OPERANT PSYCHOLOGY MAKES A SPLASH—IN MARINE MAMMAL TRAINING (1955–1965)

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Despite the wide spread use of operant conditioning within marine animal training, relatively little is known about this unique application of behavioral technology. This article explores the expansion of operant psychology to commercial marine animal training from 1955 to 1965, specifically at marine parks such as Marine Studios Florida, Marineland of the Pacific, Sea Life Park, and SeaWorld. The contributions of Keller and Marian Breland and their business Animal Behavior Enterprises (ABE) as well as other early practitioners of behavioral technology are reviewed. We also describe how operant technology was introduced and formalized into procedures that have become the cornerstone of marine animal training and entertainment. The rapid growth of the marine park industry during this time was closely linked to the spread of behavioral technology. The expansion of operant training methods within marine animal training is a unique success story of behavioral technology. © 2014 Wiley Periodicals, Inc.

Many of us enjoy observing animals and animal behavior during visits to zoos, wildlife parks, animal refuges, and circuses. The public's affinity for animal entertainment is particularly apparent in the popularity of marine animal shows at aquatic parks like SeaWorld and Discovery Cove. Since its opening in 1964, SeaWorld San Diego boasts more than 130 million visitors ("History of the Park," 2011). Shows featuring dolphins leaping through hoops or over high bars and trainers riding killer whales are standard at today's marine animal parks. "Shamu" and "Flipper" have become part of the American lexicon and have helped sparked the public's interest in marine life and conservation. Sixty years ago however, training a dolphin, an aquatic animal that could easily swim away from its human trainer at will, posed a serious challenge to animal trainers. Such a problem was addressed nicely by the expansion of operant conditioning into marine animal training. Yet the history and development of the training techniques still used by these popular displays are relatively unknown.

The spread of operant psychology from the research laboratory to applied areas is a popular topic among historians of psychology. Applications such as the air crib (Benjamin & Neilson-Gammon, 1999), teaching machines (Benjamin, 1988), Project Pigeon (Skinner, 1960; Capshew, 1996), and behavior modification (Krasner, 1990) have been discussed at length. A special section of *The Behavior Analyst* (Pilgrim, 2003, pp. 233–295) was devoted to the

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expansion of behavioral psychology to pharmacology (Laties, 2003), the Yerkes Primate Lab (Dewsbury, 2003), and psychiatric research (Rutherford, 2003b). Rutherford (2009) further explored the expansion of behavioral technology in a variety of areas, including prisons, psychiatric units, autism, self-help, and communities based on Skinner's *Walden Two* (Skinner, 1948). With the exception of Capshew (1996), these historical accounts largely focus on human applications or on areas relevant to academic research (primate studies, pharmacology, etc.).

The use of behavioral technology in the area of applied animal psychology (animal training) has been less well documented, despite its success. Rutherford (2009) acknowledged this absence in the historiography, pointing out that although Skinner's experimental analysis of behavior was developed through extensive use of pigeons and rats in operant chambers, histories of its applied expansion have largely focused on human, rather than animal, behavior change efforts. Morris (2003) noted that with a few exceptions "the relations between animal training as a profession and behavior analysis as a discipline were not much evident until the 1990s" (p. 283). To begin to address this gap in the historical literature, the first and third authors published an account of the successful work of Keller and Marian Breland and their business, Animal Behavior Enterprises (ABE), to train animals for advertising and entertainment during the mid-twentieth century (Bailey & Gillaspy, 2005).

The purpose of the current article is to add another chapter to the history of the expansion of applied behavioral psychology to commercial animal training from 1955 to 1965. Specifically, our focus is on the first applications of behavioral technology to training marine animals by ABE at Marine Studios of Florida[1] and Marineland of the Pacific (MOTP). Although ABE is largely responsible for the introduction of behavioral technology to marine animal training, the Brelands were not the only practitioners of operant conditioning within the industry. Thus, we also describe the introduction and subsequent adoption of behavioral methods at two other prominent marine parks, Sea Life Park in Hawaii and SeaWorld in California. We propose that the effectiveness and efficiency of operant methods were key to its rapid spread throughout the marine animal industry.

Today, marine animal training is unique as perhaps the only area of animal training in which behavioral technology has become the dominant training paradigm. To understand the use of behavioral methods with marine animals however, it is important to review the early movement of behavioral science from the laboratory to applied animal behavior and the early development of the marine park industry. Thus, we begin with a brief account of the development of applied animal psychology in general and operant marine animal training, in particular.

APPLIED ANIMAL PSYCHOLOGY

Project Pigeon, Skinner's World War II effort to develop an animal-based (pigeon) missile guidance system, is widely acknowledged as the pivotal event that gave rise to applied behavior analysis (Skinner 1960; Capshew, 1996). Working on the top floor of the General Mill Utility building in downtown Minneapolis, Minnesota, Skinner and several graduate assistants, including Norm Guttman and Marian and Keller Breland, trained pigeons to peck a screen which activated a guidance mechanism that could steer a missile to an actual target. The pigeons were very accurate in lab testing, but the National Defense Research Committee was skeptical and the project was terminated in December 1943 before being fully developed.

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1. The name, Marineland, was often used to refer to either Marine Studios, as in Marineland of Florida or Marineland of the Pacific. Marineland was actually both the name of the town in Florida, in which the park was located and later the name of park itself. Gradually the name Marine Studios was dropped in favor of Marineland of Florida. In this article, we use the name Marine Studios to differentiate it from Marineland of the Pacific.

