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Choice and Control of Enrichment for a Rescued and Rehabilitated Atlantic Bottlenose Dolphin (*Tursiops trunactus*)

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By

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Abstract

Animals living under human care experience stress related to a lack of control over their environment. One way to remedy this is through the use of cognitive enrichment, such as choice and control of enrichment. This type of enrichment has been shown to have benefits for animals under human care including increased activity and social interactions. To determine if choice and control was more beneficial than enrichment alone, a three year old male Atlantic bottlenose dolphin (*Tursiops truncatus)* was exposed to novel enrichment items in two experimental conditions. For the first condition, the animal was given a novel object. During the second condition, the animal was asked to choose between two novel enrichment items and the selected item was added to his environment. Activity level, habitat usage, social, and play behaviors were recorded following the addition of the novel item to the animal's environment. The results indicated an increase in non-stereotypic behaviors and object play. An increase in attention during training sessions was also seen during the experimental conditions.

Key Terms: cetaceans, toys, novel objects, environmental enrichment

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Introduction

Entertainment, education, companionship, and research are just a few of the reasons why humans have kept and cared for animals (Kuczaj, Lacinak, Fad, Trone, Solangi, & Ramos, 2002), The welfare of animals living under human care is a prevalent debate in today's society (Morgan, Line & Markowitz, 1998). Of particular interest are cetaceans, namely bottlenose dolphins (*Tursiops spp.*) (Kuczaj et al., 2002). One way to improve the lives of these animals is through choice and control of enrichment (Morgan, Line & Markowitz, 1998). This current study will investigate the effects of choice and control of enrichment on captive bottlenose dolphins. To thoroughly understand this topic, it is important to look first at the history of animal husbandry, cetaceans under human care, and stereotypic behaviors. It is then possible to discuss enrichment, novel objects as enrichment, and finally choice and control of enrichment.

History of Animal Husbandry and Cetaceans under Human Care

Animal husbandry began in the Neolithic period (8000-3000 B.C.) as early self-sufficient societies began to herd wild animals that raided their crops (Kisling, 2000). The collection of wild, more exotic species began in 3000 B.C. as private menageries began appearing around the world as a means of showcasing the owner's power and wealth (Kisling, 2000; Hoage & Deiss, 1996). The nineteenth century, however, brought in a new area of animal exhibition, as the natural history museum of Paris integrated the Versailles menagerie into its public displays and in 1828 the London Zoo opened its gates to the public (Hoage & Deiss, 1996). Public interest in nature grew with the publication of Charles Darwin's *Origin of Species* in 1858 (Hoage & Deiss, 1996). It is around this time that the public display of cetaceans began.

Samuels and Tyack (2000) noted that the earliest recognized accounts of the use of cetaceans for public presentation date back to the 1860s and 1870s. Aquaria located in the United States and Great Britain had exhibits featuring beluga whales (*Delphinapterus leucas)*, bottlenose dolphins and a harbor porpoise (*Phocoena phocoena)* (Samuels & Tyack, 2000). It is thought that P.T. Barnum, a renowned circus proprietor, had the first trained cetacean, a beluga, displayed in New York City during this time (Samuels & Tyack, 2000). Aquariums and zoological facilities are responsible for changing the world's view on small cetaceans from sources of oil, leather, and meat to creatures with gregarious and social habits similar to those of humans (Samuels & Tyack, 2000). Public interest in captive species extended beyond simply seeing the animals into a concern for their physical and psychological condition.

Stereotypic Behaviors

One way to evaluate the well-being of an animal living under human care is to inspect stereotypic behaviors. These are behaviors that are invariant, repeated, and appear to serve no purpose (Lawrence & Terlouw, 1993). Stereotyped behaviors can include, but are not limited to, pacing/patterned swimming, regurgitation, licking, self-mutilation and head-tossing (Shyne, 2006). Understanding the origins of these behaviors can be imperative to finding a solution to them.

Stereotypies can occur for a number of reasons, including restricted feed intake (Lawrence & Terlouw, 1993) as well as the inability to solve an ecologically relevant problem like foraging, finding a mate, or escaping interaction with external stressors such as humans or loud noises (Shyne, 2006). Lack of stimulation can be another cause for stereotypic behaviors (Shyne, 2006). It is important that such behaviors are reduced or eliminated, if possible.

Decreasing the frequency of stereotypic behaviors is vital for two fundamental reasons. The first being that they are typically indicators of stress (Lawrence & Terlouw, 1993) and the second being that visitors to zoological facilities often abhor seeing such behaviors (Shyne, 2006). The reduction of stereotypic behaviors can be achieved through environmental enrichment, which creates an atmosphere similar to the animal’s natural environment. Enrichment is a multifaceted concept that animal caretakers apply to improve the welfare of animals under their charge.

Enrichment

Enrichment pertains to any modification to an animal's enclosure that would improve the animal's health and allow it to express behaviors seen by its counterparts in the wild (Shyne, 2006). This could include scattering scents around the enclosure, adding habitat enhancers (e.g. benches or branches) or other stimuli (e.g. physical toys) to the enclosure, varying the method through which the animal obtains its diet (e.g. feeder puzzles), behavioral training and others. Modifications to the environment have the potential to enhance every species’ quality of life.

