

THE SHAPE OF ENRICHMENT

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Scent Preferences of Southern White Rhinos

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During a nine-month internship at the Phoenix Zoo, I decided to explore olfactory enrichment for two southern white rhinos (*Ceratotherium simum simum*). The male, Khetla, was 36 years old and the female, Tambile, was 35 years old. They were already provided with a

variety of enrichment items: logs that were stacked daily by the keepers, a bowling ball that was typically placed on top of the log pile, spices (such as sage) that were occasionally distributed in the exhibit, a pond, and a mud wallow.

Novel plant items, such as papyrus or cattails, were also infrequently placed on exhibit. Upon investigating the white rhino's natural history, I found that this species compensates for its poor eyesight with an excellent sense of smell and hearing (Penny, 1987), and its nasal cavity is larger in volume than its brain cavity (Balfour, 1991; Penny, 1987). Scents are used to mark territory and to advertise the status of individual animals, and investigation of scents takes up a large proportion of a territorial male's day (Estes 1991). With this information, a scent enrichment

project seemed very appropriate for these animals.

No information was available, however, on which scents might be preferred by rhinos. While the Phoenix Zoo occasionally used spices as part of rhino enrichment, no formal data was available about the rhinos' preference among the spices used. In 1996, Zoo Atlanta conducted a behavioral enrichment project that included olfactory enrichment for their black rhinoceros (*Diceros bicornis michaeli*), but they did not measure preferences among the scents used (Hodgden, 1996). For my project, I decided to investigate scent preferences, with the hypothesis that the rhinos would react more strongly to some scents than to others.

The rhinos were observed for several weeks to record a baseline for their behavior. This was used to determine the optimal times for observing the rhinos, and to develop a check sheet for documenting their behavior during the enrichment project. After the baseline observations were complete, the female rhino died (on December 31, 1998). In order to determine if the male rhino's behavior had been altered by her death, the baseline observations were repeated. He demonstrated no significant change in behavior or activity patterns from those that had been previously observed.

A long list of scents was originally suggested for this study, but in order to allow repetition of scents, the list was reduced to the following:

McCormick Pure Anise Extract
McCormick Imitation Banana Extract
McCormick Imitation Coconut Extract

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Southern white rhinoceros (*Ceratotherium simum simum*)



Old Spice Aftershave
McCormick Imitation Maple Flavor
McCormick Pure Peppermint Extract
Safeway Pure Vanilla Extract
Safeway Distilled White Vinegar

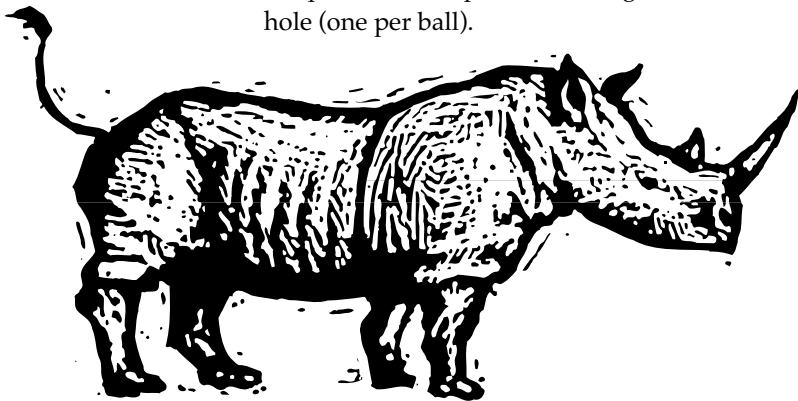
Peppermint extract appeared to elicit the largest variety of responses. For example, the rhino mouthed the bowling ball, moved it under his nose, and moved it across the exhibit. Marking behavior was most frequently observed with anise extract.

These scents were chosen because they are readily available and relatively inexpensive. In addition, because they were all liquid scents, a common

technique could be used for exposing the rhino to the scents.

Bowling balls were chosen as the vehicle for providing the scents to the rhino. They were selected for these reasons: balls of uniform shape, size, and color could be obtained; a bowling ball was already used for enrichment, so its presence would not alarm the rhino; bowling balls had been demonstrated to withstand normal interactions with the rhino (pushing, rolling, etc.); and the rhino would not have direct access to the scents. Five bowling balls were used for the project. Each of the balls was painted black and numbered (1 through 5) with yellow paint. The balls were used as follows:

- One ball with nothing placed in a finger/thumb hole.
- One ball with a sponge soaked with water placed in a finger/thumb hole.
- Three balls with a sponge soaked with one teaspoon of scent placed in a finger/thumb hole (one per ball).



