htm

McLaughlin, E. C. (2016, June 24). Disney beaches reopen; state believes it caught killer gator. Retrieved March 19, 2018, from https://www.cnn.com/2016/06/23/us/orlando-florida-disney-beaches-reopen-alligator-caught/index.htmlScott, D. E., Brisbin, I. L., Jr., Glenn, T. C., & Hopkins, W. A. (n.d.). American Alligator. Retrieved March 2, 2018, from http://archive-srel.uga.edu/outreach/factsheet/AlligatorBrochure.pdf

Povey, K., & Winsten, K. (2003, January 28). CEC Ambassador Animal Position Statement. Retrieved March 21, 2018, from https://www.aza.org/cec-ambassador-animal-position-statement

IMPROVING NAIL CARE IN A WHITE-NOSE COATI (*NASUA NARICA*) UTILIZING NATURAL BEHAVIOR AND OPERANT CONDITIONING

Autumn Henry, Bird & Mammal Trainer II, Texas State Aquarium
Ashley Warrington, Bird & Mammal Trainer II, Texas State Aquarium
Lauren Wilson, Bird & Mammal Curator, Texas State Aquarium

Sonora is an 11-year-old, female white-nosed coati (Nasua narica) who resides at the Texas State Aquarium in Corpus Christi, TX. As she's aged, Sonora is less inclined to emit behaviors that would naturally wear down her nails i.e. digging and climbing. This has created an issue where her nails grow out quickly and snag on materials both in her enclosure and on stage, which seems to be a negative and frustrating experience for Sonora. She is trained to voluntarily enter an induction chamber where she can be anesthetized for medical examinations but this is not an ideal process for routine nail care. Trainers decided that in order to decrease risks associated with anesthesia and to improve her welfare, a voluntary nail filing behavior should be trained that utilizes the coati's natural behavior of digging. We used a PVC pipe wrapped with fine-grit sandpaper and desensitized her to the object. Sonora was then shaped to scratch at the sandpaper with her front nails through a protective barrier. We then switched out the fine-grit for a coarser variety of sandpaper for more efficient filing. This ensures that Sonora can voluntarily participate in her own nail care rather than have her nails be trimmed solely while she's under anesthesia. We have already noticed a drastic reduction in both nail splitting and snagging since the introduction of this behavior. Because the reduction in negative behaviors has appeared to alleviate frustration, we believe her welfare has been improved by training this behavior.

Introduction

Sonora is an 11-year-old female white nosed coati (*Nasua narica*) who is a program animal in the Wildflight show; a bird and mammal presentation at the Texas State Aquarium in Corpus Christi, TX. Sonora came to the facility as a juvenile and has participated in operant conditioning training for the majority of her life. As an animal ambassador Sonora works free contact on a leash with her trainers, although any tactile interaction is generally limited to grooming sessions. Initially, Sonora had no specific training for nail husbandry and any trims or filing necessitated anesthesia. In their native habitats, coatis' nails will naturally be worn down through behaviors such as climbing trees and foraging for food. Sonora's enclosure has extensive perching and shelving at different heights to encourage climbing. In addition, she participates in shows daily and often goes on walks for enrichment. These behaviors all assisted in the natural wearing of Sonora's nails, ensuring that a nail husbandry behavior was not necessarily required for quality of life. However, at 11 years old, Sonora is starting to experience symptoms of aging; female white nosed coatis have a natural lifespan of 14 years (Nowak, 1999) and can live up to 26 years in human care (Weigl, 2005). In her older age, Sonora has displayed a decreased level of activity and is starting to show signs of arthritis; in turn, she climbs less often and her nails are not being worn down as much through regular activity. Sonora was also experiencing frequent splits in the nails of her front paws, resulting in tearing of the nails and snagging on objects in her enclosure. Due to her age, trainers desired to minimize how much she had to be anesthetized and the need for a voluntary nail care behavior became apparent.

Objective

A voluntary nail husbandry behavior would be trained to reduce or prevent nail splitting and to maintain appropriate nail length on the front paws, thereby reducing the need to anesthetize Sonora for nail care and ultimately improve her welfare.

Methods and Materials

The initial method chosen to train the nail husbandry behavior was to use operant conditioning training, through protected contact, utilizing a target pole. The target pole was constructed of a 2 ft long 1 in. diameter PVC pipe with a tennis ball attached to one end. With Sonora standing on the ground inside of her enclosure, trainers would prompt her to target one of her front paws to the tennis ball through the side of her enclosure, then hold the target while allowing trainers to manipulate her paw in order to file or trim her nails.

This method was subsequently revised, substituting a station behavior for the target. The same piece of PVC pipe was utilized without the tennis ball and was clipped or held to the outside of her enclosure. With this revised method, Sonora would be asked to place both paws through the side of her enclosure and on the PVC simultaneously. She then was asked to hold her station while trainers manipulated her paws and nails.