The physiological and psychological importance of enrichment for animals kept under human care is a relatively new concept. Researchers first began investigating the idea in the mid-20th century (Ben-Ari, 2001). The University of California completed a study in the 1940's which concluded that rats housed in groups in larger enclosures with habitat enhancers and an assortment of external stimuli showed differences in brain structure and a wider variety of investigative behaviors compared to lone rats in less enriched environments (Ben-Ari, 2001). Research on the impact of enrichment continues today while analyzing a wider variety of species.

A study by Anderson (2001) attempted to compare the behavioral differences of captive and wild animals. This research focused on the behavior of giant octopuses (*Enteroctopus dofleini)*. In their natural environment, octopuses spend much of their time hiding in their dens. However, they do exhibit unique behaviors when hunting for food or courting a mate (Anderson, 2001). Giant octopuses kept under human care need enrichment, because they do not have a reason to hunt or find a mate. Anderson (2001) found that challenging feeder puzzles, like putting food in a jar, help stimulate the animals. However, this study lacked measurable data to truly compare the results.

Although all species can benefit from enrichment, most research focuses on terrestrial mammalian species (Ben-Ari, 2001; Shyne, 2006). Subject species have ranged from giraffes (*Giraffa camelopardalis)* to black-footed ferrets (*Mustela nigripes*) (Ben-Ari, 2006; Vargas & Anderson, 1999). Non-human primates are often subjects of enrichment studies due to the Animal Welfare Act that stipulates all non-human primates must have environmental enrichment in their habitats (Crawford, 2012). This mandate for enrichment is not in place for all captive species; however most facilities provide various types of enrichment for the animals under their care.

Novel Objects as Enrichment

A common type of environmental enrichment is the addition of novel objects into the animal's habitat. This is a method that is used across a wide variety of species, including marine mammals (Baer, 1998). Of course, when adding something to an animal's environment, there are safety issues to consider. Novel objects should be durable and non-toxic. They should have the ability to be sanitized if they are to be used multiple times and should have no rough edges or components which could entrap any part of the animal (Baer, 1998). Novel objects are an easy –to-use type of enrichment.

Once a novel object has been added to an animal's environment, the enrichment process can begin. The animals are able to express investigative and manipulative behaviors while exploring the new objects. Abnormal behaviors become less frequent. Researchers have also seen an increase in activity when novel objects are present, which battles obesity and musculoskeletal deterioration (Baer, 1998). When active animals show little interest in a novel object, it can be an early indicator of disease or injury. Novel objects also allow animals to participate in play. For cetaceans, play pertains to object manipulation. In their natural environment, cetaceans will play by holding kelp in their mouths while swimming, bow-riding with large ships and even catching and releasing food repeatedly (Kuczaj, Lacinak & Turner, 1998). Captive cetaceans can partake in some of these behaviors when novel objects are present. However, animal caregivers must know how to properly implement novel objects as enrichment.

It is important to keep enrichment as exciting as possible. If a novel object is in an animal's environment for too long it loses its enriching qualities (Kuczaj, et al., 2002), and the animal experiences habituation, which is the waning of a behavior due to repeated or prolonged stimulation (Kuczaj, Lacinak & Turner, 1998). Events or items that are too novel can have aversive effects, so a cornerstone to proper enrichment use is to keep it consistent but at an unpredictable rate (Kuczaj, Lacinak & Turner, 1998). It is also essential to consider the age of the subject. Research indicates that the age of the subject impacts the effectiveness of the enrichment (Videan, Fritz, Schwandt, Smith & Howell, 2005). Older chimpanzees used fixed, less easily manipulated enrichment items with higher frequency than younger chimps (Videan, Fritz, Schwandt, Smith & Howell, 2005). Additionally, older animals that had been housed alone or in impoverish conditions showed no signs of interacting with novel objects (Markowitz & Aday, 1998). It is important to keep in mind the species and the characteristics of the individual animal which will be partaking in a newly designed enrichment program so that aversive effects and habituation do not occur.

Finding the perfect balance of novelty and familiarity can be challenging when designing an enrichment program. Two Australian sea lions (*Neophoca cinerea)* kept at the Adelaide Zoo were the subjects of a study that looked at the effectiveness of enrichment (Smith & Litchfield, 2010). For the first period of enrichment implementation the sea lions received enrichment that was not food related. Food related enrichment was distributed during the second period of enrichment (Smith & Litchfield, 2010). Implementation of enrichment lasted three days. Both forms of enrichment decreased the amount of time spent in stereotyped behaviors and increased the amount of time spent being active (Smith & Litchfield, 2010). The sea lions in this study ignored the non-food related enrichment when it was introduced for the third and final time on the third and final day of the enrichment period (Smith & Litchfield, 2010). This exemplifies the importance of keeping enrichment novel, so that habituation does not occur.

Another study also highlights this convention. In 2002, Kuczaj et al. examined novel objects as enrichment for 16 individuals of 10 species. Eight species, 14 of the individuals, were marine mammals. All individuals were provided with a personalized novel object under two different experimental conditions. In the first condition, individuals received their enrichment during two 60-minute sessions. Enrichment was provided for the individuals for variable lengths of time distributed throughout 15 sessions totaling 120 minutes for the second condition. The results showed that the participants engaged in more object directed activity when the presentation of the object was for shorter, more sporadic periods. This supports variable schedules for novel object directed enrichment programs.

Choice and Control of Enrichment

Another enrichment type of interest is choice and control. A lack of control over their environment is thought to be one of the most stressful factors for animals in captivity (Morgan, Line & Markowitz, 1998). To address this, choice and control of enrichment allows the animals to have control by giving them a choice which will alter their environment. It is a new and innovative approach that is being used to improve the well-being of captive animals. There are two main types of choice and control enrichment: habitat usage and tool or novel object.

