Depression in Caged Animals: A Study at the National Zoo, Kuala Lumpur, Malaysia

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Introduction

Psychologists have studied animal behaviors for many years. The behavioral phenomena they study are often similar to the research done by physiological psychologists, for instance, studying the nature and functions of the central nervous system and the cognitive and perceptual processes in animals through experimentation. A specialty within the discipline is comparative psychology that studies animals' evolutionary adaptation to the environment. These psychologists may study animal behavior including inherited behavior patterns like courting and mating, defensive behaviors, predation and parenting behaviors. Behavioral psychologists also initiated their research doing learning experiments with animals, particularly pigeons and rats. B.F. Skinner devised the learning machine, more commonly known as the "Skinner Box" that has been used to research animal behaviors in laboratory settings. Skinner also developed "reinforcement schedules" that are commonly used to train animals in places like the zoos and circuses. Ivan P. Pavlov, the Russian physiologist studying salivary mechanisms in dogs became famous for his discovery of "classical conditioning" procedures and "higher-order learning" in dogs. Martin Seligman (1975, 1971) in his research with rats, described the phenomena of "learned helplessness" in animals when they encounter conditions over which they have no control. These animals learn to become "helpless" and give up trying to cope with the challenging circumstances resulting in the animal equivalent of depression. The field of animal psychology has grown to the extent that there are now at least three professional journals addressing animal behavior issues and the study of animal behaviors has now become interdisciplinary in nature. In other words, most of the well-known academic programs in animal psychology integrate psychological and zoological approaches to the study of animal behavior. The departments of veterinary medicine and departments of comparative psychology often offer such programs jointly. There are also specializations in biopsychology related to animal behavior.

Psychologists' primary aim in studying animal behavior is to enhance knowledge of human physiology and learning mechanisms. Learning experiments with animals also help psychologists understand human intelligence, stress, and even aggression and reproductive behaviors. Seligman for instance, drew some important conclusions from his studies. He theorized that the same phenomena may happen to the humans who are faced with extenuating circumstances in their lives. A new area of research called "Animal Assisted Therapy" studies how humans can benefit from animal interaction, for instance, how the elderly residing in nursing homes or long-term psychiatric patients in hospitals who have minimal or no interaction with family members or friends can benefit from interaction with pet animals. Behavioral psychologists have now joined efforts with professionals from other areas of animal science and are researching applied companion animal ethology, psychology, and behavior therapy. There are strict professional regulations from the American Psychological Association on the ethical and humane treatment of animals used for psychological studies (see http://www.apa.org/science/anguide.html). However, animal research by psychologists is rarely directed at studying emotions such as anxiety and depression.[2] A literature review of the three major psychology journals on animal studies, *Journal of Comparative Psychology, Journal of Experimental Psychology: Animal Behavior Processes* and *Animal Learning and Behavior* did not yield any study related to depression in caged animals. Most research in these journals are limited to lab animals like rats, guinea pigs, pigeons and monkeys and house pets or domesticated animals. Research findings on these or other animals did not include study of emotional behaviors. While some informal studies or comments are published in western newsletters of Animal Rights Groups, systematic investigation on animal depression is seriously lacking. This deficiency is almost glaring in developing countries where conditions at the zoos are far from adequate for reasons including low priority on animal research and budget constraints.

