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Invited Lecture

MORE MISBEHAVIOR OF ORGANISMS: A PSI CHI LECTURE BY MARIAN AND ROBERT BAILEY

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In 1992, Dr. Marian Breland Bailey, assisted by her husband Robert E. Bailey, gave the following presentation at the Psi Chi Banquet of the University of Central Arkansas. She and her first husband, Keller Breland, were students of B. F. Skinner and established Animal Behavior Enterprises (ABE) in 1947 and the IQ Zoo in 1955. Unknown to many historians of psychology, most of ABE's projects extended outside the confines of the IQ Zoo and included work for the military, fairs, parks, businesses, and entertainment venues. Dr. Bailey's Psi Chi lecture should prove invaluable to students, researchers, and scholars, for it is one of the few places where the extensive nature of ABE is described in an overarching fashion.
Key words: animal behavior, Breland, history of psychology, IQ Zoo, operant

The following is a transcription of a lecture and slide presentation given in 1992 by Dr. Marian Breland Bailey (see Figure 1) at the Psi Chi Banquet of the University of Central Arkansas. She and her first husband, Keller Breland, were students of B. F. Skinner at the University of Minnesota (Peterson, 2004; Skinner, 1960, 1979, 1983). In the 1940s, she and Keller established Animal Behavior Enterprises (ABE), a business that capitalized on their skill in operant conditioning (Breland & Breland, 1951, 1961). She and Keller moved to Hot Springs, Arkansas, in 1951. They established the IQ Zoo in Hot Springs in 1955, where tourists were entertained by dancing chickens, guitar-strumming ducks, basketball-playing raccoons, and piano-playing rabbits (see Figure 2). Keller died in 1965, and in 1976 Marian married Robert E. Bailey, a former civilian trainer for the U.S. Navy's marine mammal program. Marian died in 2001.

Dr. Bailey's work, in collaboration with Keller and Robert, extended far beyond the confines of the IQ Zoo, and her 1992 Psi Chi lecture is invaluable because it documents her reach in applying operant procedures and reveals much historical information not available elsewhere. Her career spanned

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Figure 1. Marian Breland Bailey and dolphin, circa 1965.

Figure 2. Piano-playing rabbit.

over 60 years, several hundred species, and thousands of individual organisms, and included projects for the military, fairs, parks, businesses, and entertainment extravaganzas (see www3.uca.edu/iqzoo; Bailey & Gillaspy, 2005; Gillaspy & Bihm, 2002; Marr, 2002). Unfortunately, most historians of psychology are not aware of her extensive work with species across the phylogenetic tree, for much of this work is not documented in published papers and books (but see Bailey & Bailey, 1980, 1993). Instead, it was often recorded in the business documentation of ABE.[1] The remaining documents now reside in Akron, Ohio, at the Archives of the History of American Psychology (www3.uakron.edu/ahap/).

This lecture was transcribed and edited for clarity and ease of reading by the four authors, who also verified its accuracy. (Dr. Bailey's remarkable claims are also documented in the photographic slides that accompanied the lecture.[2]) William Lammers, the Psi Chi faculty advisor in 1992, introduced Dr. Bailey at the banquet.

Introduction by William Lammers

William Lammers

Dr. Marian Bailey teaches psychology at Henderson State University in Arkadelphia, Arkansas, and she operates Animal Behavior Enterprises in Hot Springs. She and her husband, Robert Bailey, have made numerous significant contributions to the fields of operant conditioning and ethology. A catalog of their research projects includes work with raccoons, ducks, dolphins, gulls, and albatrosses. Marian Bailey is one of B. F. Skinner's most famous students. He wrote about her in detail in his autobiography, and she helped him develop Project Pigeon at the University of Minnesota. Although most of her work has been as an experimental psychologist, she has been interested in the application of operant techniques to help others.

1 Many of the ABE records were destroyed in a fire at the Bailey's home in the 1980s, making a historical reconstruction even more difficult.

2 A copy of the lecture is available on DVD from Dr. Elson M. Bihm, Department of Psychology and Counseling, University of Central Arkansas, Conway, AR 72035. E-mail: elsonb@uca.edu

Applying her knowledge of positive reinforcement to the training of persons with mental retardation, she was one of the first contributors to behavior therapy. In 1961, she and Keller published a classic article, "The Misbehavior of Organisms," which is considered to be one of the first important papers in ethology, and one that is still fascinating to read even after 30 years. Dr. Bailey is an important figure in the history of psychology and we are happy that she accepted our invitation.

Lecture and Slide Presentation

Marian Breland Bailey

I'm very happy to be here tonight. It's nice to meet all of you and be with you. I hope I can live up to my billing. Some of you may know my husband, Bob Bailey. Bob is a biologist, and he has been absolutely indispensable in much of the work we have been doing. Right now, he's going to be my slide projectionist and help me out if I bog down.

Many people have commented on what we have been able to teach animals. I want to make the point that what is perhaps more important for us is what we have been able to learn from the animals themselves.