Although Project Pigeon was never operational, the experience had profound effects on Skinner and the Brelands (Capshew, 1996; Peterson, 2004; Bailey & Gillaspy, 2005). Both were convinced of the potential applications of operant principles and behavioral technology. See Peterson (2004) for an enlightening examination of the importance of the first use of hand shaping during Project Pigeon. Describing the significance of Project Pigeon, Skinner (1979) stated, "The research that I described in *The Behavior of Organisms* appeared in a new light. It was no longer merely an experimental analysis. It had given rise to a technology of behavior." (p. 274). Such technology could be used to solve real world problems and improve society. The remainder of Skinner's career was largely defined by his advocacy of the application of operant principles and technology to improve the human condition (Capshew, 1996; Rutherford, 2009).

Although similarly impressed by the powerful potential of the behavioral technology operationalized during Project Pigeon, the Brelands took a different path. In 1944 they made the drastic decision to leave the University of Minnesota without completing their doctoral requirements and to pursue the application of operant psychology to commercial animal training. They purchased a small farm in Mound, Minnesota, and began training a variety of animals for advertising and entertainment purposes. They called their business ABE and in 1947 secured contracts with General Mills Inc. to train barnyard animals for the advertisement of Larro Farm Feed (Breland & Breland, 1951). The Brelands moved to Arkansas in 1950 and soon after opened the I. Q. Zoo, a popular tourist attraction in Hot Springs, Arkansas. ABE expanded into a variety of entertainment endeavors and government work, eventually employing over 40 individuals before closing its doors in 1989 (Gillaspy & Bihm, 2002).

The Brelands reported their initial success in a 1951 *American Psychologist* article titled, "A Field of Applied Animal Psychology." By harnessing the power and precision of Skinner's behavioral technology, they proposed that applied animal psychology "brings together the two formerly unrelated fields of professional animal training and modern behavioral science" (Breland & Breland, 1951, p. 202). In the article, the Brelands also called on academic psychology to become more involved in applied animal work. In the same year, Skinner (1951) also described the application of operant methods to animal training in *Scientific American*, further demonstrating the potential applications of behavioral science to animal training. The following year Skinner even presented a "live" demonstration of operant training, shaping a dog to jump up a wall on command (Harvard trained dog, 1952). See Peterson (2001) for an excellent review of the significance of this event. The Brelands also patented and promoted a dog training program called *Master Mind*, an early version of clicker training in the late 1950s and early 1960s (Breland & Breland, 1955, 1958, 1962). The profession of animal training seemed poised for an operant revolution.

Unfortunately, it was not until the 1980s that behavioral methods found some measure of acceptance within the animal training profession; most notably in dog training (Pryor, 1984, 1999; American Veterinary Society of Animal Behavior, 2007). Karen Pryor (1984) popularized behavioral technology for the dog training community with the publication of *Don't Shoot the Dog!* She emphasized positive reinforcement, shaping, and the bridging stimulus (in the form a clicker) over the use of aversion and punishment. Prior to this, dog training methods often lacked empirical support (Hiby, Rooney, & Bradshaw, 2004) and relied heavily upon aversive techniques, many of which are still in use today (Lindsay, 2005; Millan & Peltier, 2007). In the 1990s, the Applied Animal Behavior (formerly, the Trainers Forum) Special Interest Group of the Association for Behavior Analysis International (ABAI) was established to formalize relationships between behavioral analysts and the animal training profession (Sobie, 2009). This group continues to be very active within ABAI.

FIGURE 1.
Bob Bailey, first Director of Training of the U.S. Navy Marine Mammal Program, at the U.S. Navy Dolphin Facility, Pt. Mugu, California, circa 1964. Retrieving objects on command was a simple task taught all of the Navy's dolphins. The ball retrieval exercise is an early stage of object retrieval under stimulus control. Photo courtesy of Bob Bailey ScD, Animal Behavior Enterprises, Hot Springs, Arkansas.

OPERANT MARINE ANIMAL TRAINING

Although the widespread application of operant conditioning to animal training and behavior would largely go unrecognized and unrealized for nearly three decades, one exception was in the area of marine animal training. During the 1950s and 1960s behavioral technology became the primary approach for training dolphins, whales, and other marine animals at Marine Studios, MOTP, and the U.S. Navy[2] (Bailey & Gillaspy, 2005). The Brelands and ABE played a major role in this expansion, adapting operant methods for use with aquatic animals, writing the first manuals for training dolphins and whales (Breland, 1955a, 1957), creating and scripting shows, and actively training others in operant technology (see Figure 1). The use of operant training at other marine parks such as SeaWorld in California and Sea Life Park can also be traced back to the influence of ABE. At Sea Life Park in Hawaii, Karen Pryor was introduced to operant training methods by Ken Norris, who worked with the Brelands while Curator at MOTP (Norris, 1956; Pryor, 1975). Kent Burgess, Director of Animal Training at SeaWorld (1964 to 1971), began his career at ABE and learned operant conditioning from the Brelands (Bailey & Bailey, 1992a, 1992c). The rapid growth of the marine animal training industry can be closely linked to the spread of behavioral technology and the unique niche filled by marine animal entertainment.

Despite the important role played by operant psychology in the development of marine animal training, it is a relatively unknown part of the history of psychology. With the exception of Gillaspy, Bailey, and Anderson (2008), there are no published accounts of the first

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2. Although beyond the scope of the current article, behavioral technology played an important role in the development of the U.S. Navy's Marine Animal Program in the 1960s. The Brelands first introduced operant techniques to the U.S. Navy and served as consultants from 1962 to 1965 (U.S. Naval Ordnance Test Station, 1962; Bailey, 1965). The 3rd author was the Director of Training for the Navy program during this time and learned operant techniques directly from the Brelands. Critical to the success of the U. S. Navy program was the training of the trainers, many of whom transferred their knowledge of operant training techniques to marine parks. Given the high profile use of dolphins and other marine animals by the Navy (e.g., SeaLab, mine detection, harbor patrol, etc.), this is another fascinating and untold story of the expansion of operant psychology.

applications of operant psychology to marine animal training in the 1950s or the initial spread of behavioral technology within the marine park industry. Most of the history of marine animal training has been passed down orally or through brief mention in books about dolphin training (i.e., Pryor, 1975; Defran & Pryor, 1980; O'Brien, 2004; Messinger & McGinnis, 2011). From these accounts, one might be left with the impression that operant conditioning was not used until the 1960s or 1970s. Another misconception is that behavioral methods were an adaptation or refinement of traditional circus methods (Davis, 1997). Although these methods have a place in the history of marine animal training, it was operant training that played the more substantial role in aquatic animal entertainment.

