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Published online: 08 Jun 2010.


To link to this article: http://dx.doi.org/10.1207/s15327604jaws0101_6

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COMMENTARY

On the Psychological Well-Being of Chimpanzees

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The behavioral and cognitive abilities of chimpanzees are extremely similar to those of humans. Goodall (1986) has demonstrated that chimpanzees in the wild are not so different from hunter-gatherer human populations. They live and hunt in communities, they form strong social bonds with their friends and families, and they make tools. They display a tremendous amount of cultural diversity in regard to tool making, tool use, and food preferences. Perhaps the most pertinent similarity is the fact that they can suffer emotional and physical pain just as we do and often for the same reasons (Goodall, 1986).

The chimpanzee's cognitive abilities are as striking as are their behavioral and cultural similarities to humans. The work of Gardner and Gardner (1989) has demonstrated the cognitive ability of the chimpanzees to communicate with the signs of American Sign Language. Other research has demonstrated that chimpanzees can pass their signing skills on to the next generation, that they use their signs to spontaneously converse with each other when no humans are present whatsoever, that they will sign to themselves, and that they will use their signs during imaginary play (Fouts & Fouts, 1989; Fouts, Fouts, & Van Cantfort, 1989).

The cognitive differences between apes and humans is one of degree, as Darwin's notion of continuity has maintained for over 100 years. Other scientists have argued that this cognitive continuity extends to many other animals beyond chimpanzees. Because our fellow animals are aware, because they think, because they feel, there are ethical aspects to consider before doing any sort of animal research. In this regard, King (1986a), former director of the Yerkes Regional
Primate Center, has stated: “Human awareness of the sentience of other species and our ability to empathize with suffering leads us to a responsibility, recognized by our society, to treat animals with a compassion and concern for their sentience” (pp. 406-407).

Concern for an animal’s well-being is particularly critical in research. If an animal is not properly cared for, it will effect the efficacy of the experiment by introducing confounds. Davenport (1979) noted that laboratory primates are typically housed in stressful, unnatural environments conducive to the development of abnormal behavior. Standard primate housing can easily result in both social and environmental deprivation. Such conditions confound the research and make any findings questionable. On this topic, King (1986b) stated:

There are many ways that non-experimental stress can occur in the laboratory or in the animal housing situation and many ways that stress can affect experimental results . . . environmental and social stress can influence neurological, endocrinological and immunological processes . . . . Among the stresses, which can produce abnormal biological and behavioral changes, are: immobilization, isolation, aggression, trauma and crowding. (p. 10)

In other words, experimenting with animals housed in impoverished conditions is not a scientifically sound procedure. Two questions arise from this conclusion: What is the nature of impoverished conditions; and What is the nature of conditions conducive to an animal’s well-being? These two questions go together because if we know what conditions are harmful, we can avoid them, and thus improve the conditions with their removal. There is a plethora of research demonstrating harmful conditions for primates, most of it typically reported in deprivation studies (Davenport & Menzel, 1963; Davenport, Menzel, & Rogers, 1966; Davenport & Rogers, 1968, 1970; Davenport, Rogers, & Rumbaugh, 1973; Elias & Samonds, 1973; Evans, 1967; Harlow, 1964; Harlow & Harlow, 1962, 1965, 1969; Menzel, 1963, 1964; Menzel, Davenport, & Rogers, 1963a, 1963b, 1970). In addition to telling us what to avoid in housing captive primates, these studies also implicitly tell us what might be beneficial.

A necessary prerequisite to good science is humane treatment—the two should not be in opposition to each other; in fact, they must complement each other. The following are some specific areas where improvement in one will improve the other.

**CAGE SIZE AND SPACE REQUIREMENTS**

Cage size is a sensitive topic for most researchers who keep captive animals of any sort. In 1987, at a United States Department of Agriculture (USDA) sponsored meeting on the topic of primate psychological well-being, cage size was looked upon with dread by most of the participants. Some of them had thousands of cages that they feared would be considered inadequate. Although that USDA committee's
charge was to come up with recommendations for regulations that would address the new law concerning the psychological well-being of primates, the primary concern was not on well-being, but on the financial costs associated with any new cage size regulations. To be sure, this might be a legitimate concern. However, it was inappropriate for the committee’s task—nonhuman primate well-being.