The final method changed the behavior being asked of Sonora from a passive one where she stationed or targeted and allowed her nails to be manipulated to one in which she could choose to actively participate. The PVC pipe was wrapped with fine P180 grit sandpaper affixed with zip ties to create a filing surface. Sonora was asked to station both front paws on the PVC pipe. Then using her natural affinity for digging and through shaping using the verbal bridge "good", Sonora was trained to voluntarily scratch the claws of both paws so they made full contact with the sandpaper. Upon success with this sandpaper grain we used progressively coarser grit (P150 and eventually P100) to increase the efficiency of filing.

Results

In both the initial and revised methods, Sonora chose to participate in the session but experienced difficulty with duration during targeting or stationing. With the initial method, Sonora displayed a preference for digging at the tennis ball with her paw. In both methods, we also experienced difficulty with Sonora allowing her nails to be handled, as she would often pull away when we attempted to manipulate her paws.

With the final method used, we were able to successfully shape the behavior of Sonora scratching at the sandpaper, utilizing her natural tendency to dig, which resulted in visibly apparent filing of her nails. Sonora continued to voluntarily participate in sessions and broke from the session less frequently.

While the behavior was being trained, nail filing sessions occurred daily; currently these sessions are done two to four times per week. Since this behavior has become a regular part of Sonora's husbandry, she has not experienced further splitting or tearing of the nails on her front paws.

Conclusion

From the inception of this behavior, the ability for Sonora to have a degree of control over nail husbandry sessions was important. Protected contact was therefore utilized to allow Sonora choice and control in whether to participate, as well as for trainer safety. If she did break from the session we gave her the opportunity to re-station and she was consistent in choosing to come back to the session during such situations. However, Sonora broke from the session frequently when trainers attempted to manipulate her paws. Instead of expending energy shaping for a nail trim where she would allow nails to be cut via paw manipulation, trainers decided to shape the behavior she was offering. Since she already showed a tendency to dig at the tennis ball target, it was a simple matter of attaching sand paper to the end of the PVC instead and shaping for digging on this new surface. Trainers began with a fine P180 grit sandpaper to desensitize Sonora to the grain due to concerns that it could be aversive; however, Sonora showed no issues with the new texture. It only took a couple of sessions for her to understand what was being asked of her. Upon consistent apparent filing, the P180 grit sandpaper was exchanged for the coarser P150 variety. There was no difference in her participation or behavior when the switch was completed. When the P150 wore down to the point where it was no longer wearing down her nails we switched to the even coarser P100. Thus far this coarse variety has had no adverse effects on Sonora.

Utilizing the natural behavior that coatis possess to dig had additional benefits. Sonora was more engaged in the training sessions since she was the one who originally initiated this natural behavior and thus was more likely to actively participate. This allowed trainers to shape a fully functional behavior within a short period of time. Not only was she participating in these sessions regularly of her own volition, she also consistently stayed for the entirety of the session despite having the opportunity to leave.

There are several possibilities for further development of this behavior. Sonora will fully scratch her right claws against the sandpaper multiple times prior to receiving reinforcement, whereas filing the claws on the left paw requires multiple smaller approximations. Instead she has a tendency to rub or pat her left paw pads against the grain of the sandpaper. This could be because she finds the sensation reinforcing. Continuing to use small approximations with high quality reinforcers may eventually equalize the discrepancy in nail filing behavior between the two paws. Sonora also occasionally shows frustration or boredom if the rate of reinforcement is not high enough due to incorrect criteria. If this is the case then Sonora has the choice to leave the session, but she also has the opportunity to return, and consistently chooses to do so. Offering higher quality reinforcers (i.e. egg, banana) seems to mitigate frustration and she meets the criteria more frequently.

While this nail filing behavior does not fully compensate for her previous levels of activity, it does help to maintain nail length throughout the year. Since the initiation of this nail husbandry behavior, she no longer has splits that catch on objects in her enclosure, which could lead to more serious medical issues. Sonora receives a yearly physical where she is required to be anesthetized, so the veterinarian can trim her nails fully to make certain they remain an acceptable length. During the rest of the year, we will utilize this new nail husbandry behavior to ensure that there are no splits or snags that will disrupt her daily routine or require medical attention. Since anesthetization now only needs to occur once a year, Sonora's quality of life and safety has become substantially better. She has less of a chance of developing an issue from undergoing frequent anesthesia in her older age and the creation of this voluntary behavior gives her an opportunity to control her environment while providing medical care and improving her welfare.

Acknowledgements

We would like to thank the Bird and Mammal team for continued help throughout this training process, the Texas State Aquarium for giving us this opportunity to present at the ABMA conference, and the Physical Plant team for providing us with necessary tools and terrible jokes.

References

Nowak, R. M., & Walker E.P. (1999). Walker's Mammals of the World. Baltimore: *The John Hopkins University Press*.

Weigl, R. (2005). Longevity of mammals in captivity; from the Living Collections of the world: a list of mammalian longevity in captivity. *Kleine Senckenberg-Reihe, 48.* Stuttgart: E. Schweizerbartsche.