Research on the history of operant psychology within marine animal training is complicated in that few early marine parks maintained or preserved records to the present day. Over the years, much of the early history of the industry has been lost or destroyed; death of key personnel, facility closings, fires, and hurricanes have been especially devastating. Fortunately, some primary sources have survived. For this article, data[3] were collected from a variety of sources including archives, personal papers of key individuals, and oral histories. In addition, the 3rd author, Bailey, witnessed or participated in the spread of operant technology in many of the venues described and is thus an invaluable primary source. To provide additional context for the impact of behavioral technology on marine animal training, we provide a brief description of the initial attempt to train dolphins for public performance at the world's first oceanarium, Marine Studios.

MARINE STUDIOS: THE WORLD'S FIRST OCEANARIUM

The forerunner of all modern marine parks was Marine Studios located near St. Augustine, Florida. Opened June 23, 1938, Marine Studios featured two large salt water tanks designed by Florida architect, Fred Henderich (Hill, 1956). Visitors could view of a variety of marine animals through a series of windows below the waterline and from an observation desk around the top. Two of Marine Studio founders, Douglas Burden and Ilia Tolstoy, coined and copyrighted the term, "oceanarium" to refer to this " . . . aquarium in which the species are not segregated – one which approximates the appearance of the bottom of the sea" (Hill, 1956, p. 23). Although originally designed as an underwater movie studio and marine research and education center, Marine Studios quickly became a popular Florida tourist attraction. During World War II, Marine Studios was closed to the public but operated as a marine research laboratory. After reopening in 1947, tourists also returned; the park averaged half a million visitors per year between 1947 and 1956 (Nessler, 1955).

Of the many ocean creatures on display at Marine Studios, the common Atlantic bottle-nosed dolphin (*Tursiops truncatus*) was especially captivating to the public (McBride, 1940). The first major dolphin attraction was the Top Deck Show, in which personnel in sailor uniforms and designated as "Jump Masters" leaned out over the water-holding fish, enticing the dolphins to leap into the air. Dolphins could often be seen taking fish right out of the mouth of a Jump Master or from the hand of a famous celebrity (Hill, 1956). Unintentionally, these Jump Masters used a primitive or at least undocumented, form of shaping by requiring increasingly higher and more varied jumps (such as flips) from the dolphins.

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3. Data were collected at the Breland-Bailey Papers, Marineland's Dolphin Conservation Center Archive, St. Augustine Historical Society, Miami Seaquarium, and the Kent Burgess Papers. The Breland-Bailey Papers are a collection of personal papers, correspondence, and other materials of ABE. Marineland's Dolphin Conservation Center Archive is a collection of documents and artifacts from Marine Studios. Primary sources also include oral history interviews with Kent Burgess, Marian Breland-Bailey, and other marine trainers.

FLIPPY: THE WORLD'S FIRST TRAINED DOLPHIN

Visitors to Marine Studios were also fascinated by the dolphins' behavior between the jump shows. The dolphins often played with sticks, balls, or inner tubes and initiated games of fetch with visitors (Rolleston, 1949a). In response to the popularity of these behaviors, Adolf Frohn, a German sea lion trainer with Barnum and Bailey and Ringling Brothers Circus, was hired to train the dolphins to play with inner tubes on command (Rolleston, 1949b). Although Frohn had never seen a dolphin before, he agreed to try.

Frohn's initial effort to train a group of dolphins was unsuccessful, but prompted the training of an individual dolphin beginning in September 1949 (Rolleston, 1949c). The subject was a newly captured 150 lb., two-year-old male, named Flippy (Hill, 1956). Frohn's first tasks were to get Flippy to accept fish from him and to remain in his presence. Fearful of unfamiliar objects and situations, newly captive dolphins often ignore or avoid fish offered by their keepers or thrown in their tanks (Brown, 1960; Pryor, 1975). Frohn needed a way to stay in physical contact with Flippy. Thus, Flippy was transferred to a lagoon behind the Marine Studios laboratory and Frohn rowed a small boat into the lagoon to remain in close proximity (Hill, 1956). In February 1951, after 22 months of training, Marine Studios announced to the public the world's first trained dolphin (Anderson, 1951; "Flippy, The Docile Dolphin," 1951). Flippy's ability to learn surpassed expectation. Flippy did six "tricks" —ring a bell, honk a bulb horn, catch and retrieve a ball or stick, raise a flag, pull a surfboard ridden by a dog or young woman, and jump through a paper-covered hoop emblazoned with the Marine Studios logo (Hediger, 1952; Rolleston, 1955a; Hill, 1956).

The entertainment value of a trained dolphin was obvious; however, Marine Studios also strongly emphasized the scientific nature of Flippy's training (Dillin, 1952; Dempewolff, 1952). The training was framed as an experiment of dolphin intelligence and connected with previous dolphin research (McBride & Hebb, 1948; McBride & Kritzler, 1951). Although Marine Studios denied plans to regularly exhibit Flippy, there were frequent demonstrations for dignitaries and for the press (Hediger, 1956). This type of association between science and entertainment would become standard marketing practice in the animal theme park and entertainment industry (Mitman, 1999).