Project Pigeon and General Mills. For those of you who aren't acquainted with some of the work we have been doing at Animal Behavior Enterprises since 1947, and some of the background before that, I was one of B. F. Skinner's graduate students, I think number two chronologically. My first husband, Keller Breland, and I did work with Dr. Skinner at the University of Minnesota. When Keller and I left the University of Minnesota, we had almost finished our work on our doctorates. We left to go with Dr. Skinner to work on the Pigeon Project, along with some other Minnesota graduate students, including William Estes and Norman Guttman. It was during our work with Dr. Skinner on Project Pelican[3] that my first husband and I got the idea that this theory, Skinner's operant conditioning, was a lot better than anybody appreciated at the time, even the psychologists who were working with it. The things that Skinner was able to do with pigeons on this project convinced us that we could make a living at applying this approach.

So we started as soon as we could after the war. We left the university and started our own business of training animals by applying operant conditioning theories. Our first customer was General Mills, with whom we had been doing the work on Project Pigeon. (They were the prime contractor with the Navy for Project Pigeon, which involved teaching pigeons to guide missiles, as you might be aware.) General Mills offered a logical place to start. We knew people in the company, and they knew what we were able to do with animals. We started out by selling sets of trained animals to them. We developed the behaviors, we developed the equipment for it, and we put the show on the road, so to speak. And they *were* shows.

The shows were produced to advertise General Mills' farm feeds at county and state fairs. Our first shows involved chickens performing on a little tabletop. At first, they were encased in glass because we hadn't

3 Like Skinner in his 1960 article, Marian refers to the project with different names, including the "Pigeon Project" and "Project Pelican."

gotten away from the Skinner box notion—we thought that we had to enclose these animals. We rapidly got away from that, and we found out they would just stay right there on the tabletop and tend to business. Our first ones were sent out on the road with General Mills' feed salesmen, whom we successfully trained to handle the animals to keep the operant behavior going. Then, we began to get into semi-automated acts. This is the first one of these, and this is really a glorified Skinner box again. [*Slide of chicken playing baseball, with bat, ball, and baseball diamond; above diamond is a Larro Feeds logo.*] This is Larro Casey. She pulls a rubber ring to work the bat and send the ball into the field. Well, we went on with many of these. They weren't automated in the sense that our later acts were, but some of them worked with a push button that gave a light signal to the animal, or the animal was just placed in front of the equipment.

IQ Zoo. In 1955, we opened the IQ Zoo in Hot Springs as a place to display the work that we were doing, and most of the early shows at the IQ Zoo were acts we had developed for General Mills. [*Rabbit playing red piano, with dancing chicken to right on platform.*] Both of these were originally General Mills' acts: the piano-playing rabbit and the dancing chicken. The dancing chicken was one of those that we mentioned in our "Misbehavior of Organisms" article.[4] We went on to build an even more elaborate form of Larro Casey. [*Baseball diamond with figurines of players in the field; chicken running between second and third base.*] Here, the chicken not only operates the bat, but then the chicken runs the bases, and this involved a chained response of fairly great complexity for a chicken.

The IQ Zoo generated a lot of publicity, including the following shot. [*Keller Breland and TV-star Marlin Perkins, kneeling by a ramp and slide.*] This was one of the bits of film that later appeared on the television show *Wild Kingdom*, starring Marlin Perkins. We were on Marlin Perkins' old show, *Zoo Parade*, several times and then on *Wild Kingdom* two or three different times. That's my first husband Keller Breland down there next to Marlin Perkins, and this was going to be a set for a sliding pig.

Marine mammals. As a result of an article in *Time* magazine about the IQ Zoo, we came to the attention of people at Marineland in Florida, then called Marine Studios. [*Pilot whale jumping out of water, pushing ball with mouth.*] We developed the first scientifically trained dolphin show at Marine Studios. (This actually is a pilot whale, which we trained later.) We were also the first ones involved in training pilot whales, first for Marineland of the Pacific and then for Marineland, Florida. In developing these shows, we went further than we had with our General Mills' salesmen. We trained the behavioral technicians at Marineland to train the animals themselves. We instructed them in operant conditioning methods, and this was the first time that this had been done with marine mammals. At Marineland, we developed all these techniques for teaching laypeople, who had no college education or training, in the operant conditioning of behavior.

As a result of this early dolphin experience, we were called upon to be consultants to the Navy on their marine mammal project in the early 1960s. [*Two men and dolphin near boat in the open water.*] As we had at Marineland, we trained the Navy personnel in operant conditioning techniques, developed training manuals and also techniques for transport and handling. This

4 Breland and Breland (1961).

is the early transport method that we developed for taking the Navy dolphins from their capture point around Gulfport, Mississippi. [*Two wooden crates containing dolphins, attended by man.*]

Bob

I'd like to interject here that the technology of transporting has evolved a great deal since these shots were made.

