

Original /Review Articles

Environmental Psychology and Great Ape Reproduction

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At the 1980 Great Ape Infertility Workshop, we concluded that "physical and social environments must be improved if not optimized if great apes are to reproduce satisfactorily..." In 1982, the trend toward improvement continues and there are some promising signs that reproduction has been enhanced as predicted. The problem of designing and evaluating captive environments which will facilitate interaction, reproduction, appropriate parenting, and socialization is well within the scope of Environmental Psychology. I intend to illustrate the promise of this applied research field in the remarks that follow.

The intellectual roots of this work may be traced to three individuals: Robert M. Yerkes, Heini Hediger, and Robert Sommer. Early in his distinguished career, Yerkes acknowledged the importance of the physical environment. In his 1925 publication *Almost Human* he wrote:

If... we were asked to sum up ... the essentials of success in keeping and breeding the higher primates, we should emphasize the following points: freedom, or reasonably spacious quarters; fresh air and sunshine, preferably coupled with marked

vanations in temperature; cleanliness of surroundings as well as the body; clean and carefully prepared food in proper variety and quantity; a sufficient and regular supply of pure water; congenial species companionship and intelligent and sympathetic human companionship ... ; and, finally, adequate resources and opportunity both in company and in isolation for work and play.

Fifty years later, it appears that great ape management practices have finally begun to reflect this sage advice.

Similarly, Heini Hediger (1950) long ago recognized that captive environments could be enriched. In his own words:

Naturalness in the treatment of wild animals does not consist ... of a pedantic imitation of one model section of nature. It means that a substitute must be found suitable for animals, taking into account the new conditions of life in captivity. Naturalness, in the sense of a biologically correct type of space, is not the result of an attempt at imitation, but of an adequate transposition of natural conditions.

More recently, the work of Robert Sommer has been a rich source of ideas and insight. His book *Tight Spaces* (1974) especially influenced my own thinking. Differentiating between "hard" and "soft" environments, Sommer observed that the behavior of people could be profoundly influenced by such design features. I have argued elsewhere that this dimension of habitat is a variable of some significance in captive animal behavior. I have been furthermore guided by Sommer's classic declaration that:

If living creatures cannot be left in their original habitat, the least that can be done is to place them in natural and responsive surroundings - natural so that their character is not warped, and responsive so that their individuality and creativity are firmly respected.

The literature of Environmental Psychology (hereafter EP) complements nicely the views of these three men. Indeed, the extant data can be uniquely applied, since in EP the research on humankind can be applied to animal welfare issues. This irony is akin to Harlow's (1979) view that:

... one should never study problems in monkeys that cannot be solved in man.

A well-known text in EP written by Bell, Fisher and Loomis (1978) defined the field as follows:

Environmental psychology is the study of the interrelationship between behavior and the built and natural environment.

This definition can be effectively utilized in studies of both human and animal behavior. The relevance of EP to great ape behavior is relatively easy to demonstrate.

Consider the design feature of comfort. The man-made environment is typically hard, barren, and inflexible. This is

in contrast to the softer, more malleable features which are characteristic of the natural habitat.

Of equal importance is the influence of the animal's living environment on human perceptions and attitudes. The appearance of the environment and its adverse effects on the occupants' behavior lends credence to the view that animals are brutish and vulgar. Poor exhibition techniques may stimulate derisive abuse and are likely to reinforce attitudes of human superiority and indifference.

In marked contrast, a naturalistic presentation promises to inculcate positive attitudes and engender respect and appreciation, if not outright reverence for wildlife and the wilderness itself. Regrettably, I am aware of no data which conclusively support this assertion; I am anxious to put it to the empirical test.

A previous trend in design permitted plants only on the periphery of environments. Bold new designs call for plants within.

Hediger (1950) has furthermore argued that plants serve multiple functions in nature for food, support, comfort, and as signalposts, playthings, tools, building materials, cover, and camouflage. The role of plant foods as an occupational device is illustrated by the work of McGrew (1974) who noted that some hard-shelled fruits may require prolonged processing, thereby engaging the animals in a kind of work. As Thorington (1970) has similarly argued:

Since feeding is such a major activity in the lives of primates, feeding behavior is a dominant aspect of their biology- a large part of their natural history... It may greatly influence... social behavior ...

Hediger also suggested that the contours and features of nature are rounded and diverse, not angular and unchanging. At the San Francisco Zoo's new "Gorilla World" and at Seattle's in-

novative Woodland Park Zoo, these principles have been successfully employed.