Despite Marine Studios' proclamation of Flippy's training as a scientific experiment, Frohn was unscientifically secretive about his training methods (Dillin, 1950, 1952). Frohn was a trainer from the circus tradition, which operated on a guild system of passing down the craft from master to student over a long period of apprenticeship. A fourth-generation circus trainer who was reportedly born in the back of a circus wagon, Frohn learned the animal training trade from his father, also an accomplished sea lion trainer ("Adolf Frohn," 1951). The younger Frohn developed his own act and toured with his father throughout Europe and Asia (Conklin, 1961). In the circus training tradition, Frohn trained his animals in private and kept no training records or written instructions that might reveal his methods. In addition, his assistants did not participate in any actual training, rather Frohn insisted they "serve only in a passive capacity" (Dillin, 1950, p. 2). This included preparing fish, handling equipment, cleaning up, and doing other chores.

Some understanding of Frohn's methods can be ascertained from Marine Studios' press releases, photographs and internal memos, as well as from descriptions of contemporary circus training methods (see Hediger, 1952, 1956; Messinger & McGinnis, 2011). By all reports, Frohn disavowed the use of any form of punishment or physical deprivation (Dillin, 1950; Hediger, 1952; Hill, 1956). This philosophy is realized in techniques that utilize positive reinforcement more formally. He also stressed the importance of the animal-trainer

relationship. Trust, affection, and patience were viewed as the cornerstones of a productive training relationship (Conklin, 1961).

It is also clear that Frohn, like most successful animal trainers, understood the value of food as a reward. In circus training, however, rewards were given after completion of a complete behavioral sequence (e.g., catching a ball) as opposed to the intentional reinforcement of discreet behaviors that were shaped into a final target behavior (Hediger, 1952). While he was most certainly rewarding desired behaviors, there is no evidence that suggests that Frohn had knowledge of the distinction between reinforcement and reward. To obtain desired behaviors, Frohn used a technique called "putting the animal through the action," which involved either physically manipulating an animal to perform the behavior or coaxing it through the behavior by leading with food (Hediger, 1952). Since physically manipulating a 250 lbs dolphin in the water to jump through a hoop or catch a ball is virtually impossible, leading with food was the preferred method. In a rare instance of professional courtesy, Frohn allowed the U.S. Navy Director of Training, (the 3rd author) to witness one of his training sessions with a dolphin. Specifically, Frohn repeated the word "turn" while spinning in place as the dolphin watched. Finally, pictorial evidence suggests that Frohn also used a form of gradual approximation (Messinger & McGinnis, 2011). Photos taken at different points during training show Flippy swimming through a hoop held underwater, then slightly out of the water, and eventually three feet above the water. Similar to Mountjoy et al.'s (1969) analysis of traditional falconry, Frohn's methods seem to represent an undocumented method of shaping adapted for use with dolphins. And while these produced consistent tricks and behaviors, a more formal system was needed to tap into the dolphin's full potential.

The difficulties of developing a trained dolphin show soon became apparent. Flippy experienced a variety of health and behavioral problems and his public performances became sporadic (Marine Studios, 1955). In 1952, Frohn began training an understudy named Splash (Marine Studios, 1959). Progress was slow. Splash learned only a few tricks, including raising a flag, retrieving objects, shaking hands with his flipper, and vocalizing on command ("Porpoise Training School," 1954). Perhaps acknowledging the unreliability of their performances, a Marine Studio press release stated, "While this feature [*the trained dolphin act*] is not a part of the regular show, visitors . . . ..can now watch the four workouts held daily except on Saturdays" ("Porpoise Training School," 1954, p. 1). A more serious difficulty was Frohn's secrecy about his training methods. Since Frohn did not share his methods with management, Marine Studios was totally dependent upon him to produce the show. When management refused to meet Frohn's salary demands, he resigned in spring 1954 (Rolleston, 1954). In February 1955, he was hired as Training Director at one of Marine Studio's newest competitors, Miami Seaquarium. Frohn's assistants, newly elevated to trainer status, continued to present shows, but were ill-prepared to solve training problems or produce new behaviors (Rolleston, 1961a). By early 1955, Marine Studios' dolphin show, which had become their premier attraction, was in serious trouble.

OPERANT PSYCHOLOGY COMES TO MARINE STUDIOS

The Brelands came to the attention of Marine Studios' General Manager, William F. Rolleston, through popular media coverage of ABE. ("Farmyard students," 1955; "I. Q. Zoo," 1955). In April 1955, Rolleston invited the Brelands to visit Marineland "to observe our porpoises and to offer suggestions as to training methods and additional acts that the porpoises might be taught to perform" (Rolleston, 1955a, p. 1). Like Adolf Frohn, the Brelands had no previous experience with cetaceans or marine mammals, however they already had broad
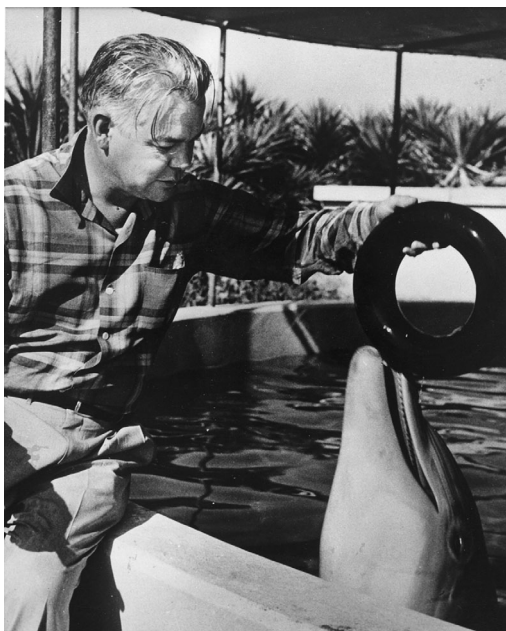
FIGURE 2.
Keller Breland, President of Animal Behavior Enterprises, at Marine Studios (now Marineland of Florida) in 1957.
Breland and his wife Marian Breland were the first to apply a systematic operant conditioning program with dolphins,
whales, and sea lions. Photo courtesy of Bob Bailey ScD, Animal Behavior Enterprises, Hot Springs, Arkansas.

experience with many species of birds and mammals (Breland & Breland, 1951; Bailey & Gillaspy, 2005).