Marian

That's right. It has been upgraded. They don't use boxes anymore; they have a kind of sling that they put the dolphin in. This was a Navy plane that was used to transport the dolphins. [*Navy aircraft with people standing outside.*] Most of the transport was done by plane. And, actually, this particular plane was bringing the animals to Hot Springs, which was something we did later for the Navy and also for SeaWorld. We trained and brought dolphins to Hot Springs and kept them in artificial salt water there. We were one of the first ones to bring them inland and keep them in artificial salt water. The Brookfield Zoo and the Philadelphia Aquarama were the first ones to bring dolphins inland. We were all doing this around the same time. Two of the animals we brought to Hot Springs were Navy animals. [*White-sided dolphin jumping in midair.*] This was also at Point Mugu, California. This is another species of dolphin. The Navy experimented on large numbers of other kinds of dolphins. This is a white-sided dolphin.

This is Bob with the first dolphin ever to be released into the open ocean on purpose and then brought back. [*Bob Bailey in water, with dolphin.*] This was Bob's project. One of the dolphins, Buzz-Buzz, was so named because of an experiment we did on discrimination there. Buzz-Buzz was one of those brought to Hot Springs and then to Point Mugu and then, as I said, released in the open ocean. This is now a commonplace method. We don't think anything of it, but this is where it began.

Tourist attractions. During the 1950s and 60s, we expanded greatly into tourist attraction and show business for parks and fairs. We developed shows with numerous species, and one of the things we learned from the animals (and people) was that the answer to the question "What is that animal doing?" lies more in the eyes of the beholder than anything.

This bird, a green-winged macaw, we say is roller-skating, but of course, a macaw has no concept of roller skates as children do. [*Macaw on skates.*] These are specially designed little roller skates. The bird pushes its feet forward, but actually all the bird is doing is walking. Now, those skates are not actually strapped to its feet as with some roller-skating penguins and other animals. He actually steps up onto the skates. [*Bird with paintbrush in mouth, painting on canvas placed on easel.*] You might say that this bird is painting a picture, but once again there is no such thing. The animal is simply manipulating a piece of stick in its mouth. It picks up the stick as birds do in the wild, and we make it look like painting. It's the equipment, the props that you put at the other end of the manipulandum that produce the illusion.

And these birds are supposedly playing basketball. [*Bird on left placing plastic ball into basketball hoop; bird on right looking on.*] This is an interesting game. We had to modify the basketball so the birds could get it with

their beaks. This is a wiffle ball, a hollow baseball. There is quite a lot of competition between the birds when they play basketball. The birds get quite excited when they're playing. They fight for the ball and squawk at each other. There are some birds that won't play with each other.

This is another show we developed at Knott's Berry Farm in California. [*Person holding microphone next to goat on balcony.*] You can see up on the balcony another example of "What is the animal doing?" That goat looks as if it is talking into the microphone, but all it is doing is moving its mouth.

This is a movie which was made for schools, for elementary schools. [*Rabbit looking on as young girl colors with crayons.*] That's my little daughter there, my oldest daughter, Frances, a long, long time ago. It was released in France, and in English it's called "Frances and her Rabbit." The rabbit brings her the crayons.

Now, it looks as if these two rabbits are kissing each other. This is Romeo and Juliet. [*Two rabbits nose to nose; one is standing on hind legs, while the other is leaning over the side of a miniature balcony.*] This was a shot from *Life* magazine. We trained these rabbits especially for that publication. What we found out after the shot was taken was that the rabbits were chewing each other on the nose. But anyway, it looked very romantic.

Government contracts. In the late 1960s and 70s we undertook a fairly wide range of government contracts. Most of these grew out of our work with the dolphins, where much of our reputation was established amongst agencies interested in animal work. We worked with a number of species. The first series was a set of experiments on the load-carrying capabilities of various species of animals. [*Monkey wearing yellow vest.*] We had the task of developing the means for the animals to carry weights, and the prime objective was to see how much weight they could carry and still take on their normal living functions, for instance, moving around, climbing, and so forth.

We also did some work for the Army on locating buried antipersonnel mines. [*Dog seated before two square patches on ground.*] We used Golden Labradors for this. The animal was trained not to dig up the mines, which would have been fatal, but simply to make a suitable response to indicate the presence of the mine underground, and so we decided to make the dog sit by it. This is a picture of a dog sitting at a training station. They could detect the mines up to 12 inches in depth, which was really quite good. This was designed for the detection of post-Vietnam minefields, where we actually had to detect some of our own mines that had been laid down. Those dogs were eventually transferred to drug enforcement down on the Mexican border.

This is another project we did for the Army. [*Man standing in back of pickup truck, with cages stacked in the back.*] This involved an ambush-detection scheme using pigeons. The birds were trained to detect enemy personnel camouflaged alongside a road, again in the Vietnam setting. This is a training scenario where a bird is trained to fly to the person off the road. [*Field with road in distance; man in foreground with arm outstretched for approaching bird.*] For more advanced training, people would be very deep in camouflage, and the birds were remarkable in their ability to detect camouflage.

Bob

The system was tested at Fort Bragg, and there was a company of Special Forces personnel who were designated to ambush the convoy, and in over 45

attempts at ambushing this convoy protected by the pigeons, not one was successful. They detected 100% of the time.