Recent innovations at Seattle include a flexible chain seating bench combined with browse to increase comfort.

At *Apenheul* in Appeldoorn, the Netherlands, the planted environment is both vertically challenging and spacious. The designer, Wim Mager (unpublished ms.) described this 5 acre island as an "unconventional" design which facilitates group behavior and activity.

Since the "personalities" and locomotor adaptations of the respective taxa vary somewhat, some dimensions of the physical environment may be more applicable to one taxon than another. A vertical composition seems particularly appropriate for an arboreal primate such as the orangutan. A unique design solution has been constructed at the Phoenix Zoo in Arizona.

Other design variables may be briefly mentioned. The presentation of browse stimulates manipulation and nest-building, and may even modify such unsavory behaviors as coprophagy and regurgitation/reingestion. Appropriate cover provides opportunities for play, escape, and privacy. Movable and especially hollow objects, such as empty oil drums and beer kegs, enhance displays as other behavioral scientists such as Van Hooff (1973) and McInnis and Kraemer (1977) have shown.

In a paper soon to be published in the new journal *Zoo Biology*, Susan Fisher Wilson demonstrates that movable objects are associated with greater activity. The presence of such objects must therefore be regarded as beneficial to the psychological well-being of apes.

Although many examples of innovative design and behavioral enrichment can be cited, it must be acknowledged that experimental studies of design effects have been few and far between. Recently, in collaboration with Elizabeth Watts and her students at Tulane University, I

carried out a pretest-post test study on environmental change.

The former environments for both gorillas and orangutans were inappropriate and barren. The new design called for a larger, moated, complex and naturalistic environment which was carefully tested by the consultants.

The presentation was enhanced and new behaviors emerged. Effects on aggression and social interaction were clearly demonstrated. We have recently conducted similar evaluations at the Kansas City and Topeka Zoos respectively.

The physical environment can also be successfully manipulated in rehabilitation projects. At the Bastrop Chimpanzee Facility in Texas, honey-pots (first suggested by Jane Goodall) are periodically deployed to combat boredom. Successful introductions and resocialization of previously restricted animals take place in social groups amid relatively spacious and complex surroundings.

The amount of space is important but as Hediger asserted, even more crucial is the quality, form, and nature of the surfaces exposed to animals. The manipulation of these variables in both experimental and applied settings is a problem within the domain of Environmental Psychology.

Recently, Betsy O'Donoghue (1982) reported that the introduction of an unfamiliar female stimulated sexual behavior in a previously lethargic male orangutan who had for many years failed to breed with his cagemate. Enhanced space has been suggested as a stimulus to breeding in captive gorillas at the Yerkes Primate Center (cf. Nadler, 1982) and at the San Francisco Zoo (Kitchener, personal communication). Intuitively, changing social and physical environments promote reproductive behavior. The data to support this contention are slowly accumulating.

Of course, environmental change should not be absolute; opportunities for continuing novelty ought to be a

feature of every design. Menzel (1971) eloquently championed this cause when he wrote:

Almost any novel, moving, changing or intense stimulus is apt to enhance physiological arousal level and overt responsiveness for a time; but then - assuming the stimulus is innocuous - its effect steadily diminishes with repeated presentations, as if each stimulus in turn must lose its charge and become assimilated into the indifferent standard.

Some infertility in humankind appears to derive from the influence of "psychological" variables. Our understanding of such events is poor. It is not altogether unlikely that similar factors may be at least partially to blame for the reproductive problems of our closest living relatives, the great apes. As physical and social opportunities are enhanced, captive great ape reproduction should be similarly affected.

In quoting his mythical character, the chimpanzee "Pano," William Conway (1978) recently remarked that "a laboratory might be a nice place to visit, but I wouldn't want to breed there." This accurately portrays one of our most difficult problems. Although laboratories are inherently more restrictive in character than are zoological gardens, it is possible to soften and render complex the most difficult of environments. Constraints of time and money, if not human inertia, are the typical obstacles to such progress.

It is useful at this point to apply the definition of health which has been suggested by the World Health Organization. As stated in their constitution: "Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity." By the scope of this definition, healthy apes are those that are active, sociable, busy, and reproductively successful. Environmental Psychology is a tool for achieving these ends.

There is much work to do as we extend the boundaries of Environmental Psychology into the domain of animal behavior. The great apes represent a unique test case, and it is with them that the potential applications may be most usefully applied.

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