After an initial visit in late April 1955, the Brelands quickly adapted operant methods for dolphins. In June, they signed a one-year contract for $5000.00 to begin a training program, which included developing and training new behaviors, designing props, providing written training manuals, and instructing Marine Studios staff in operant methods (Breland, 1955b). Due to his poor health, it was decided that Flippy would receive no further training (Breland, 1955c). Flippy died two months later on August 1, 1955 (Marine Studios, 1955). In contrast to Frohn, K. Breland began by training two of Frohn's assistants, Andre Cowan and Henry Czarotta, in operant conditioning (Rolleston, 1955b). Working with Splash, K. Breland demonstrated the use of the bridging stimulus to shape and more precisely control behavior (see Figure 2). A bridging stimulus is a signal (whistle, click, etc.) that acknowledges to the animal that they have responded correctly at the moment they respond. This allows any number of signals to serve as a sort of bridge between the desired behavior and the delivery of the reward (Breland & Breland, 1966; Pryor, 1984; Ramirez, 1999). This immediate feedback not only expedites learning but is crucial in maintaining focus when working with an animal across some interval of time or physical space that makes immediate reinforcement impossible. Clicker training is one example of a bridging technique. Training also began with three additional dolphins; Algae, a young male born at Marine Studios and two newly captured dolphins (Breland, 1955d). Although Splash's performances became more reliable, training new behaviors to improve show quality proved difficult for Marine Studios trainers.

In September 1955, K. Breland sent ABE's Head Trainer, Kent Burgess, to Florida to speed up the program (Rolleston, 1955c). As a student in the master's program in psychology

at the University of Arkansas, Burgess interned at ABE during the summers. After graduation in 1954, he was hired full-time at ABE. A farm boy from Tennessee, Burgess combined an interest in animals with the skills of an experimental psychologist. At ABE, he quickly became a proficient trainer. In three weeks, Burgess taught Splash eight new behaviors and Algae 11 new behaviors (Breland, 1955e). Reporting Burgess' success, Keller stated, "... with the method we have employed [*operant*] a tame healthy porpoise can be trained to show standards in a few weeks" (Breland, 1955e). In less than six months after hiring the Brelands, Marine Studios' dolphin show was back on its feet (or flippers, so to speak) with twice as many behaviors and a reliable replacement.

The importance of ABE (and operant psychology) for maintaining show quality and producing more spectacular acts was immediately evident to Marine Studios' management. Douglas Burden pushed General Manager Rolleston to sign the Brelands to a long-term contract (Carter, 1956). Acknowledging ABE's services as "... based upon highly specialized skills and experience, and that such services are unique and irreplaceable," Marine Studios signed ABE to a six-year, $30,000 exclusive contract (Marine Studios, 1956, p. 4). ABE agreed to provide Marine Studios "the exclusive right to all its [*ABE's*] services in the training, care, handling and exhibition for instruction and entertainment of fresh and salt water porpoises, dolphins, and other cetaceans, and to its services in furnishing advice and instruction with respect thereto" (Marine Studios, 1956, p. 1). ABE's services included more than just training animals. The contract specified that ABE would also train trainers and show announcers, evaluate training and show performances, create and produce shows, and prepare show scripts. Thus, ABE played a major role in designing and executing Marine Studios' main attraction.

In the tradition of scientist-practitioners, the Brelands introduced the tools of behavioral science to the Marine Studios' training program. They wrote the first operant training manual for training dolphins in 1955 (Breland, 1955a; Gillaspy, Bailey, and Anderson, 2008). The original manual was divided into two sections, general principles and individual act instructions. The general principles described basic learning and behavioral principles and instructions for using the bridging stimulus, shaping, extinction, differentiation, schedules of reinforcement, and props. Understanding the function of these principles, trainers were given a common language and a consistent method for their training sessions. The individual act section consisted of two to three page descriptions of the target behavior, goal of the act, use of props, specific training directions, signaling instructions, cautions, and showmanship, educational, and publicity considerations. The 1955 manual formed the basis for subsequent Marineland-ABE manuals for training dolphins and whales (Breland, 1957, 1958, 1959, 1961a, 1962). ABE also initiated the use of training logs to standardize and systematize training. Completed after each training session, trainers documented what behaviors were worked on, amount of food consumed, any problems or concerns, and progress toward goals. Using the logs, trainers could work with a variety of animals, and management could track their progress. Understanding the importance of continued assessment, the Brelands also developed an observational rating system for evaluating show performances (Breland, 1956b). Observers sat in the stands and recorded data on the performance of both dolphins (height of jumps, completed vs. missed behaviors, etc.) trainers (timing of bridging stimulus, criteria for reinforcement), and announcers (pace of show, adherence to script).

An importance consequence of this systematic application of behavioral science was to shift the emphasis of the performance from the trainer to the dolphins. In the circus, the trainers are the stars of the show. It is their special knowledge and secret techniques that result in amazing animal behaviors. Shows were also a series of discreet behaviors prompted by the trainer. With the Breland's approach, however, operant psychology was not a secret

methodology, but rather the basis for a behavioral technology taught to all Marine Studios trainers. Trainers were interchangeable; the animals and their behavior were the real stars.