Habitat usage is a type of choice and control enrichment that is often overlooked. Two captive polar bears *(Ursus maritimus*) housed at the Lincoln Park Zoo were the subjects of a choice and control study in 2006 (Ross). For this study, the gate separating the exhibit and off-exhibit areas was kept open so the animals could come and go as they pleased (Ross, 2006). Both animals had previously been seen participating in stereotyped behaviors such as pacing or head rolling (Ross, 2006). After the implementation of the enrichment, the frequency of stereotyped behaviors significantly decreased and the frequency of social behaviors increased considerably (Ross, 2006). This study indicates that choice and control of enrichment plans are beneficial for captive marine mammals.

A study in 2010 looked at how visitor attendance affected primate behavior, including habitat usage (Smith & Kuhar). The study observed siamangs (*Hylobates syndactylus)* and white-cheeked gibbons (*Hylobates leucogenys)* at Disney's Animal Kingdom. There was no difference in the amount of time the primates participated in social or solitary behaviors when the park was busy or slow (Smith & Kuhar, 2010). The primates did spend more time hidden from the public on days with higher attendance (Smith & Kuhar, 2010). The researchers concluded that the primates should have visual barriers in their enclosures so that if the animals desire, they could escape from the public (Smith & Kuhar, 2010). Allowing the animals a choice in habitat usage is not the only way in which animals can control their environment.

Tool use and manipulation of novel objects are an example of more choice and control enrichment. A study in 2003 presented captive chimpanzees with choice and control of enrichment by offering the subjects a wide variety of tools they could manipulate to retrieve juice (Morimura, 2003). For this study, diluted orange juice was placed in acrylic tube feeders, which had a single hole large enough for the subjects to fit their hands in to. Tools, such as straws, cloth, or timber, were left around the enclosure so the chimps could choose to use them if they desired (Morimura, 2003). The researchers found that the chimps used tools with greater frequency to obtain juice from the feeders as opposed to using their hands or mouth alone (Morimura, 2003). Because chimpanzees use tools in their natural environment, this was a good way to allow the captive animals to exhibit natural behaviors. This study showed that choice and control environmental enrichment types can have positive effects on the animals' well-being as well as allow the animals more freedom of choice when it comes to behaviors (Morimura, 2003). Non-human primates are often the subject of choice and control enrichment studies

Another example involves rhesus monkeys (*Maca camulatta*). Ten adult females were given access a battery powered device which contained a radio and a food dispenser, both of which the monkeys could manipulate (Morgan, Line & Markowitz, 1998). The caretakers could control the amount of food dispensed, which helped maintain the difficulty of the task. The subjects used the device and interest in it was sustained throughout the 12-week study period. Results showed a decrease in abnormal behavior and an increase in non-stereotypic movements (Morgan, Line & Markowitz, 1998). An improvement in the ability to cope was speculated due to the results of this study. Cortisol levels were significantly lower when the individual had access to the device and they also showed less heart rate reactivity when restrained in a squeezing mechanism within the home cage. By having control over their environment the subjects expressed natural behaviors with higher frequency and were more capable to manage stressful situations; both of which are considered improvements to the animal's overall well-being.

An additional study utilized Diana monkeys (*Ceropithecus Diana*). Stations were created high within the enclosure, which the monkeys could leap between to collect plastic chips. These chips could be exchanged in an automat for a variety of food items (Markowitz & Aday, 1998). The primates had control over their environment because they would elect to use the chips whenever they wanted. They could use them right away, hoard them, steal them from other monkeys or give them away. Some individuals even stole food from the monkey dispensing its chips into the automat (Markowitz &Aday,

1998). This enrichment program allowed the animals to exhibit natural behaviors while providing them with many opportunities to make choices.

Choice and control of enrichment programs have also been implemented for marine mammals. A study at the Steinhart Aquarium at the California Academy of Sciences explored choice and control in two pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and three harbor seals (*Phoca vitulina)* (Markowitz & Aday, 1998). The animals were presented with a xylophone-like apparatus which had keys made of PVC pipe of graduated length. Each key was associated with a different type of reinforcement, including fish, toys, tactile stimulation from a trainer, activation of a water jet and three different sound channels. All the subjects utilized the device, although one dolphin and one seal monopolized it when it was available to their exhibit (Markowitz & Aday, 1998). The enrichment program did not seem to improve the seals' quality of life; however there was an increase in the dolphin's well-being as measured by an increase in active behavior and a decrease in both agonistic and stereotypic behaviors. During the one-year study period; there was no significant decrease in usage of the enrichment items by the subjects. This study emphasized the importance of species-specific enrichment programs.

While a few studies of marine mammals have explored the effects of choice and control of enrichment, there is relatively little regarding cetaceans and no literature directly pertaining to rescued and rehabilitated individuals. The goal of this current study is to look at the impact of choice and control enrichment types on the frequency of object play and stereotypic behaviors. The effectiveness of the enrichment will be measured by comparing the frequency of object play and stereotypic behaviors for the selected rescued and rehabilitated dolphin from before and after the enrichment has been implemented.

Another aspect of this study, which is unique and not seen in current literature, is the investigation of the enrichment's effect on the subject's attention and performance during training sessions as rated by training staff. Ratings of attention and performance from both before and after enrichment implementation will be compared.