Nature of Modern Zoos

Historically speaking, kings and emperors kept exotic and wild animals in their palaces for entertainment and as a sign of status symbol. Colonialists also captured animals from the wild and shipped them to their countries as gifts or earned them as trophies. Animal confinement in the form of zoos started mostly from private animal collections. Modern zoos vary in size and quality—from drive through farms to small menageries and some larger zoos. They may vary greatly in the types of enclosures, respect for animals, research programs, etc. Most zoos claim to preserve species and educate the public. A typical modern and well-financed zoo would own or have information on all animal categories including the amphibians, birds, mammals, reptiles, and insects. A modern zoo would also possess animals from the desert, islands, rivers, oceans, tropical forests, etc. and in an environment that can reflect the natural habitat of the animals.[3] A fully equipped zoo would have educational programs for the children, youth, family, and even teachers. The zoo would have developed programs for animal conservation and research and even tour programs in other parts of the world. The better zoos are run very professionally and every animal has a specialized keeper. Many zoos have "adopt an animal" program enabling the public to adopt or sponsor a particular animal of their choice. A new concept of "electronic zoos" on the web contains information on all animals, including their images and sounds. Some modern zoos give out press releases on latest information available to them. For example, in a recent press release by the San Diego Zoo in California, we learned that after the Tsunami disaster in Asia, the two endangered animal species, Komodo Dragons and Orangutans found mostly in Indonesia were unaffected as Tsunami spared the islands on which these animals exist (see http://cres.sandiegozoo.org/).

Zoos may also vary in their attitudes towards certain animals. In a recent incident, the Detroit Zoo sent elephants to a sanctuary because in the words of the zoo's director, "Just as polar bears don't thrive in hot climates, Asian elephants should not live in small groups without many acres to roam, and they clearly shouldn't have to suffer winters of the north." (Detroit Zoological Institute, 2004). While confinement of animals brings some benefits to them, such as better food supply and lower risk of predation, there is a growing concern regarding negative conditions at the zoos and heightened interest in animal welfare. There are numerous animal protection organizations in the West working towards improved conditions at the animal research labs, zoos, etc. In most western countries, there are regulations that protect the welfare of captive animals. In

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the US for example, zoos are protected by the Federal Animal Welfare Act (AWA), which sets minimal living standards for captive animals.[4] Federal agencies inspect all zoos at least once per year to ensure healthy living conditions and welfare status of captive animals. The animals must also be licensed with the Federal Department (Ministry) of Agriculture. However, all zoos in the US may not pass yearly inspections and may even violate regulations resulting from sub-standard animal care, neglect, or even abuse.

National Zoo, Kuala Lumpur

The National Zoo in Kuala Lumpur, locally known as Zoo *Negara* Malaysia is located 13 km northeast of Kuala Lumpur City, the capital of Malaysia. It was established two years after the inauguration of the Malaysian Zoological Society in 1961. The total zoo area is around 63 acres situated in the tropical hills of *Ulu Klang* that was part of a jungle reserve and catchments area for the Klang Gates Dam. This zoo has over 4000 animals from 413 animal species. There are 136 species of fish, 118 species of birds, 97 species of mammals and 61 species of reptiles. The philosophy at this zoo is to keep mostly local animals, for instance, more than 70% of the birds are from the Malaysian region and 68% of fish are form the Malaysian fresh waters. Many of Malaysia's most endangered species are kept at this zoo, including the Sumatran Tiger, Sumatran Rhino, Orangutans, Clouded leopard, Storm Stork, Hawksbill Turtle, and the Malayan Bear (only 600-1000 left in the entire Southeast Asian region). A local company adopts many animals at the zoo, Esso, for example, sponsors the tiger and benefits from its advertising as the company name is displayed on a board near the cage. The Lions Group adopted the African lion at Zoo Negara under a sponsorship program costing around US$ 5,000 for feeding, medication, and maintenance of the animal. Currently the zoo runs a captive breeding program for the endangered milky storks and plans to send them to the wild. The zoo had successful breeding programs for giraffes, antelopes and flamingos. The zoo also houses a veterinary hospital on its premises.