Elaborating on the porpoise training school theme, ABE redesigned the show as a classroom setting where the dolphins learned a variety of related lessons (Breland, 1956a). A dolphin would ring a bell signaling the start of class, and a trainer would appear to begin instruction. After fetching a stack of books, the dolphins were instructed in a variety of subjects such as reading (answering questions with head nods), music (vocalizing and honking a horn), athletics (football, basketball, and baseball), fishing, and even fire safety (squirting water on a campfire left burning beside the tank). Keller suggested referring to the dolphins as "educated" vs. "trained" to highlight the central role of the animal. Throughout the late 1950s and early 1960s, the Brelands and Burgess made a series of visits to Marine Studios to consult on the show, train new acts, and work on other marine animal projects. One such project was for a film, "Children of the Sea" (Butterfield & Young, 1957), based on the book by the same name (Bronson, 1943). A precursor to *Flipper* (Tors & Clark, 1963), the story involved a young boy, who after injuring a dolphin, nurses it back to health. The two become friends, and the boy is eventually saved from a shark by the trusty, loveable dolphin. Due to location and financial problems, the film was never produced; however, Burgess spent six months training several dolphins for the film.

By 1961, the success of marine parks demonstrated the opportunities for profit in marine mammal entertainment. In light of increasing competition, Marine Studios wanted to retain their exclusive contract for ABE's services (Carter, 1961; Rolleston, 1961b). Concerns about keeping the Breland's methods propriety was a common topic in correspondence from this time. After agreeing to a one-year extension, the Brelands were interested in expanding their involvement in the marine park industry and were reluctant to remain under exclusive contract (Breland, 1961b). K. Breland was exploring other opportunities in marine animal training, including opening his own marine park (Watkins, 1962) and working with the newly formed U.S. Navy marine mammal program (U.S. Naval Ordnance Test Station, 1962). After much negotiation, the Brelands agreed to a two-year, nonexclusive contract to provide training assistance and show consultation (Marine Studios, 1962). ABE continued to provide consultation to Marine Studios through the mid-1970s.

OPERANT PSYCHOLOGY AT MOTP

In the late 1940s, Burden and Tolstoy began planning for a west coast Marine Studios (Rolleston, 1950). Along with other investors, a corporation called Oceanarium, Inc. was formed and a site along the bluffs overlooking the Pacific Ocean in Palos Verdes, California, was selected for the new facility (Economic Research Associates, 1960). MOTP opened in September 1954 as the world's largest oceanarium (McCann, 1954). In exchange for Oceanarium, Inc. stock, Marine Studios agreed to share its knowledge of the care and keeping of marine animals (Burden, 1954; Hill, 1956). This included dolphin training methods. From 1956 to 1961, ABE was thus under contract with both Marine Studios and MOTP.

It was MOTP's hope to emulate the success of Marine Studios' dolphin show (Monahan, 1956a; Norris, 1956). Prior to ABE's involvement, a circus trainer referred to as Captain Winston directed training for dolphins and sea lions at MOTP (Monahan, 1956b). Burgess was sent to MOTP in September 1956 to consult on the dolphin show (Breland, 1956). Similar to his activities a year earlier at Marine Studios, Burgess not only trained animals, but also instructed MOTP trainers and instituted a systematic, operant training program. In a 1992 interview, Ralph Penner, an MOTP trainer and diver, recalled that he was instructed by Dave

Brown, MOTP Curator, to "pick Kent Burgess' brain" about operant training (Bailey & Bailey, 1992b). Under Burgess' guidance, the dolphin show became totally operant in nature, while Captain Winston continued to train seals and sea lions. The impact of operant training on the quality of the show can be seen in the results of an MOTP customer satisfaction survey conducted in 1959. In response to the question, "What did you like best about Marineland?," 57 percent indicated the porpoise show vs. 11 percent for the sea lion show (Monahan, 1959). Further, Monahan noted that, "Early in 1956, the Porpoise Games and the Sea Circus were about even and the change to the present ranking is the result of considerable improvement in the porpoise show" (p. 2).

At MOTP, operant methods were also applied for the first time with other cetaceans. On February 27, 1957, MOTP collectors captured a female pilot whale (*Globiocephala melaena*), later named Bubbles. Although a pilot whale had been kept briefly at Marine Studios, Bubbles was the first to survive in captivity (Hill, 1956). Burgess began training Bubbles in June 1957 and within weeks, she learned to shake hands, vocalize on demand, lift a dumbbell, and jump to a target (Brown, 1960). A show featuring Bubbles was soon added to the MOTP lineup. A written manual for training whales was then produced (Breland, 1959).

By the early 1960s, MOTP General Manger, W. F. Monahan expressed little interest in renewing ABE's contract (Monahan, 1965). Trainers taught by Burgess were increasingly taking responsibility for the dolphin and whale shows. MOTP also began to distance itself from ABE. In a letter to ABE in 1965, Monahan cautioned the Brelands against giving, ". . . the impression that shows going on here [MOTP] currently are the product of the efforts of ABE" (Monahan, 1965). Operant methods were becoming standard procedure. Although the Brelands had formally introduced operant psychology to marine animal training, their contributions were soon minimized or dismissed.

SPREAD OF OPERANT PSYCHOLOGY

With the success of behavioral technology at Marine Studios and MOTP, operant psychology soon spread throughout the marine park industry. ABE's work exposed behavioral technology to others in the marine animal training field. One of the most influential individuals was Ken Norris, MOTP's first Curator from 1954 to 1960. After leaving MOTP, Norris joined the biology faculty at University of California, Los Angeles. He also became a consultant at several marine parks. Norris first met Keller Breland in September 1956 and was impressed by his knowledge of behavioral science. In a letter to F. G. Wood at Marine Studios, Norris stated, "I expect to learn a great deal from him [*Breland*] about animal behavior" (Norris, 1956).