Methods

Subjects

The research was conducted at the Institute for Marine Mammal Studies (IMMS) located in Gulfport, MS. The subject was a male Atlantic Bottlenose dolphin named Apollo who was estimated to be approximately two years of age. Apollo was found stranded on a mud flat off the coast of Louisiana in March of 2012. At the time of rescue, he was estimated to be approximately one year of age. He was found with severe sunburn and hearing tests indicated serious hearing loss. His young age, in conjunction with medical issues, made him non-releasable. He was initially rehabilitated at the Audubon Institute in New Orleans and was transported to IMMS in October of 2012. Two additional males, Buster, and Chance, and a female, Bo, ages 34, 4, and 36 respectively were also housed at this facility. However, they were not used for data collection. Initial plans were to use three of the dolphins as subjects; however, training of the experimental 'choice' behavior was discontinued with Bo due to visual impairments and Chance due to lack of interest from the animal. Buster was excluded from the beginning due to visual impairments.

All animals were housed in the same system of pools. Apollo, Bo, and Buster were gated together while Chance was in a separate area at night, during non-observation times, due to gating difficulties prior to data collection. All animals could see and interact with one another through the fencing of the gating system during this time. All four animals had been introduced and were together during observation times; however Chance was occasionally gated off at night due to trainer concerns

Novel Objects

A total of 15 novel objects were used (see Appendix B for pictures of the novel objects). One additional novel item was set aside as backup in the event that one of the 15 objects was no longer usable. Some objects were modified to adjust characteristics (e.g., filling a hole to maintain proper buoyancy) and to improve safety (e.g., filing down rough edges). Each item was approved, on the basis of safety, by the appropriate staff prior to testing.

Choice Behavior

The subject was trained to emit a “choice” behavior. The criterion for this behavior was for the animal to target, or touch, an object when the trainer held out two objects on either side of the dolphin. The item that was touched was given to the animal. The behavior was not bridged or reinforced other than adding the selected item to the subject’s environment to prevent the appearance of an unintentional trainer induced preference. Baiting, a training method that involves wiggling items to lure the subject to touch it, was not used as another way to diminish the possibility of unintentional bias.

Training of the choice behavior was completed while using items from the subject’s standard pool of enrichment. A total of 16 standard items were used. A pseudo-random order for the presentation of objects was created (see Appendix A for training protocol). All objects were shown to the subjects a total of four times, twice in each hand.

Items were never presented to the subjects in the same pairs (e.g. the small basketball and noodle were only paired together once during the 32 trial training process). The item selected, date, and trainer conducting the trial were recorded on the protocol sheet. Training of the choice behavior was considered complete when the subject completed all 32 trials and had consistently met the above-mentioned criterion.

Procedure

For baseline behavior data collection all enrichment items were randomly selected from a pool of enrichment items, which the subject had already been exposed to. Enrichment was added to the dolphins' environment at the end of the 9:15 am session. Only three pieces of enrichment per dolphin were added to the each enclosure. Behavior was recorded twice a day during randomly selected time slots from a pre-determined list of times. These pre-determined times did not interfere with training sessions.

Data was collected through above water observations in an A-B-C design where A was the baseline condition, which included the standard enrichment items available to the dolphins. Behavior was recorded twice a day in 15-minute segments. For the B condition, the subject was given a novel object. This condition lasted for five days. The C portion of the design refers to a five-day period where the subject had the ability to choose between two enrichment items each. The B and C conditions were inter-mixed, creating the experimental condition. Behavior was recorded immediately after the novel items were added to the habitat and later in the day at a time randomly selected from pre-decided time slots.

Behavioral observations were recorded via two methods with two observers at each session. The primary source was ethogram data sheets (see Appendix C). As a secondary measure, behaviors were recorded with video cameras. The observer continually vocalized the behavior of the focal animal, as well as any behavior from the other dolphins, which could impact the behavior of the focal animal. Data recorded included the locations of the dolphins, activity, object play, general behaviors, tactile behaviors and orientation. The location and activity of each animal were recorded at the beginning of each minute. Other behaviors were recorded with interval sampling with each occurrence. Additional notes were taken in the comments section of the observation sheet, including unexpected behaviors such as displacement or cooperative play.

The item selection by the dolphin took place during the 9:15 AM session. The trainers fed the last fish to the dolphin and then presented the subject with two novel enrichment items. Novel objects were paired based on size and the presence or absence of dangling "kelp," a heavy-duty felt-like material. The order in which pairs were presented to the subject was randomized and characteristics were balanced between hands (e.g. each hand had the same number of toys with dangling kelp) resulting in a pseudo-random order (see Appendix B for experimental condition protocol). Whichever item the dolphin touched first was considered as the item the dolphin selected and that item was added to the environment. The trainer then gave the dolphin the discriminative stimulus to signal the end of the session. After the morning session each dolphin had three enrichment items, two standard items and the novel choice item.

Results

Primary Activity

As predicted, the experimental conditions significantly impacted the primary activity of the subject when compared to the baseline, X^2 (2, N = 450) = 39.5, p<0.01. A statistically significant difference was also seen between the choice and non-choice conditions, X^2 (2, N = 300) = 17.7, p<0.01. As shown in Figure 1, there was a decrease in circle swimming in both experimental conditions and an increase in non-circle swimming. Figure 1 also shows a decrease in stationary behavior during the choice condition. No difference was seen in the swim speed of the subject, X^2 (2, N = 356) = 0.04, p = 0.83.