I pointed out the absurdity of the proposed regulations. At the extremes a 100 kg chimpanzee or even a 275 kg gorilla could legally be kept in a cage with only 2.33 m² (25.1 sq ft) of floor space for the animal’s entire life that might range up to 40 to 50 years. Not that any reasonable person would do this to a chimpanzee or gorilla, but the point was that it was legally possible. Unfortunately, the regulations are vague; they state that it should be larger for large apes (e.g., more than the Group 6 provision of 25.1 sq ft or 2.33 m² for the apes weighing 55 lbs. or 25 kg or more), but nothing is specified. It states: “In addition to the proposed space requirements, we proposed that facilities must provide great apes weighing over 110 lbs. (50 kg) and additional volume of space in excess of that required for Group 6 animals, to allow for normal postural adjustments” (U.S. Department of Agriculture, 1991, p. 6469).

With regard to cage size, some people have treated it as if it were a new topic with no history. Research exists in the literature, however, with implications for cage size. For example, 10 years ago Clarke, Juno, and Maple (1982) examined the behavior of three chimpanzees who were moved from a 2.44 m x 3.05 m laboratory cage (8 x 20 ft, more than seven times greater than the old minimal regulations and nearly so for the new) to a 12.2 m x 36.6 m (40 x 120 ft) island. Two weeks prior to the move to the island, the male had a mean hourly stereotypy rate of 26.5 for Week 1 and 45.75 for Week 2. Once on the island, this hourly stereotypy rate of dropped to 8.5 the first week and ranged between 0 and 4 for the following 21 weeks. In a similar study, Pfeiffer and Koebner (1978) examined the stereotypy rate in eight chimpanzees who were moved from a laboratory to an island. The two chimpanzees with the highest rates before the move were found to have decreased their stereotypic behavior by 70%, 6 months after the move to the island.

Another study conducted nearly 30 years ago has an interesting history. Line (1987) cited it as indicating that stereotypical behaviors are not related to cage size. However, when the original study is examined, with all experimental conditions taken into consideration, a different picture emerges. Berkson, Mason and Saxon (1963) experimented with varied enclosures and measured the stereotypy rates of chimpanzees who had experienced early deprivation in an earlier study done by Davenport and Menzel (1963). Berkson et al. (1963) began their study with Experiment I after the chimpanzees had been living in the standard laboratory environment at Yerkes for approximately 3 years. They found in Experiment I that when the chimpanzees were placed in a 2.06 m x 1.5 m x 1.98 m, 3.09 m² (81 in. x 59 in. x 78 in., 33.2 sq ft) wooden isolation cage that was occluded, preventing them from seeing out, they engaged in stereotypies 85% of the time. When the chimpanzees were moved to a slightly larger outdoor cage with bars allowing them to see out,
measuring 1.75 m × 1.83 m × 2.16 m and 3.2 m² (69 in. × 72 in. × 85 in., 34.5 sq ft), the stereotypy rate dropped to 52%. The lowest stereotypy rate of 15%, however, occurred when the chimpanzees were placed with other chimpanzees in an outdoor enclosure measuring 11.89 m × 17.37 m and 206.53 m² (39 × 57 ft, 2223 sq ft).

In Experiment II, Berkson et al. (1963) continued the study by investigating the effects of giving objects to isolated chimpanzees, as well as the effects of a third even smaller cage measuring 1.52 m × .84 m × .81 m and 1.28 m² (60 in. × 33 in. × 32 in., 13.75 sq ft) that had three sides occluded and one side open so the chimpanzee could see out. They reported in Experiment II that while in this new small cage the chimpanzees engaged in stereotypies 34% of the time when they had objects to manipulate and 36% of the time when they did not. These results were compared to the larger completely occluded wooden cubicle where the chimpanzees stereotypies took up 59% of their time when they had objects to manipulate as compared to 67% of their time when they had nothing. Because the rates were lower in the smaller cage (34% and 36%) the researchers concluded that cage size alone does not necessarily affect the incidence of stereotypies. However, it should be pointed out that any potential positive effect related to cage size alone may have been canceled out by the total isolation produced by the cubicle.