Marian

The birds were trained to fly out ahead of a convoy and look for personnel off the road. Another feature is that they did not pay any attention to people walking on the road. Anybody who was out in the open on the road, they paid no attention to. They were trained to hunt hidden people off the road.

Bob

And they did that with a brain that weighed roughly a quarter of an ounce.

Marian

So much for the central nervous system. Now, you probably think you know what a dolphin looks like. [*Pale-skinned dolphin underwater.*] This is a dolphin. This is *Inia geoffrensis*, the Amazon freshwater dolphin, one of the freshwater dolphins. This project was not done for the federal government—we did this work on the basic characteristics of this animal for the Fort Worth Zoo. We were able to work with this dolphin there. Basically, the dolphins are very slow moving and very flexible. They bend.

Animal Wonderland. In 1972 we opened Animal Wonderland in Hot Springs. Some of you may remember Animal Wonderland, where we put on shows involving dolphins, sea lions, birds and other types of shows for the public. [*Aerial photograph, with roads, buildings, and bodies of water.*] This is an aerial view. The park is in the foreground here, and in the back is our training facility, a big building with pens and so on, where we not only ran Animal Wonderland, but where we also developed our new research projects and shows. This is the BBC filming one of our animal shows in the Animal Wonderland. [*Still shot of cannon being fired by pig.*]

This is one of the new acts we developed while we were out at Animal Wonderland. [*Man sitting at computer terminal, with monitor and keyboard; above the monitor is a chicken behind glass window.*] This is CompuChick.

Bob

It cast horoscopes. It would do several things depending on what you'd ask it. If you'd ask, it would cast horoscopes. That was the most popular thing for it, anyway.

Marian

The visitor has a keyboard down here, and the visitor would type in a question. The chicken had its own keyboard here in the back.

Bob

You can possibly see the keyboard the chicken operates right here. There is a tiny pinhole with a flashing light behind it. Of course, the person can't see this light from the angle that they are viewing it. The chicken would actually peck out letters—it was actually typing—and it worked very well.

Marian

We discovered one neat feature in some of this research work, and that has to do with the "flicker fusion frequency" for the chicken. Their brain is much different from the human, so a light which would appear to be steady to a human is flashing to a chicken. We could give them signals in flashing lights that would appear extended to a human, but the humans had no idea we were giving signals to the chickens. It was particularly effective when light-emitting diodes came out. Otherwise we had to use neon.

International markets. During the 60s, 70s, and 80s, we went into the international market. This was a show we did for Canadian Expo '67. [*Piano-playing rabbit and dancing chicken; below is a miniature model of farm with buildings and chutes.*] The little show you see here going on at the top is the same show you saw at the IQ Zoo: the dancing chicken and the piano-playing rabbit. Down below is a rather futuristic farm scene where we had various animals performing their natural behaviors in a so-called farm setting. There was a duck that went down a slide, a pigeon that flew over onto the church roof and rang a bell. That pigeon, incidentally, was free to fly back to Hot Springs but stayed there and performed in Canada.

This is in Sao Paulo, Brazil, where we did shows for the park board there. [*Crowd watching as animals perform on busy street.*] This shows some of the adaptability of animals. They're just as adaptable here as people are, and they are able to perform even with all this commotion in the middle of the street. This is the Punch and Judy show in Mexico. [*Man standing behind counter with dancing chicken and piano-playing rabbit.*] We also trained a macaw show for Mexico, in the city of Monterey. [*Bird show.*] And this is a picture of the racing pigs, in Japan. [*Four pigs being released from racing gates by two men.*] These Japanese technicians are learning how to race the pigs.

The Misbehavior of Organisms. During all these years of teaching thousands of animals, for hundreds of different species, we couldn't help but learn a few things from them along the way. On the behavior side, the principles of operant conditioning worked for all the animals we tried to train. We were successful in modifying the behavior of almost every animal we tackled, although some presented some tough challenges. I say "almost" every animal—the reason we flunked out some animals was largely because of emotional reasons or other unsuitability.

On the misbehavior side, B. F. Skinner once remarked that animals never misbehaved. (That explains the title of our 1961 *American Psychologist* article, "Misbehavior of Organisms.") His point was that what is seen as misbehavior is simply a failure to control, manipulate, or at least recognize all of the variables. That argument we concur with—we believe in determinism, you might say—but Skinner missed our play on words from the title of his own book when we referred to "misbehavior." Of course we were making a pun on his own book title. Or if he got it, he chose to ignore it, which he sometimes did. At any rate, one important point that we did learn, particularly with things like the pigeons who were flying in front of convoys and some of the work we're going to describe here shortly, was that when you move outside the laboratory, and particularly out in the open field and sea and sky, there are many variables that are not accessible for manipulation and control. Just as with people in social situations, there are many, many external stimuli that you can't manipulate, and suitable reinforcements are

not always available. There are many things you just can't control or handle in open-field settings.