Working with dolphins at Marine Studios and MOTP, the Brelands learned about the incredible potential of aquatic mammalian species. Norris was also quick to recognize the usefulness of operant training with marine animals, particularly for behavioral research. He applied behavioral technology to the study of dolphin sonar (Norris et al., 1961). Although previous research by Kellogg (1958, 1959) and Schevill and Lawrence (1956) strongly suggested the use of echolocation by dolphins, no experiments had yet been conducted with the dolphin's vision completed obstructed. The difficulty lay in securing a blindfold over a dolphin's eyes. Norris solved this problem by conditioning a dolphin through shaping to allow suction cups to be placed over its eyes. Shaping allowed Norris to gradually expose or desensitize the dolphin to the device, then to wearing it without protest. With suction cups secured, the dolphin completed a series of object discrimination and navigation tasks, confirming the use of echolocation. Norris would continue to use operant training in later dolphin research (e.g., Turner & Norris, 1966).

Although Norris worked directly with Burgess and had a complete set of Breland training manuals prepared for the Navy, ABE was not involved in Norris' later training activities at University of California, Los Angeles and oceanaria after MOTP. Instead, Norris relied on a psychology doctoral student named Ronald W. Turner. Unfortunately, we have found little information about Turner's career, other than he graduated from the University of California, Los Angeles, in 1962 (Turner, 1962). After completing his degree, Turner worked extensively with Norris on a variety of cetacean training projects (see Turner, 1963; Turner & Norris, 1966; Pryor, 1975). One such project was Aquatic Consultants, an oceanarium consulting firm started by Norris. From 1961 to 1966, Norris and Turner were involved in the planning, design, and training for several new marine parks, including Aquarama in Philadelphia, Sea Life Park in Hawaii, and SeaWorld in San Diego (Jarrell & Reti, 1999). Two of these parks, Sea Life Park and SeaWorld, played crucial roles in the further expansion of the operant paradigm in marine animal training. The following sections review the introduction and use of operant psychology at these parks.

SEA LIFE PARK

The history of Sea Life Park and the importance of operant psychology to its success have been well chronicled by Karen Pryor (1975, 1995). Founded by Pryor and her first husband, T. A. "Tap" Pryor, Sea Life Park opened on 1963. Norris designed the physical plant and suggested Turner as dolphin training consultant. Turner would use this opportunity to produce the first, non-ABE operant training manual for dolphins (Turner, 1963). Turner's manual covered the fundamentals of operant conditioning and consisted of chapters on food reinforcement, bridging stimulus, extinction, discrimination, chaining, time outs, and schedules of reinforcement. Problems soon developed; however, as Sea Life Park trainers had difficulty putting the written instructions into practice. As Pryor noted, "The porpoises, in fact, had trained their trainers to give them fish for nothing" (Pryor, 1975, p. 4). Pryor attributed much of problem to the overly scientific language and tone of Turner's manual. Pryor was kind enough to share a copy of this manual with the authors and indeed, it does read more like a scholarly article than a training manual used by lay people. Turner's manual was also 66 pages long, as opposed to the five-page Breland manual for Marine Studios (Breland, 1955a).

Despite these challenges, Pryor eagerly absorbed Turner's manual and set to work training dolphins and instructing training staff in operant conditioning. At Sea Life, Pryor applied behavioral methods to additional dolphin species, "spinners" (*Stenella longirostrus Hawaiiensis*) and "kikos" (*Stenella attentuata*). Aware of the physical differences between these smaller, more flexible species and the larger Pacific bottlenose (*Tursiops gilli*), Pryor shaped a variety of behaviors previously unseen in dolphin shows. Over the next eight years, Pryor became a skilled and innovative practitioner of behavior analysis (Pryor, Haag, & O'Reilly, 1969). Her writings about her experiences as a dolphin trainer and her later involvement in the behavior analytic community played a major role in the spread of operant psychology in animal training. Today, Pryor is at the forefront of the clicker training movement among pet trainers (Pryor, 1999).

SEAWORLD

At about the same time Sea Life Park was in development, Long Beach restaurateur, George Millay, was planning an oceanarium for San Diego, California. With the success of MOTP, Millay was convinced of the financial opportunities of the marine park business. His original idea was for a restaurant at the bottom of San Diego's Mission Bay where diners could

observer a variety of undersea life in a natural setting. However, poor underwater visibility was the demise of this proposal. Instead, Millay and a group of investors decided to build a marine theme park that combined elements of Disney World and MOTP (Davis, 1997). In exchange for SeaWorld stock, Norris became a partner in the venture, designing the physical plant and providing consultation on animal training (Jarrell & Reti, 1999).

The initial animal training program at SeaWorld did not progress well. Six months before opening day, Norris warned Millay that, "It will probably take about two years to have a well-rounded show" (Millay et al., 1963, p. 1). This was unacceptable to Millay and he began searching for a new dolphin trainer. In early 1964, Millay hired Kent Burgess from ABE to become SeaWorld's Director of Animal Training (O'Brien, 2004).

The importance of Burgess to the early success and expansion of SeaWorld is discussed in detail by Millay (O'Brien, 2004). As Director of Animal Training and Assistant Vice President, Burgess was responsible for the training of all animals and their human trainers at a crucial time in the development of SeaWorld ("Biography: Kent Burgess," 1967). Drawing heavily upon his experience at Marine Studios and MOTP, Burgess implemented a structured system of behavioral training. This included the use of manuals, behavioral record keeping, and training courses in behavioral psychology. In many ways, Burgess approached the training department as an applied behavioral psychology laboratory. He used Holland and Skinner (1961) as the basis for his operant instruction for trainers (Bailey & Bailey, 1992a) and created a study guide of behavioral concepts ("Dictionary of Training Terms," 1965). In addition, he actively worked as a trainer, demonstrating operant methods and troubleshooting training problems. Like the Brelands, Burgess was a true scientist-practitioner, always evaluating the effectiveness and productivity of the training program. In this, he was highly successful.