Method

A project for studying animal depression at the Kuala Lumpur Zoo was arranged by this researcher. Three undergraduate students interviewed animal caretakers and veterinary doctors with a standard set of questions. The students also observed the animals during the research period. The interview contained questions on whether animals exhibited (1) unusual behaviors, (2) unacceptable or self-defeating behaviors, and (3) dangerous behaviors.[5] Unusual behavior refers to those behaviors that are strange for the concerned animals and are generally not observed under normal conditions, e.g. excessive pacing. Such behaviors are best understood by the zookeepers who can tell when a behavior is unusual. Unacceptable or self-defeating are behaviors that hurt the animals, e.g. behaviors resulting in self-injury, weight loss, etc. Dangerous behaviors are those that would hurt the other animals or animal caretakers. Answers in the positive would suggest that the animals were indeed exhibiting abnormal behaviors, often termed "zoochosis" in the zoological vocabulary.[6] In order to study depression in more detail, students asked whether animals showed changes in their emotional states, motivation, and motor functioning followed by discussions on the symptoms, causes, and treatment of animal depression. The interviews and direct observation of animals lasted for five days. Five animal caretakers and two veterinary doctors cooperated throughout the interview process. This researcher followed up on conversations with the chief veterinarian of the zoo.

Results

Interview of the zookeepers and observations revealed important information about captive animals. First, like in most other zoos, there are limited opportunities for the animals to interact with the natural environment and to express their natural behaviors displayed in the wild. The artificial environment of the zoo makes the animals passive and causes the development of a variety of abnormal behaviors. In the wild, an animal would spend most of its day hunting for food, competing with other animals, avoiding predators, rearing and protecting their young, protecting their territory or engaging in social activities. In the zoo, their food and water are supplied; territories are delineated and social groups fairly structured and stable. There are no predators to avoid and mates are selected for them. Second, the conditions of the cages and enclosures are not always appropriate. Limited space of the enclosures causes feelings of distress and irritation in animals, notably in the primates such as the baboons, monkeys, chimpanzees, and orangutans. The big cats also need a much vast area than what is given to them at the zoos.[7] Many animals find it challenging to adapt to novel surroundings as compared to their natural habitat. This is seen more in animals brought in recently from other parts of the world. Third, overcrowding of animals in small enclosures leads to filth and fighting for territory resulting in injury to the weaker animals. It also limits animal movement and physical activities within the cage. Fourth, animals often react negatively to the visitors who keep teasing or harassing the animals in order to force them to behave or act in certain ways. Sometimes the visitors will throw harsh objects at the animals thinking that by doing this the animals will come closer to them. Visitors may disturb the animals in the cages by loud noise, etc. Visitors may also try to feed unsuitable food to the animals that may result in overfeeding or interfere with the balanced diet or death of the animals. Fifth, animals show clear signs of depression resulting from the loss of a companion. Depression because of the death of loved ones is more obvious among the primates like apes and orangutans as well as in tigers and elephants.[8] The zookeepers noted twice as many females depressed than males over the loss of their companions and depression in females last much longer than in males. While the males got over their depression in weeks or months, the females would be depressed for more than a year. Sixth, lack of food or a repeat of the same type of food overtime can cause passivity and anger, especially in big animals. These animals may also refuse food because of a lack of choice for foods. Seventh, animals also show depression when their need to mate is unmet or delayed. Poor health condition results in the animals sitting around or lying in the corner of their enclosures for extended periods. A variety of stereotypical behaviors is also observed that remain unexplained by the zookeepers. The zookeepers further informed that there is no medical treatment for depression in animals at the zoo. Animal activity is rewarded in the form of food and if animals did not cooperate or denied zookeeper's instructions, then food may be withheld until they start following the rules again! The zoo also provides novel objects or toys that are changed periodically to reduce boredom and depression. Instances of animal depression were shown from following examples at the zoo:

- The apes showed depression by sitting in the corner of the cages or sleeping for long periods.
- Crocodiles in small spaces became ill with bent tail and loss of appetite. Dirty enclosures also contributed to their passivity and illness.
- Relocating the place of living within the zoo resulted in annoyance and depression in animals such as elephants, camels, giraffes, and zebras. The elephants attacked

