Cognitive Housing Options In Captive Environments

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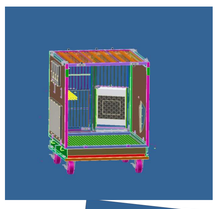
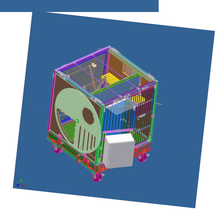




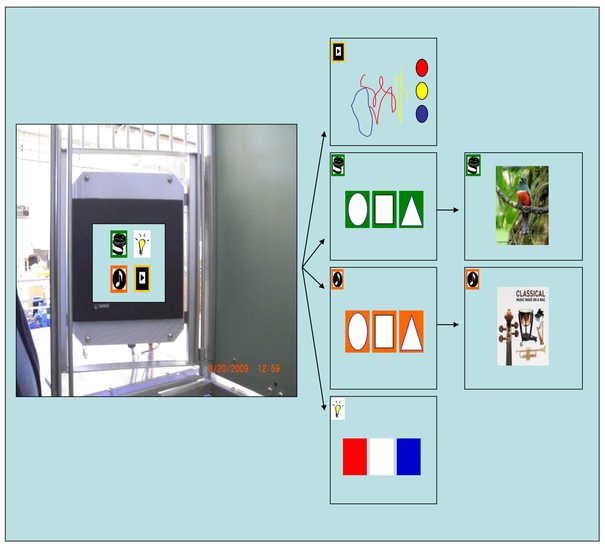
Introduction

Environmental enrichment is commonly provided to enhance and diversify an animal's captive environment. Traditional enrichment approaches may not provide sufficient environmental complexity or cognitive stimulation (Schapiro, 2007). Consequently, novel housing was designed for laboratory non-human primates (NHP's) to promote choice and environmental control through reasoning, memory, and hand-eye coordination. This caging system, named "Cognitive Housing Options In Captive Environments" (CHOICE), is equipped with an interactive touch screen that allows the animal to control audio, video, and lighting for computer-based "play" enrichment. Animals can also gain visual access to the room via a "pop-out porch" and control their degree of social contact with a paired conspecific as well as modulate their immediate ambient temperature via an infrared heat source. Because interactive technologies allow monkeys, like humans, to use complex cognitive skills, we believe this caging system will provide opportunities for evaluating individual animal enrichment, and may prevent, reduce and treat the expression of abnormal behaviors.

Touch Screen- Enables choice and control over audio & video as well as opportunities to "play" using a creative paint program and lighting (red/white/blue choices)

Environmental Control over Heating- emitted by a infrared heat technology.

Pop-out/collapsible porch- Provides NHP with novel views of their room and their neighbors.



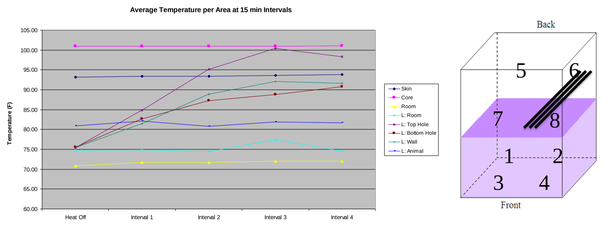
Experiment & Findings

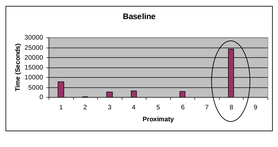
The following evaluations of the CHOICE Cage (Figure ?) have been conducted using macaque species of primate:

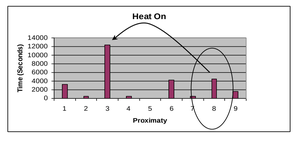
Safety and Sanitization- Effectiveness of using this cage to ensure safety to the NHP and the husbandry handler was conducted using a standardized survey. Evaluation included the ability of the unit to house NHP's, without concern of injury or escape, as well as for the human handlers that maneuver the caging during daily husbandry and cleaning. Effective sanitization was performed using a combination of Chlorofoam® (sodium hydroxide) & Clidox® (1:18 chlorine dioxide) to produce no microbial growth on agar plates and a ATP/ bioluminescence (Charm Sciences Inc. ®) finding of less than 4000 Refractive Light Units- a measure that was ½ the acceptable limits for laboratory housing supplies and equipment. (Figure?)

Caging Components- An animal was evaluated using video recording and analysis of behavior and location, compared to a normal baseline in a standard, non-instrumented cage. The animal spent as much as 5X as much time in the pop-out porch versus the perch, the earlier preferred location in a standard cage.

Heating Element- An infrared (IR) device (Normotherm®) uses radiant heat to warm without generating heat to surrounding surfaces or in the air, thus avoiding risk of burn. This heating element allows animals to self proximate to their preferred temperature. The safety of this element was evaluated using core capsule and skin temperature sensors (VitalSense®) over 24 hour periods, during which the animal's temperature remained constant (94ºF Skin/ 101ºF Core), while the room temperature was maintained at 72-74ºF (Digital & Laser thermometers). The animal was observed to be closer to the IR heat element, suggesting that the NHP's prefer ambient temperatures greater than the standard settings (Figure ?).