One of Burgess' most enduring accomplishments, and a highly visible example of the power of operant psychology, was training the Killer whale (*Orcinus orca*), Shamu. Since 1965, there have been many Shamus but the first was captured in October 1965 in Puget Sound (Burgess, 1968). Transferred to SeaWorld in November 1965, Burgess and veterinarian, David Kenney, were responsible for Shamu's care. At the time, one other Killer whale (Namu at Seattle Public Aquarium) had survived in captivity for only one year. Namu had undergone some training; Ted Griffin, Director of Seattle Public Aquarium, rode on Namu's back for public exhibit. From the very beginning, SeaWorld planned to train Shamu for a feature show. Thus, Burgess began training in December 1966. Two months later, Shamu was performing in regular shows for the public. The first Shamu show, modest in comparison to today's "Shamu Rocks" show, involved the theme of a doctor's visit. With the trainer acting as a physician, Shamu demonstrated her fluke reflexes, had her heart checked, opened her mouth for a dental exam, had her teeth brushed, rinsed and spit, kissed her doctor's cheek, and finished with high jump to a target 15 feet above the water (Burgess, 1968). Shamu was an instant hit and became SeaWorld's signature attraction.

Operant psychology was a good fit for a large marine theme park such as SeaWorld. In addition to cetaceans, SeaWorld also featured penguin, bird, sea lion, and other animal shows. Burgess' training program offered efficiency, reliability, and validity, across all these animal acts. An important component of this program that Burgess learned at ABE was the necessity of standardizing the training process. As long as specific operant training procedures were followed, multiple trainers could work with multiple animals. This ensured consistent, high-quality performances at every SeaWorld show. At SeaWorld, operant psychology further allowed the focus to be on the animal's behavior rather than on the trainer's skill. Training was thus not due to an idiosyncratic characteristic of the trainer, but to the disciplined application of behavioral technology.

CONCLUSIONS

Marine animal entertainment has become a standard American leisure activity and a highly successful industry. Each year, millions of tourists thrill at the sight of enormous whales, agile dolphins, and other exotic marine animals precisely responding to trainers' commands to perform a variety of spectacular behaviors at entertainment parks around the world. In the 1950s the task of training dolphins to perform complex behaviors on command was a very real problem for the burgeoning marine animal entertainment industry. Traditional circus training methods, which often relied on a prescientific understanding of food as a reward, were time consuming and inefficient. Skinner's experimental analysis of behavior and the technology based on that science, offered a more efficacious and reliable solution.

Exploiting the use of the bridging stimulus and shaping, the Brelands and ABE developed methods specifically suited for marine animals that could easily swim away from or ignore their trainers, making it difficult to provide immediate reinforcement. From 1955 through the mid-1960s, the Brelands and ABE were responsible for the cetacean training programs at Marine Studios and MOTP. Their involvement in these programs included not only animal training, but also developing show themes and scripts, designing props, writing the first operant instruction manuals for dolphin and whale training, and teaching operant conditioning to training staff. Archival evidence presented in this article suggests the impact of ABE's introduction of behavioral technology on the early marine park industry. Successful parks, like those reviewed here, depended upon behavioral technology to produce reliable, high-quality dolphin and whale shows.

Unlike in other areas of animal training, operant psychology spread throughout marine mammal training and eventually replaced traditional methods. One reason for this expansion was the ability of behavior analysis to solve applied problems as it had in other areas (Mills, 1998; Dewsbury, 2003; Laties, 2003; Rutherford, 2003b). Rutherford (2009) argued that the true legacy of Skinnerian behaviorism is the technology of behavior that resulted from his experimental analysis of behavior. This seems especially true in marine animal training.

Another possible reason for the scope of operant psychology's expansion in marine animal training is that other training methods were not well established or documented and thus did not have a tradition in the field. For example, it was only four years after Flippy was trained by Adolf Frohn, that ABE brought behavioral technology to Marine Studios. Although some parks maintained circus and operant training programs (e.g., operant for cetaceans, circus for seals and sea lions), operant methods were quickly recognized as the most effective and versatile.

Interestingly, the historical pathway to the expansion of operant psychology to marine animal training was one of unforeseen consequences. Project Pigeon, especially the use of hand shaping (Peterson, 2001) influenced Skinner to shift his attention from a strict experimental analysis of behavior to the application of behavioral science to improve human society (Capshew, 1996). Project Pigeon also prompted the young graduate students, Marian and Keller Breland, to leave graduate school to pursue the commercial application of behavior analysis to animal training (Bailey & Bailey, 1994). An article in *Time* (I. Q. Zoo, 1955) about ABE caught the eye of Marine Studios General Manager, Bill Rolleston, who contacted the Brelands about using their methods with dolphins (Rolleston, 1955a). Always eager for an opportunity to extend their science especially to an animal they had never even seen before, the Brelands readily adapted operant methods for dolphins. The openness of the Brelands to share their methods, with their own staff (Kent Burgess) and with staff at Marine Studios and MOTP, facilitated the rapid spread of behavioral technology to other parks. Training programs

at Sea Life Park and SeaWorld can be traced back to ABE or individuals who worked with the Brelands and were exposed to the Breland's manuals for training cetaceans. A little over 10 years after the Brelands made their first visit to Marine Studios, most of the successful marine parks in America were embracing behavioral technology.

Despite this success, the application of behavior analysis to marine animal training is a little known story in the history of psychology. This article extends the historiography of behavioral technology and its initial applications to marine animal entertainment. The rapid expansion of operant principles and methods within the field of marine animal training in the 1950s and 1960s is a unique success story of behavioral technology.

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