One of the things we learned when we started to deal with these species was the truth of Orwell's remark that "not all animals are created equal—some are more equal than others" (that was a remark from *Animal Farm*). You'll see along the way here, some are more equal. It has been commonplace for many years in psychology that not all stimuli are equally effective for an individual animal or a species. The range of various physical-energy spectra to which animals can respond has been the subject of intensive research for many, many years. We have made use of some of these capabilities in some of our work—for example, in the responses of dolphins, whales, and cats to ultrasonics, chiefly in signaling and guidance.

Some of this work we did at Key West. This is the Key West Navy dolphin facility, which we operated for a period of years. [*Aerial view of the ocean with beaches, pens, and facilities.*] These are the pens where we worked with the dolphins on preliminary work. See the dock there, large pens, and the open bay. (Over to the left are bunkers that held Polaris missile warheads, but they were well guarded.) Here we did a considerable amount of open ocean work. Bob was the director of this project.

Bob

I might mention that off to the left of the screen is a channel running to the open Gulf of Mexico, and to the right of the screen is a channel that runs to the open Atlantic. So we actually had access to very large bodies of water.

Marian

This is one of the very early mock-up guidance packages that we used with the dolphins. [*Person attaches a guidance device to a dolphin in the water.*] They're strapped on the dolphins' backs. They got much more sophisticated and much smaller as we went on, but it was a means of giving ultrasonic signals to the dolphin, and we used these in our guidance work with the dolphins.

Bob

For this particular project—and we can talk about this now—the principal object was to get the animal from Point A to Point B, and the routine distance from Point A to Point B was well in excess of a mile. The type of control was either by radar or satellite communications. Bear in mind that this was in the late 1960s, and at that time satellite communications were just really coming in, so we were very much state of the art.

Marian

As we described in our "Misbehavior of Organisms" article, for a given animal or species, not all responses are created equal, and some are much more easily conditioned than others. Some are virtually resistant to conditioning or modification. If you've read the article, you may recall the capsule-vending chicken. The chicken was supposed to take a little plastic capsule with a souvenir in it and knock it out of its slot. However, the

response of picking up the capsule and banging it was much stronger than pecking it out of its case for the visitor. We had to reduce the size of the chicken. We couldn't modify that behavior at all. The chicken would keep dragging these things inside the cage with her. She wouldn't get reinforced for it, but she kept doing it. So we got little baby chickens that couldn't pick up things quite as well.

Now this is a similar behavior. [*Pig carrying a gold nugget in mouth.*] Notice the pig's head is raised here. This is a mining pig. Its behavior is very similar to the piggy bank we describe in our article. The pig is bringing a nugget of gold out of the mine, and he is supposed to drop it down the chute and into the mining car, but again the pig roots this thing around, tosses it around. It's not as strong as with the piggy bank because that nugget is a lot bigger and heavier, so he doesn't tend to fool around with it quite as much.

Bob

That's one of the reasons we made it so big, so he wouldn't toss it around.

Marian

Once again, this is a much stronger response, this tossing and rooting it around, than putting it where it belongs. And as others have found, fear of storms in dogs (and people) and fear of snakes by monkeys (and people) are much easier to learn than some other phobias. A type of behavior that's easy to condition, or which appears strongly, we can see in this dancing chicken. [*Box with two compartments: left compartment contains a chicken on platform; right compartment dispenses food.*] This is the automated dancing chicken. All the chicken has to do is pull this loop and actually only stand on this platform for a given number of seconds and it will be fed. But the scratch response is so strong that it comes out anyway, so the chicken scratches and appears to dance. These are examples of several responses that seem to defy the laws of behavior.

The rabbit pictured here tugs repeatedly on the lever and keeps on tugging it even after the feeder has sounded and reinforcement is waiting for him. [*Two-compartment box, with rabbit in left compartment atop a toy fire truck; sign above reads, "The Rabbit Fire Chief."*] The animal isn't simply piling up more food. We tested that out. We let extra food drop through the cup, and it got only a small amount. Furthermore, in this particular setting, he only gets fed once, even though he keeps on tugging. This is another thing we learned from the animals: how the ecological niche shapes behavior. We found, in the case of herbivores, there's no hurry to eat. The rabbit can pull and pull on the lever, or pull and paw on the wheel of fortune. [*Wheel with numbers on it; rabbit to the left of wheel is spinning wheel with paws.*] This is the situation with this gambling wheel. It only needs to click the feeder once, but the rabbit will sit there and keep twirling and twirling that wheel for some time, even though it doesn't produce any more food.

Bob

The grass will not get up and run away.

Marian

Exactly, that is the point—that herbivores don't have to be in a hurry. Their food is not going anywhere. It will be there for them. The grass doesn't get up and run away. [*Large harmonica with cow behind it.*] You can't see the cow in this picture very well; it's rather dark. However, he is playing the harmonica, and all it has to do is stand there.

Bob

The cow plays the harmonica, and it sounds awful. (Laughter.)