After the bowling balls were painted and numbered, they were placed on exhibit with no scents for three trials. This was done to acclimate the rhino to their presence and to validate the check sheet. The bowling balls were placed near the front of the exhibit, in an area typically visited by the rhino as he walked around the exhibit. The balls were placed approximately two to three feet apart, with the set of bowling balls surrounded on three sides by logs. The logs were used to minimize the possibility that the rhino would push the ball(s) into the moat at the front of the exhibit.

Four trials were conducted for each scent, with three scents in each trial. All trials were conducted on Saturday. The bowling balls (with scents) were placed on exhibit while the exhibit was being cleaned. The rhino was then observed from 9:30 to 11:30 a.m. and from 2:00 to 4:00 p.m. All interactions, particularly with the bowling balls, were videotaped for later analysis. A check sheet was used to record the rhino's activity every five minutes, and to document any interactions with enrichment items as they occurred.

The rhino had a variety of responses to the scents. These included ignoring, looking near (within three feet), sniffing, rolling the bowling ball under his nose, rolling the bowling ball across the exhibit, mouthed the bowling ball, and marking (urinating on) the bowling ball. Of the scents tested, five (almond, coconut, Old Spice, vanilla, and vinegar) elicited five or fewer total interactions. These were removed from further consideration. The four remaining scents (anise, banana, maple, and peppermint) were analyzed further by comparing bout duration to the controls.

Of the four scents that were fully analyzed, only peppermint extract demonstrated a statistically significant difference in bout duration when compared to the controls. Anise extract, however, elicited the most total number of interactions (25). Peppermint extract appeared to elicit the largest variety of responses. For example, the rhino mouthed the bowling ball, moved it under his nose, and moved it across the exhibit. Marking behavior was most frequently observed with anise extract.

Of the scents that were tested, peppermint extract and anise extract contained the largest concentration of alcohol (89% and 73%, respec-



tively). The rhino's interest could be due to the amount of alcohol present. It should be noted, however, that Old Spice aftershave has a high alcohol content but only elicited two visits. To test the effect of alcohol on the rhino's preference, further observations could be conducted with alcohol instead of water as one of the controls.

This enrichment study could be expanded in a number of ways. First, additional scents from the

original list could be tested using the same techniques as those used for this study. Dry scents, such as spices, could be wrapped in cheesecloth, with cheesecloth used as one of the controls in

which ball was used as a control or for a scent was randomly determined each week. While it is possible that a residual smell in the bowling balls affected the results, the rhino's reaction to the various scents and control balls was consistent throughout the study. Therefore, I believe that this did not affect the study results. In the future, a means of sealing the interior of the finger/thumb holes should be investigated to make this job easier.

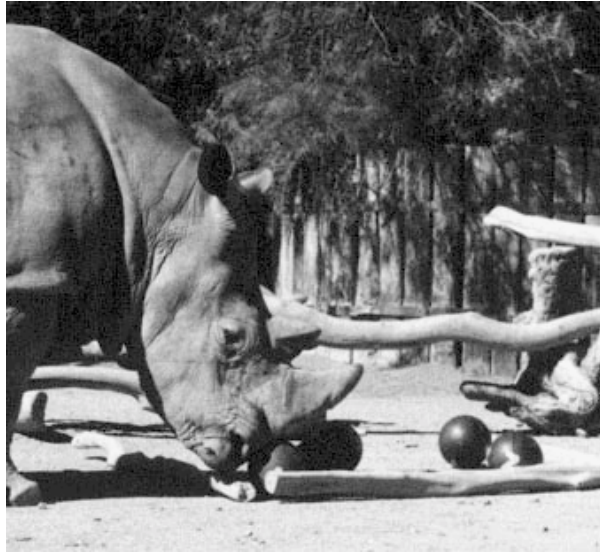
Any scents that are identified as favorites could be used in other forms of enrichment. For example, the scent could be placed on one or more of the logs, used to create a scent trail on the floor of the exhibit, or painted on walls in the exhibit. This may result in more exhibit exploration by the rhino, as well as encouraging natural behaviors like patrolling and marking territory. ♦

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Khella investigates the scented bowling balls.

lieu of the sponge. The rhino's preference for mint could be further investigated by trying different types of mint, such as spearmint or wintergreen. Fresh mint leaves could also be crushed and wrapped in cheesecloth, to eliminate alcohol as a factor in the rhino's interest.

One unexpected benefit from this project was the interest shown by zoo visitors. Many visitors were curious about why bowling balls were placed on exhibit, and they were interested to learn both about rhino's excellent sense of smell and the scent preference study. Their interest provided an excellent opportunity to further educate the zoo public about the natural history of the white rhinoceros, and to explain the purpose of enrichment. Anecdotally, it seemed that many visitors left with a more positive view of the Phoenix Zoo and the manner in which it treats its animals.

An unexpected problem encountered during the study was the difficulty of cleaning scents out of the bowling balls between trials. All balls were cleaned with soap and water, scrubbed with rubbing alcohol, and rinsed at high temperature to minimize any residual smell. The selection of