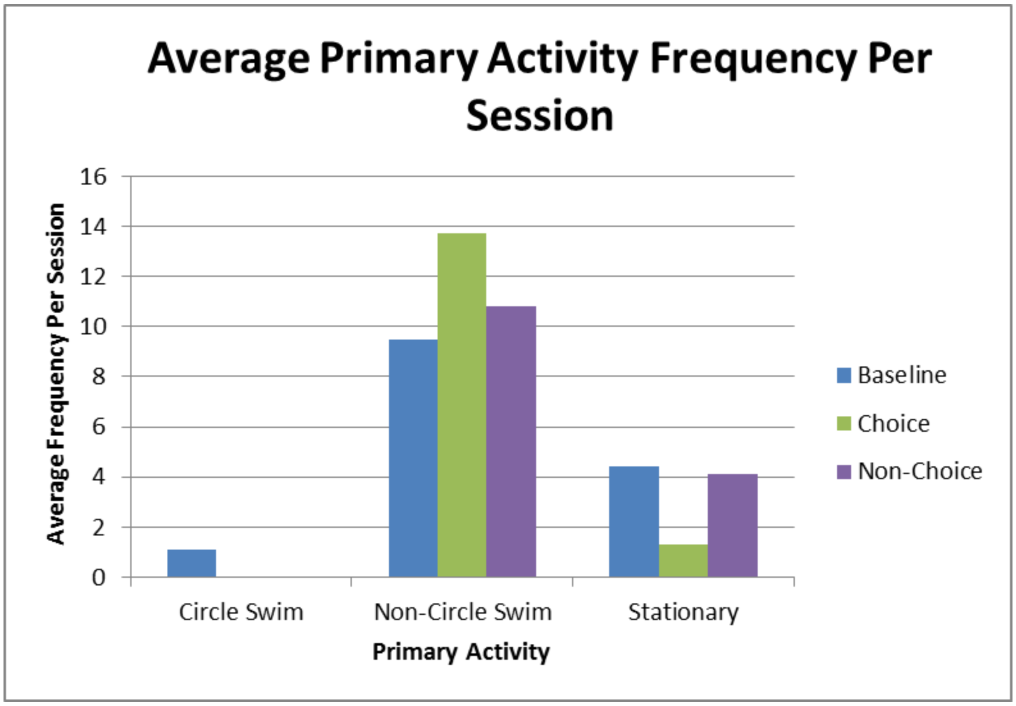


Figure 1: A graphical representation of the subject's average primary activity throughout data collection

Attention and Performance

Data from the attention and performance ratings were also analyzed using a Chi Square. The subject generally scored very high, with only one instance of a score below a 7. Because the chi-square analysis required expected values above 0, only the scores from 7-10 were analyzed. Data for one training session during each of the choice and non-choice experimental conditions were missing, meaning there were 19 ratings for attention and performance in the choice and non-choice conditions whereas 20 ratings were given in baseline.

A significant difference was seen between the baseline and experimental conditions for the subject's attention ratings, X^2 (2, N = 58) = 9.02, p = 0.02. Figure 2 depicts the increase in attention in both the choice and non-choice conditions compared to baseline. No difference was seen in any condition concerning performance ratings, X^2 (2, N = 57) = 3.85, p = 0.27.

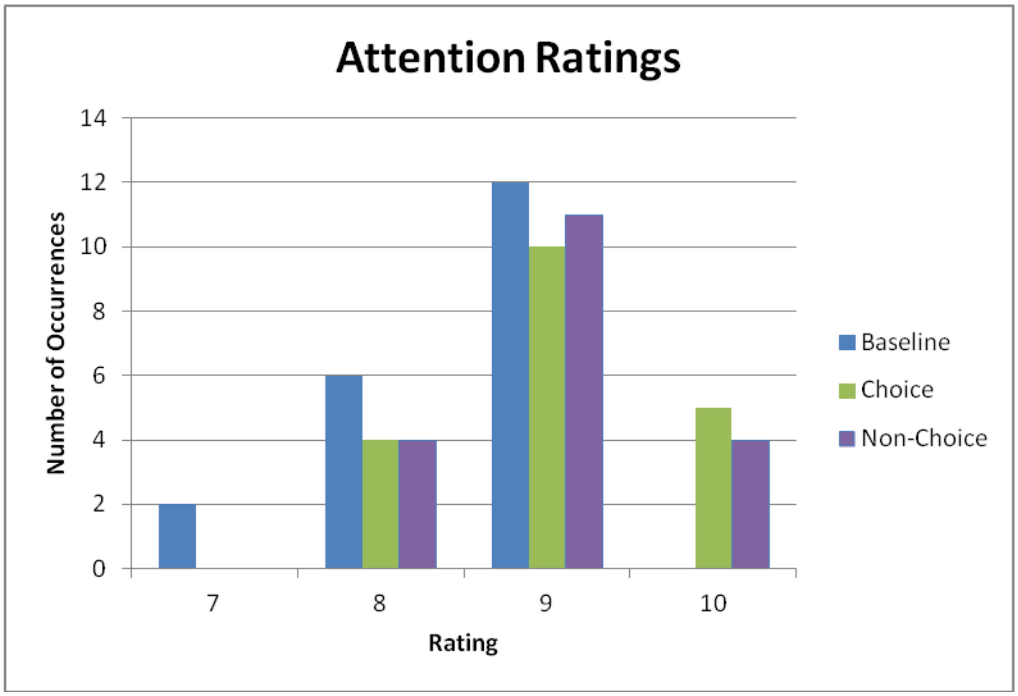


Figure 2: Attention Ratings throughout Data Collection

Habitat Usage

There was a significant change in habitat usage by the subject, X^2 (3, N = 450) = 54.4, p<0.01. The modification to pool usage can be seen in Figure 3. To understand this shift in habitat usage, correlations were conducted. There were positive correlations between the time the subject spent in the east pool and interference by the other young male, Chance, r (298) = 0.36, $p < 0.01$. A similar correlation was seen with the time the subject spent in the middle pen and interference by Chance, r (298) = 0.13, $p = 0.02$.