Marian

Along these lines, we first tried to put a cow in an action sequence. The first thing we had in mind for an ad featuring a cow was to have a make-believe bullfight, which was kind of humorous—to have a real cow out there doing a bullfight. And we tried to get some action out of the cow, but it was in ludicrous slow motion. The cow just would not move, so we scratched that show. We decided to put cows, you might say, in sedentary occupations, where we had them more stationary.

The interesting thing is that when we came to dolphins and whales, we found the same thing applies. [*Dolphin in midair jump.*] This is evolutionarily interesting because the dolphins and whales are much more closely related to the big herbivores, like cattle, than they are to carnivores. Although the dolphins now are hunters and carnivores, many of their behavioral characteristics are much like those of cattle. For example, when they are fighting, their first response is a butt. They can rake with their teeth and they can bite, but they do a great deal of butting in their fighting, like goats and deer. When you try to do a high-jump act like this with dolphins and whales, and put them into situations where they have to put out a lot of energy and speed, it doesn't help at all to deprive them of food or try to run their drive up. [*Whale in midair jump.*] They don't respond to that; neither do cattle. They will not put out more intense or rapid behavior when they are terribly, terribly hungry than they will when they are just moderately hungry. It's interesting, and it fooled a lot of dolphin trainers for a long time.

Now, the sea lion is a different proposition. [*Sea lion, on pedestal, balancing ball on nose.*] The sea lion is an out-and-out carnivore. The sea lion is much more closely related to typical land carnivores like dogs and bears than it is to its cousins of the sea, the dolphins. They're not really cousins, and they may appear to be similar animals, but they're not really. The sea lion is a real carnivore, and he will bite the trainer.

Animal intelligence. When people ask a familiar question of us—"What animal is the smartest?"—they are really saying, "What animal is most like humans in many characteristics?" They are trying to compare animals using human-intelligence concepts, but intelligence is a messy concept. Sometimes people not only include the characteristics of learning in describing intelligence, but even things that we call emotional or moral or ethical properties. For example, narrators on television will say that the "animal misses its mate," or the "animal is grieving," or the "animal is trying to help." Or they will refer to the "noble eagle" and things of that sort. From our animal work, we have learned that some of the fundamental learning processes do

enter into a definition of intelligence: conditionability, rapid formation of discriminations, and probably the most important, generalization, in terms of making the same response to different stimuli (stimulus generalization) as well as modifying a response to the same stimulus (response generalization). But basically, when people ask us what is the smartest animal, we like to answer that every animal is the smartest for the ecological niche in which it finds itself. Otherwise, it wouldn't be there.

But we can, as other people do, compare animals to people, so let's first discuss some of the "bird brains" of the animal world. [*Black swan next to white balls/eggs on ground.*] We speculated that the swan's brain is so far away from its body, that by the time the message gets to its body, it doesn't know what to do anymore. Here's another one, a peacock. [*Peacock with bell above its head.*] With great difficulty we trained this individual to ring a bell. We have no explanation for this—it looks very much like a chicken or a turkey, but we think all its brains are in its tail feathers.

At any rate, here are some of the geniuses of the bird world. This is the hyacinth macaw. [*Macaw and white board with red square, yellow star, and blue circle; bird is lifting knob on blue circle.*] They are a very rare macaw. We have no reason to believe that this hyacinth is any more intelligent than any of the other macaws, but members of the parrot family are extremely capable birds. [*Macaw riding bicycle across tight wire.*] They compare favorably, in terms of "intelligence," in quotes, to many of the mammals, such as a cat or a dog, than they do to many of the other birds. The cockatoo is another bird in the parrot family, and they are very smart. [*Cockatoo riding a scooter.*] Here is a bird on a scooter. The cockatoo works the scooter as a child would, with one foot on the ground and one on the scooter.

This is the apparatus I used in my dissertation research on the visual acuity of animals. [*Equipment for discrimination task.*] I am bringing this up in this context because this involved a very difficult discrimination. I wound up with some rather inconclusive results in my dissertation. I believe this was due not so much to visual acuity per se, but also to the ability to master this complex discrimination, which was between vertical and parallel lines and requiring a matching response. This is the target, which consisted of lines. These are very big, parallel, and they got smaller and smaller. [*Target with black and white horizontal stripes.*] I actually moved the target down the end of the field about two football fields, and the only animal that finally would be able to make the discrimination was the raven. [*Raven sticking head through hole in box, making a selection response of the disk on the left.*] This is a Western raven. They certainly had extremely good vision at a distance, but I think that part of their ability was not only good vision but also being able to keep up with this complex discrimination task. I did other species as well. This is a herring gull. [*Herring gull sticking head through hole in order to make selection response.*] They bombed out midway in the experiment.

Now, a raccoon is certainly a very, very capable animal. [*Raccoon putting basketball into hoop.*] They are among the brightest of the animals, very much like bears, and certainly up there with dogs and cats. They are good problem solvers.

And the pig, the pig is a very capable animal. [*Pig standing on hind legs playing a piano.*] Incidentally, you might be interested to know that the piano is made of quarter-inch plate steel and the keys are cast aluminum.