When the results of Berkson’s et al. (1963) Experiment II are compared to the results in Experiment I (i.e., moving the chimpanzee from the small cages to the 206.53 m² outdoor enclosure), another conclusion can be drawn. Namely, that small cages of the size tested were all too small and that the minor increases did not make much of a difference. However, when there was a dramatic increase in cage size (e.g., from 3.09 m² to 206.53 m²) with the outdoor cage and by placing the chimpanzees in a social group, a dramatic improvement in their behavior was observed. I interpret these results to mean that a linear relation between cage size and psychological well-being as measured by stereotypical behavior or aggression may be incorrect. In other words, small increments in cage size do not have a great effect in reducing stereotypical behaviors. Cages smaller than 34 m² have a nonlinear relation with regard to indices use to indicate psychological well-being or the lack thereof. These indices can be affected by external conditions such as ability to see out or having objects to manipulate. The largest positive effect in terms of reducing stereotypical behaviors occurs when the chimpanzees were placed in a large outdoor area and were socially housed. This conclusion is consistent with the Clarke et al. (1982) and the Pfeiffer and Koebner (1978) studies.

The consistent message from the Berkson et al. (1963), the Clarke et al. (1982), and the Pfeiffer and Koebner (1978) studies was that we should be looking for captive enclosures that have outdoor access and that simulate the complexity and expansiveness of the natural habitat of the chimpanzees. This brings me back to the beginning of this section, where suggestions with regard to changing cage size regulations met great resistance because of cost considerations. I should point out that Steve Suomi’s compound for the monkeys at the Poolesville facility was not nearly as expensive as it would be to build a much smaller building filled with many
small cages. Likewise, relatively inexpensive moated islands for chimpanzees can be designed or enclosed outdoor areas. The task of any committee that is charged with addressing the psychological well-being of chimpanzees should not be to create a cost analysis on the well-being of primates, but instead to try to determine what will promote well-being, regardless of cost.

The issue of cage size should be driven by performance-engineering standards. Either one of these standards, performance or engineering, are meaningless alone. Engineering standards alone ignore the effects of the standards on the primates, and performance standards alone ignore the environment in which the performance is expressed. To only require performance standards makes as much sense as a scientific study to only examine effects and ignore the cause. At a more pragmatic level, if some engineering standard improves the well-being of primates, then it should be shared and established as a standard for all primates rather than ignored.

**DESIGN OF HABITAT**

Complexity is the main idea here. Having a variety of characteristics in the environment encourages a variety of behaviors ranging from social interactions in groups to privacy. In designing an enclosure, escape outlets, privacy refuges, and visual barriers must be provided to help reduce aggression and social stress (Fouts, Abshire, Bodamer, & Fouts, 1989; Fritz & Nash, 1983; Maple, 1979; Maple & Stine, 1982; van Hooff, 1973).

Some researchers have changed traditional cage design to reduce stress. Rumbaugh (1988) reported that a slanted cage front makes it less conducive for male chimpanzees to display, which in turn results in a more tranquil social setting.

A complex environment also provides for the diversity of individual preferences among the chimpanzees, which seem as great as our own. The more varied the environment the better chance that it will contain something for everyone.

**SOCIAL NEEDS**

Addressing the social needs of the chimpanzee is critical. As referenced earlier, dozens of studies examining the effects of social deprivation indicate that the damage resulting from deprivation can be permanent. In this regard, Davenport (1979) has stated that "The persistence of cognitive deficits in the restricted-reared chimpanzees, even after 12 years of environmental enrichment, prolonged testing, and group maintenance, is interpreted to mean that deficits so acquired are not readily corrected" (p. 351).

To reiterate, the social environment is perhaps one of the most critical elements in achieving primate well-being. Compatibility is an important quality. Animals should be carefully monitored for changing social relationships and action should be taken to remove individuals that cannot get along.
Another critical aspect of the social needs of the primates includes the human caregivers that are responsible for their well-being. The human caregivers should be carefully selected for their compassion and caring. They should have extensive training with regard to techniques and the species they are studying. Fouts, Abshire, Bodamer and Fouts (1989) detailed some suggestions with regard to topics and methods. Likewise, Rumbaugh, Washburn and Savage-Rumbaugh (1989) pointed out that the researcher employing a chimpanzee for biomedical or behavioral research should have firsthand experience with them.