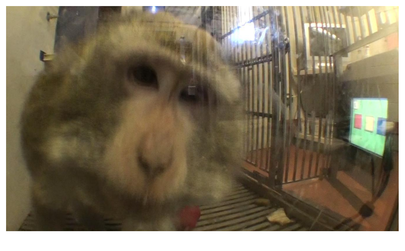


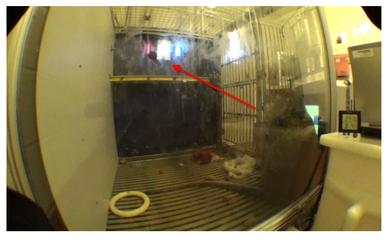
Touch Screen- Validation studies have been conducted to ensure the functionality of the touch screen device, the ability of the animal to learn and use the features as well as the interpreted response benefit of the provided choices: Audio, Video, Light & "Play". During the validation period changes were made to ensure that the interactive program would work as expected in order to move forward with experimental testing of individual animal preference and the ability of such interactive devices to benefit animal welfare. (Figure ?)
Data was collected from 2 NHP's for 2 hours, 2 times daily for 4 weeks. Sessions were video recorded and analyzed to ensure the touch accuracy, activation of choices and-response. Data captured was analyzed for space utilization in the cage (& the amount of time spent in the proximity of the touch screen), amount of time directly interfacing with the touch screen device and what *choice* was made. Summary of this analysis confirmed that the animal often spent time in the presence of the screen, continued to interact with the screen over the course of 4 weeks, interacted with the touch screen and activated all of the provided choices. Behavioral assessments were conducted to interpret the animal's response to the activated choice as being purposeful with the animal making positive visual, vocal and physical cues in response to touching the choices. The touch screen is formatted with a history file so that NHP interactions with the interface are recorded. In addition the program has been made user friendly so that it allows easy manipulations to: amount of time played, # of choices (video only, video selections up to 3, video & audio, etc.) & selections offered.

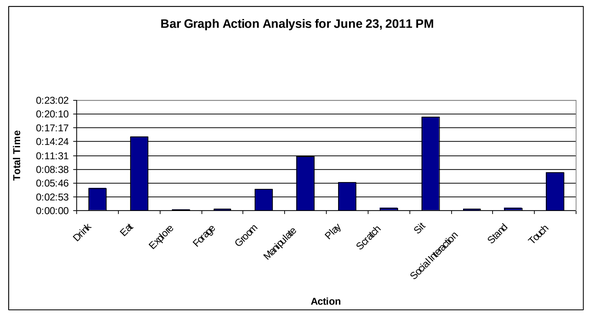
Social Housing Dial- use of the social dial has not been evaluated. Several modifications have been made from the original prototype to ensure safety of non-human primates. Testing is anticipated to begin with socially compatible and already pair housed animals.

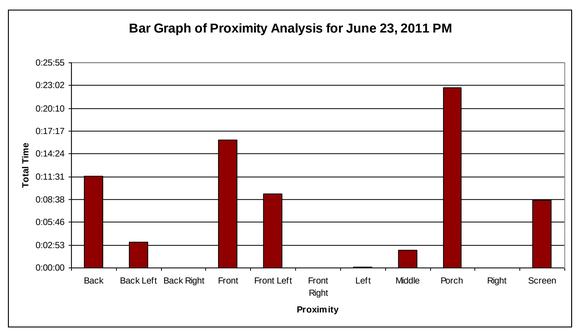
Conclusion

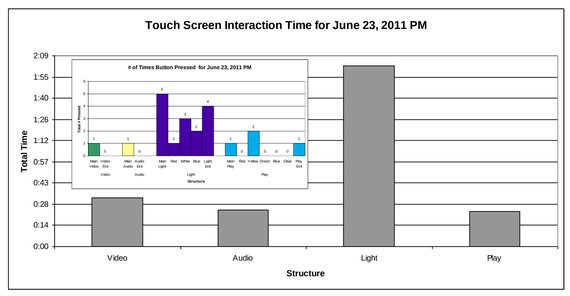
The CHOICE cage is being evaluated for its capability and effects on improving animal welfare by alleviating stress and boredom and encouraging expression of species-specific behaviors. With detailed observations, such an application can reveal a greater understanding of an individual animal's needs and preference for multiple environmental stimuli. This, in turn, may lead to a greater understanding of how abnormal behaviors develop and how they can be successfully treated and ultimately avoided.

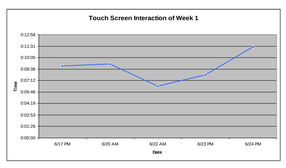


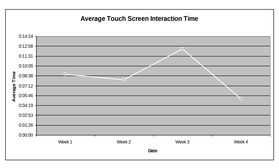












References

Scott, Pearce, Fairhall, Muggleton and Smith. Training Nonhuman Primates to Cooperate With Scientific Procedures in Applied Biomedical Reseach. Journal of Appl. Animal Welfare Science, 6(3), 199-207.

Schapiro and Lambeth. Control, Choice, and Assessments of the Value of Behavioral Management to Nonhuman Primates in Captivity. Journal of Appl. Animal Welfare Science, 10 (1), 39-47.

Basset, Buchanan-Smith. Effects of Predictability on the Animal Welfare of Captive Animals. Applied Animal Behaviour Sci. 102 (07), 223-245

Information

For More information on the CHOICE Cage and updates on it's evaluation and use visit

Britz & Company http://www.britzco.com

Center for Comparative Medicine www.virtualvivarium.com

Resources

Charm Sciences Inc. ® http://www.charm.com/en/products/atp-hygiene-swabs/pocketswab-plus/pocketswab-learn-more.html

Normotherm® http://www.normotherm.com/

VitalSense® http://vitalsense.respironics.com/

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