Bob

And it was only good for one season.

Marian

Anybody who's been a farmer and tried to raise pigs will know what I'm talking about. They tear up anything. Again, this does not speed up their reinforcements.

Avian behavior. Way back in the 1950s—in fact this was some of our introduction to ethology—we learned a lot about the importance of early attachment on social adjustment. We learned it with ducks. [*Duck in model boat, paddling.*] We got supposedly tame ducks from farmers. They had been out in the yard with other ducks, but we could not train them in a human setting. They wouldn't come near a human being; they would be terrified and tried to "duck out." About this time, we encountered the works of Konrad Lorenz, the ethologist, and we learned about the importance of imprinting for certain breeds of animals. After we imprinted the ducklings, we took them at one-day-old and farmed them out to schoolchildren who raised them so they'd be nice and tame for human beings. We found also that many other animals have to be similarly imprinted if they're going to work satisfactorily with humans. They have to think of the human being as their parent.

Ever since that time, before we try working with a species, we evaluate it in regard to these characteristics. In some animals that is necessary, and we have learned, of course, that there are different critical periods. With ducklings and goslings, it's the very first few hours after hatching. This is an albatross. [*Albatross flying.*] I will show you some work we did on Midway Island, the naval station there. Nobody had successfully raised albatrosses, not even the people on Midway. Part of it was a dietary problem, and we conquered that, but it's also important to imprint them. So we worked with the tiny albatrosses (but they were still big even when they were infants). This is the baby. [*Single albatross.*] It looks rather like Big Bird, and they are big. They grow very fast. This is about the age when it is good to take them from the nest. This mama is feeding her baby. [*Mother bird feeding fuzzy albatross.*]

Bob

Look how tidy that is. She feeds him without spilling a drop.

Marian

It's regurgitation of partly digested food, squid. Now, we tried this, and we succeeded too, but it wasn't anywhere near as neat. [*Man feeding albatross.*] Here's one of our trainers feeding the baby.

Bob

By the time you were finished, you were covered head to foot with this horrible mixture of ground-up squid, vitamin E, and mink oil. If you ever had a date scheduled for that evening, you'd just forget about it.

Marian

Our trainers spent quite a lot of time in purgatory. This is a young cormorant. [*Marian bending over baby cormorant.*] Cormorants are not like ducklings—you don't have to get them when they are just a few hours old. The critical period for birds of this sort, the so-called altricial birds that spend some time in the nest, is to get them just before they are ready to leave the nest. So you have to identify that critical time. You can tell if you go up to a nest of young cormorants and they scream and turn their heads away and try to get out of the nest and run away from you, it's too late. They are already imprinted to the mother. But if you get them, and they reach up and open their beaks and want to be fed, you got them where there is still time left to do something.

These are herring gulls, which again we got for a Navy project. They're just getting out of the nest. [*Nest with baby gulls.*] Let's see, here is one just peeping out, here's one that is still wet, and here's one that is pretty well fluffed out. The critical time period is within four to 16 hours. If you take them too soon, they are too wet and lean for survival. So we collected these for a Navy project, which proved to be one of the most interesting things about socialization that we were able to do. Here we're transferring some young herring gulls to Hot Springs from Massachusetts. [*Cardboard box of baby birds; Marian tending birds.*] We transported them aboard American Airlines, and they were very glad to get rid of them.

Anyway, this is a juvenile herring gull—we raised these from an early age. [*Gull removing ring from life-size dummy of man wearing life jacket.*] Here we have a dummy. This project involves the bird flying out over the open ocean and picking up a marker in the form of a ring from a downed airplane pilot or something of that sort. We used the dummy here to start with. Returning with the ring was an arbitrary response, so we could tell, even if the bird had flown out of our sight, whether we had done something right.

Bob

Later on the bird would carry a transponder that we tracked by radar.

Marian

At any rate, here we're training a gull to pick up the ring. This is a young bird. How old would you say this bird is?

Bob

I'd say about 9 months old.

Marian

They had a lot of flight training. These were all trained by hand. Here we substituted a person for the dummy. Here it is taking the ring from the person. [*Herring gull on platform, removing ring from hand of trainer.*] This is a little automated boat. [*Bird atop a small wooden boat on wheels; boat sitting in grass.*] That was in our pasture. We had a pond in the pasture. It was an automated radio-guided boat. We built it ourselves. [*Miniature boat in water, to the left of a standard-size boat.*] Here the bird is carrying the ring, and this

is out on Lake Hamilton where we did some of our work. [*Bird taking flight from side of boat in water.*] It is leaving the boat to go hunt for the dummy in the water. (We had a lot of people trying to rescue our dummy, too.)

Bob

When the dummy was located at a distance of a mile and a half to two miles from the boat, some search patterns went on for 45 minutes, and we had no idea where the bird was because we'd lose the bird at a half mile. We could not see the bird from beyond a quarter to a half a mile, so the fellows would play solitaire or poker on the boat while they'd wait for the bird to come back.