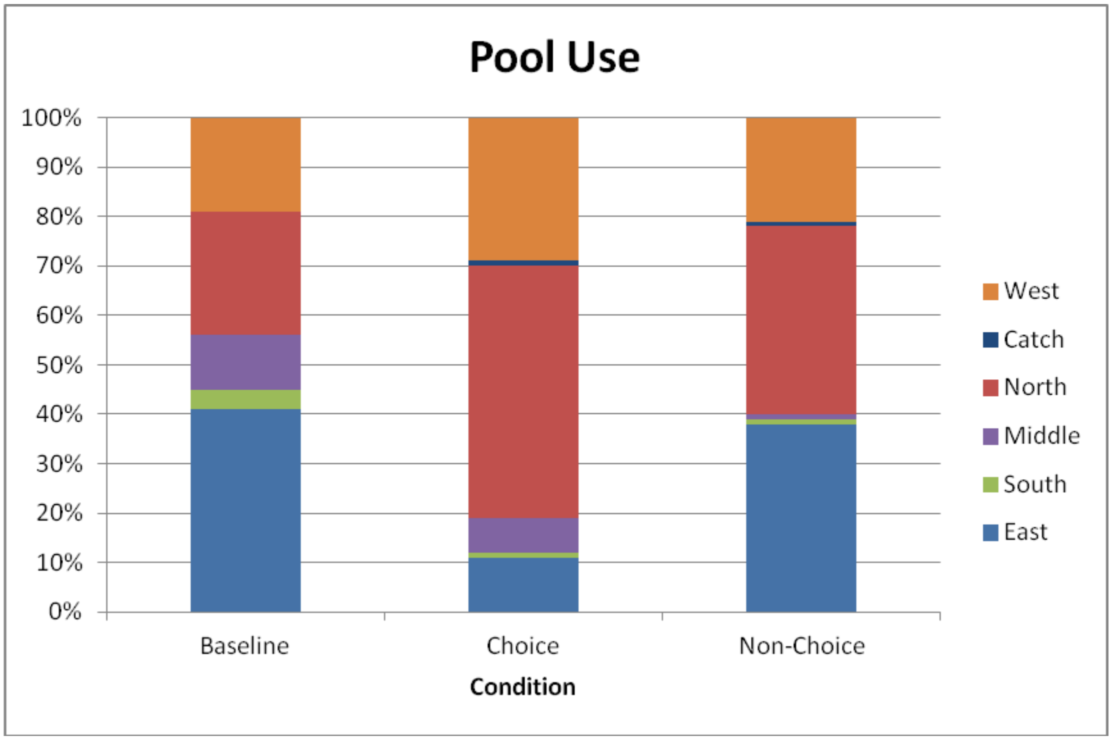


Figure 3: Percentage of Time Subject Spent in Each Pool during Each Condition

Object Play

When looking at only object play as it pertains to the standard objects, there was not a significant difference between all conditions, X^2 (3, N = 179) = 0.58, $p = 0.89$. There was a significant difference between object play overall in the choice condition and in the non-choice condition, X^2 (2, N = 187) = 10.9, $p < 0.01$. As Figure 4 demonstrates, the difference in object play occurred not with the choice, or novel object, but rather with an increase in object play with the standard objects.