The 1991 USDA regulations do not adequately address this most important variable of social needs. The final regulations merely provide that individually housed primates be able to see and hear other primates. This has been the typical situation in this country for years. However, the mere ability to see and hear other primates is no substitute for contact. The result is that singly housed animals are being socially deprived resulting in dire consequences for their well-being. As long as social housing for primates is not mandated, albeit with a provision for exceptions therefrom for research purposes or because of the particular needs of individual animals, it is safe to say that the majority of facilities and other entities regulated by USDA will not provide it.

ENRICHMENT AND THE COSTS OF ENRICHMENT

An important characteristic of enrichment items is the destructibility or mutability of the items. We have found at the Chimpanzee and Human Communication Institute that if the item changes or can be destroyed then the chimpanzees will use it more. However, such items as boomer balls, that are practically indestructible, lose the chimpanzee’s interest quickly. Items that change or that can be destroyed are not necessarily expensive, such as cardboard boxes, magazines, or play clothes. Fouts, Abshire, Bodamer and Fouts (1989) described several toys, games, activities and events that are effective enrichment techniques for chimpanzees.

With regard to costs, Fouts, Bodamer and Fouts (1990) examined the cost of material and the cost of personnel time to prepare and present the enrichment item for the chimpanzees. Such items as buckets of frozen water containing dried fruit were used by the chimpanzees 81% of the time and cost $0.42 to make (commercially produced dried fruit being expensive) and averaged 1 min 19 sec to prepare. Yogurt dipping problems were used by the chimpanzees 66% of their time, cost $0.16 per item and took 3 min 28 sec to prepare. The point is that enrichment need not be expensive.

In addition to the ideas stated before, enrichment programs should be reviewed, added to, or varied on a regular basis. A chimpanzee can only be enriched with the same old thing for so long before it becomes a mindless routine that is boring to everyone. Variety and change are the main points here.
One final point, will be addressed with regard to the 1991 USDA regulations that require each entity to establish a plan for primate enrichment. Having an enrichment program plan on file does not meet the goal of the original legislation, which required a physical environment adequate to promote the psychological well-being of primates. Some entities will surely try to get by with the provisioning of toys like boomer balls, ropes, constantly playing television sets and sticks. Although these items might amuse the primates for a short time, they should not be considered final solutions. One way to ensure that these enrichment programs meet some national standards is to require that all enrichment programs be filed with the USDA so that they then can be examined and commented on by the rest of the scientific community and the interested public. By this means we may open up communication channels and share ideas so that the well-being of the primates truly comes first. It has been argued that making this plan available would compromise the entities security. I can think of no reasons why these sharing these programs compromise security any more than does the publication of a research protocol.

**PAINFUL EXPERIMENTATION**

The chimpanzee's similarity to humans is not particularly beneficial to them. It is because of their phylogenetic similarity that they are popular as biomedical subjects. But this is a two-edged sword; because of that similarity, we should be even more sensitive to the potential suffering they might experience.

It is my opinion that all painful experimentation should be publicly justified prior to the research, and all research involving painful experimentation that is submitted for publication should explicitly justify in its method section why there was no other course or alternatives available for the study. All painful experimentation must be open to peer and public scrutiny prior to and after its completion. If there is a less painful way to accomplish the same thing, we would certainly want to know about it before the deed is done.

**ACKNOWLEDGMENTS**

A version of this article was originally presented to the National Research Council's Institute of Laboratory Animal Resources' Committee on Well-being of Nonhuman Primates on December 17, 1992. The committee was charged with making recommendations for a revision of the *Guidelines for the Care and Use of Laboratory Animals (Guide)* that was last revised in 1985. The current revision is in press. For statements in the new revision *Guide* (U.S. Public Health Service, in press) relevant to the points I raised before the committee, see, particularly, sections or chapters...
on “Space Recommendations” (pp. 22-26), “Behavioral Management” (pp. 32-33), and “Pain, Analgesia, and Anesthesia” (pp. 58-59).

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