Marian

Now, this is where we transported the project to San Diego, and we are turning it over to Navy personnel. [*Bird with ring in beak, returning to boat in San Diego Bay.*] Point Loma is off there in the background. Here the bird is bringing a ring back to our boat. You can see the series: Here we are putting the dummy in the water. [*Man placing dummy with life jacket into water.*] Our boat goes off and leaves the dummy floating, and you can see the ring in the dummy's hand. [*Dummy floating in water.*]

Bob

Again, the reason for the ring is so that we don't have to have the boat around to identify exactly the time when it's picked up. If the bird does not come back with the ring, it meant the bird did not find the target.

Marian

Here's the bird leaving the boat out of San Diego Bay, flying out over the ocean, finding the dummy, picking up the ring, flying off with the ring, and flying back to the boat. [*A series of slides of the bird leaving the boat, flying near boat, flying over dummy, landing on dummy, flying away from dummy, and landing on boat.*] Now this is the interesting part that I'm going to comment on later. It is being pursued by the enemy. The enemy are gulls native to the San Diego coast there. Our bird is a foreigner here. It is an Atlantic species. The enemies are in hot pursuit, and there are several of them, and they certainly would have beaten up our bird. So the bird is making tracks for our boat, coming into the boat and landing. [*Bird landing on platform on boat.*]

Now here is another shot where we launched them from the shore. [*View of Pacific Ocean with person on shore, releasing bird from box.*] The bird, where is the bird?

Bob

Can anyone find the bird here? The bird is right here (points to infinitesimal point on ocean), and the target is somewhere out here, about four or five miles out to sea (points to horizon of ocean). We tried releasing the bird from the shore. The bird had never done it from the shore before, but it solved the problem without any problem.

Marian

The important point about this is, and we discovered this while we were working on Lake Hamilton when one of our gulls was attacked by an eagle. Bald eagles are still fairly common around Lake Hamilton, and this bird was attacked while bringing the ring back to the boat. The bird was still quite a ways from the boat, and the eagle repeatedly dove at the bird, but the bird kept flying on. It was hit by the eagle three times and driven into the water, but it got up out of the water. It never let go of the ring. It came back and finally made it to our boat. Just as it got to the boat, the eagle made a final pass at it and actually succeeded in piercing the gull's lung. It went that deep.

Bob

Actually, it completely penetrated the body of the gull where the talon came out the breastbone.

Marian

Yeah, the bird never let go of the ring, and it got back into our boat. We took it for emergency surgery, which was performed. The veterinarian stitched it up, and it lived to fly again, and it went right back to work. The point I am trying to make is this: All of this would not have been possible, including the vast distances, if the bird had not been thoroughly socialized to humans.

This sheds some very interesting light on some other social animals. Horses, dolphins, and even elephants you can take as adults from the wild and socialize them to people. Now, this is not true of many species, so you have to know what species you are dealing with. We mentioned that the gulls, ducklings, sheep, and many other species have to be imprinted at an early age. Yet, when they are socialized, they will do remarkable things. We say "for their humans," but we don't know exactly what is going on here, and we certainly need to understand the process a great deal better than we do. Why should the elephant, for example, tolerate these little goads and things like that? Why would an elephant do anything for a man? Here is the man, the elephant can pick him up, throw him around, kill him instantly, but it will let the man get up on his trunk, get up on his back, and why this happens, we really don't understand.

We are beginning to understand how important the attachment process is for human beings, the fact that there are critical periods in human attachment as well as for other animals. It is very important for our understanding of human social relationships to understand the importance of this process. Because without it, I think, we are doomed to no society at all. The importance of the attachment is such that if children are not firmly attached to adults in their infancy, they are not going to be desirable social citizens or even functional social citizens when they grow up. And so, some of the things the animals have shown us are extremely important. They certainly need to be verified and expanded at the human level, but it's been a very instructive process.

For the next two slides, you are challenged to identify the participants. [*B. F. Skinner facing Bird Brain exhibit while talking to Bob and Marian Bailey.*] One participant you can't see. Bird Brain is over here in the box on the right.

Bird Brain plays tic-tac-toe with humans. This was taken at the annual meeting of the Association for Behavior Analysis.

Bob

And there is B. F. Skinner losing to Bird Brain. [*B. F. Skinner making selection on Bird Brain panel.*] If anyone knows tic-tac-toe at all, you know that the move Skinner has just made is the wrong move.

Marian

He lost several games to Bird Brain. After several games, he said, "I thought I knew how to play tic-tac-toe." The next year we brought the bird back, but Skinner said he had practiced tic-tac-toe during the previous year just in case we decided to bring the bird back.

This is the final scene. [*Parrot on back, holding up a flower with its feet.*] Thank you all very much.[5]

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5 Until her death in 2001, Marian continued to make similar presentations to university students and to conduct operant conditioning workshops throughout the United States, always in the company of her husband. Today, Bob remains active in the field of applied animal psychology and ethology, presenting animal training workshops worldwide and consulting for a variety of animal-related businesses and governmental agencies.