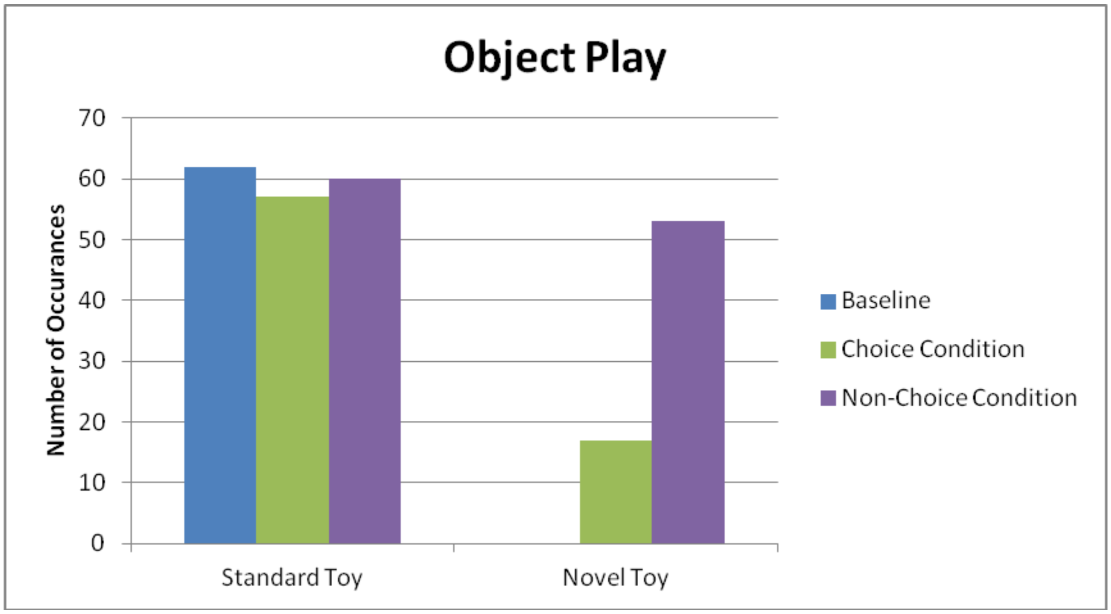


Figure 4: Comparison of Object Play in Choice and Non-Choice Conditions

It was hypothesized that Chance interfered more with Apollo's toy play during choice conditions. To examine this possibility, a correlation was run between the number of intervals in which there was both object play by Apollo and interference by Chance. There was a positive correlation between Chance interference and object play with novel objects, r (298) = 0.19, $p < 0.01$. Similarly, a positive correlation was seen between object play with standard objects and Chance interference, r (298) = 0.18, $p < 0.01$. Correlations were also found between pool usage and object play. A positive correlation was seen with novel object play in the east pool, r (298) = 0.44, $p < 0.01$. With standard object play, a positive correlation was seen with the north pool, r (298) = 0.16, $p < 0.01$, during the experimental conditions. During baseline, a positive correlation between standard object play and the middle pool was observed, r (148) = 0.34, $p < 0.01$. Additionally, a correlation was seen with standard object play and the south pen during baseline, r (148) = 0.17, $p < 0.01$.

Discussion

The goal of this study was to investigate the effects of choice and control of enrichment on rescued and rehabilitated bottlenose dolphins. Overall, the enrichment implementation had a positive effect on the subject by decreasing the frequency of stereotypic behaviors, increasing object play, and improving attention during training sessions. It is important to look at each in depth.

One of the most notable changes in the subject's behavior was in his swimming patterns. Circle swims are often considered to be stereotypic behaviors for marine mammals. The subject's shift from circle swims to non-circle swims demonstrates an improvement in the subject's overall well-being. It could be speculated that the cause of the stereotypic behavior was a lack of stimulation, or habituation to the standard objects. Because the presence of novel toys decreased the frequency of the circle swims, this seems to be the likely cause of the stereotypic behavior.

The effect of the choice component of the enrichment was an increase in active behavior, and subsequently a decrease in stationary, or resting, behaviors compared to non-choice and baseline conditions. This increase in active behavior can have many benefits for the subject including improved physical fitness and expression of natural play behaviors.

Another area that showed improvement was object play. Although the amount of object play with standard objects was the same across all conditions, there were additional instances of object play directed at the novel objects during the experimental condition. It is important to compare novel object play between the two experimental conditions of choice and non-choice.

Although a significant difference was seen between the choice and non-choice conditions, it was not in the expected direction. The hypothesis was that Apollo would play more with objects that he had chosen and the opposite effect was seen, with Apollo showing an increase in object play with novel objects during the non-choice condition when compared to the choice condition. In trying to determine why this might be, it was noted that the other young male, Chance, interfered frequently during the experimental conditions. As mentioned, the observers noted all occurrences of interference from Chance in the ‘comments’ section on the observation sheet and a correlation was found between novel object play and interference from Chance. Therefore, it seems that Chance preferentially interfered with object play in the experimental conditions. This seems to be a novel behavior as in other studies and through months of personal observation of the same pod, displacement from objects and cooperative object play were not reported, nor were such behaviors seen in the baseline condition of this study.

The last primary difference in the subject’s behavior from baseline to experimental conditions was in his pool usage. The subject had access to all regions of the pool during observation hours, and was familiar with all areas so the change in habitat usage was unexpected. Correlations were once again done, this time with habitat usage and Chance interference. Correlations were evident between the east and middle pens. The subject spent less time in these pens throughout the experimental conditions.

Correlations were also run to see if object play occurred in particular pens more frequently than others. During baseline, there was a correlation of object play with the south and middle pools. Incidentally, there was a decrease in the percentage of time the subject spent in these pools during the experimental conditions. The experimental conditions showed a correlation of object play with novel objects in the east pool. This is typically where the subject was given the novel item, as this is the pool where training sessions took place. The subject spent less of this time in this pool during the experimental conditions, and given the correlation of novel object play with the east pool, it is not surprising that novel object play occurred less than standard object play. Another correlation was found during the experimental periods, this time pertaining to standard object play. There was a correlation of standard object play with the north pen. This explains why standard object play did not change during the experimental conditions, as a correlation was not seen between interference from Chance and the north pool. Ultimately, the data suggests that Apollo was spending more time in pools that Chance was less likely to interfere in. The difference in object play during experimental conditions can be explained by the subject's shift in habitat usage to avoid interference with Chance.

An important factor that must be considered when looking at this study is the relatively new social structure of this pod. Although the animals were all familiar with one another, the social structure was still unstable at the time. This social instability could explain the newly seen displacement and other types of interference Chance projected onto the study's subject. Social structures are an important component to consider with rescued and rehabilitated animals because they may be added to an already established social structure consisting of mothers and their offspring. Because the pod observed in this study consists mainly of males, aggressive behaviors are likely to be common. Bo, the female, and Buster, the oldest male, had been together at other facilities before coming to IMMS, and thus likely had a strong relationship. Because the rescue dolphins that were added to their environment were male, dominance became an issue. Conducting this study again, or something similar, now that the social structure is more stable would likely result in more accurate results.

There are many future directions in which this line of research could be taken. Adding more subjects would be beneficial, and make the results more applicable to other populations. The use of novel objects with characteristics the subjects are not familiar with, for example objects that made noise such as a rain stick, would be a way to build upon this research. It would be interesting to see if this study's subject, a deaf individual, would respond to the sound. Such objects would potentially be beneficial for visually impaired individuals such as Bo and Buster, because it would stimulate a sense not typically stimulated through novel objects. Creating a device that would allow the subjects to select items (i.e. tactile stimulation, bubbles, ice, etc,) would be another direction this research could go. With such an apparatus, it would be possible to look at individual preferences in the dolphins. Lastly, the technique of evaluating the subject's attention and performance during training session is something that could be applied to any type of enrichment study. This could help training staff better engage their animals during training sessions.

Conclusion

This study investigated the effects of choice and control of enrichment for a rescued and rehabilitated bottlenose dolphin. The enrichment had a positive impact on the subject. This positive impact can be seen by the reduction in stereotypic behaviors. Additionally, an increase in attention during training sessions was seen during the experimental conditions, indicating that allowing the subject to have control over his environment by allowing him to choose a novel object was a positive change to his daily routine. These should be considered as preliminary findings as only one subject was used. Further research is needed to add on to and support the findings of this study.

Appendix A

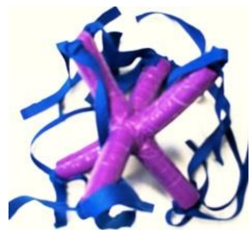
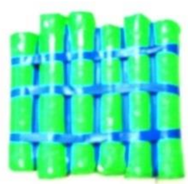
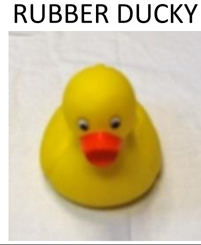
Protocol for Training the “Choice” Behavior

Trial	Left Hand	Right Hand	Bo		CJ		Apollo
1	small basketball	noodle	L R		L R		L R
2	large buoy	whole float mat	L R		L R		L R
3	noodle hoop	buoy with kelp	L R		L R		L R
4	horsehoe toy	hose	L R		L R		L R
5	half float mat	small buoy	L R		L R		L R
6	disc with kelp	large basketball	L R		L R		L R
7	noodle with astroturf	football	L R		L R		L R
8	whole float mat	noodle with kelp at one end	L R		L R		L R
9	buoy with kelp	half float mat	L R		L R		L R
10	large basketball	noodle hoop	L R		L R		L R
11	noodle	horseshoe toy	L R		L R		L R
12	football	large buoy	L R		L R		L R
13	noodle with kelp at both ends	disc with kelp	L R		L R		L R
14	hose	small basketball	L R		L R		L R
15	noodle with kelp at one end	noodle with astroturf	L R		L R		L R
16	small buoy	noodle with kelp at both ends	L R		L R		L R
17	half float mat	noodle	L R		L R		L R
18	noodle hoop	disc with kelp	L R		L R		L R
19	large buoy	small basketball	L R		L R		L R
20	football	whole float mat	L R		L R		L R
21	noodle with astroturf	hose	L R		L R		L R
22	large basketball	horsehoe toy	L R		L R		L R
23	noodle with kelp at one end	small buoy	L R		L R		L R
24	buoy with kelp	noodle with kelp at both ends	L R		L R		L R
25	small basketball	noodle with astroturf	L R		L R		L R
26	noodle	large basketball	L R		L R		L R
27	whole float mat	buoy with kelp	L R		L R		L R
28	horsehoe toy	noodle hoop	L R		L R		L R
29	disc with kelp	noodle with kelp at one end	L R		L R		L R
30	hose	half float mat	L R		L R		L R
31	noodle with kelp at both ends	large buoy	L R		L R		L R
32	small buoy	football	L R		L R		L R

Appendix B

Experimental Condition Protocol

Trial	Left Hand	Right Hand	Apollo
1	NON-CHOICE  NOODLE W/KELP SQUARES		
2	NON-CHOICE  FLOATING HOSE		
3	JOLLYBALL 	BOOGIE BOARD 	L R
4	BAT 	SMALL NOODLE RING 	L R
5	NON-CHOICE  SINKING HOSE		

6	NON-CHOICE  NOODLE WITH BUOY		
7	NOODLE SHELL 	NOODLE JAX 	L R
8	NOODLE RAFT 	TEASER BALL 	L R
9	HOSE HOOP 	RUBBER DUCKY 	L R
10	NON-CHOICE  TWO BOOGIE BOARDS		

Appendix C

Observation Data Collection Sheets

Date:		Session:	Observer:
Animal:		Location:	Start Time:

	Time (min)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Location	East Pool															
	South Pen															
	Middle Pen															
	North Pen															
	Catch Pen															
	West Pool															
Activity	Circle Swim															
	Non-Circle Swim															
	Stationary															
	Fast															
	Slow															
	P/G Swim															
Play	w/choice object															
	w/standard object															
	Sexual contact w/object															
	Bow w/ Object															
Ori	Object															
	Dolphin															
Social	Tactile															
	Chase/Follow															
	Flee/Avoidance															
	Rake															
	Group Social Ball															
	Chin Slap															
	Tail Slap															

Comments:

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