their keepers when their place of living was changed. Giraffes also showed their depression by refusing to eat when moved within the zoo from one place to another.
- Animals like the orangutans, chimpanzees, and camels, showed sensitivity to the rain by exhibiting extreme passivity or annoyance and fell ill when exposed to the rain.
- Animals like the primates, showed abnormal behaviors including screaming, jumping around, pacing, or passivity during the times when there were more visitors, like on weekends and public holidays. An orangutan died last year due to overeating of peanuts given by the visitors.
- A male orangutan named Abu showed symptoms of depression after the death of its female companion. Abu refused food for three consecutive days and spent most of the time sleeping. Abu learned to spit all the time apparently to get attention. These symptoms continued for several months. A female orangutan preferred to sit in her enclosure rather than go out with others because of her depression after the death of its baby. A female tiger at the zoo was very depressed after the death of its newborn baby and defended it from the zookeepers who tried to remove it from the cage.
- Tigers often showed restlessness by pacing, snarling, and demonstrating stereotypical behaviors like making figures of eight, etc.
- Stressed-out mothers faced hardship in breeding healthy offspring. For example, the female orangutan named Rokiah got pregnant several times and delivered her baby successfully, but every time the baby died soon after birth.

Table 1 includes the symptoms, causes, and proposed treatment of depression in captive animals. The reader may notice an overlap among factors that cause depression, primary among which is the artificial environment of the zoo.

Observations at the zoo revealed additional information such as:

- The elephants played on cement slabs and had to make-do with tree trunks made of cement. While elephant shows were interesting and kept the big animals busy, some exercises were quite unnatural, e.g. one and two hand-stands and standing on hind legs
- Enclosures for the primates were very small and there were trees made of cement for animal amusement
- Enclosure for the giraffe was small and they paced frantically on a small strip of land without grass or vegetation
- The pond for the three hippos was extremely small with shallow water

On the more positive side, the zookeepers report that the animals are given a balanced diet that contains adequate nutrition, vitamins, and minerals. There is great effort in food preparation ranging from choosing fresh and quality ingredients, cleanliness, with both, a variety and quantity of foods. Feeding techniques are used such as hiding the food around the enclosure in the grass or in tree branches or attaching poles on the roof to induce some effort in the animals to use their stealth, power, speed, and grip when obtaining foods. A recent project on improving enclosure design including wall paintings cost the zoo around US $10,000. The staffs agree that despite all efforts, it is impossible to create truly naturalistic environment at the zoo. Staffs also admit that gaining full understanding of species-specific behavior would improve the conditions of the animals in many ways, especially in decreasing their depression.

Discussion

Current psychological literature presents minimal findings on the study of animal depression. Modern zoos can be a place of learning, research, and conservation of animals but the possibility of neglect remains high. Psychologists interested in animal behavior can play an important role in understanding and improving conditions at the zoo for better psychological well-being of the animals that are a living part of our environment. Unlike zoos in the West that must meet federal regulations in order to remain open, zoos in developing countries stroll behind or completely lack in such regulations. Periodic inspections of the zoo from authorities may be lacking and lead to various kinds of animal neglect and abuse as the primary motive for most of the zoos may be commercial and not educational. The Kuala Lumpur Zoo, which is partially government funded is doing what it can to maintain or uplift the quality of the zoo. The zoo has recommended gradual removal of cages and their replacement by environmentally appropriate enclosures that would enhance natural behaviors in the animals. Despite the zoo's ongoing effort for improvement, minimal progress has been observed over the years. While the authorities are striving for a better zoo, the implementation of new programs requires time and money that is not readily available. The zoo administration has made some recommendations to the government focusing mostly on improved layout and design. The present study resulted in a comprehensive assessment of the situation and a list of issues that need immediate consideration by the authorities. The following recommendations also require ongoing effort from zoo personnel and may bring many desired changes.

- Staff education on species-specific behaviors and increased staff training in handling of animals by the experts in the field.[9] Consultation with international agencies may be helpful and some foreign organizations may even provide assistance through their trained volunteers. These organizations have substantial funds for animal research and welfare.
- Develop minimal standards and manuals with instructions of what is expected of the zoo and its staff. This is a project for the authorities responsible for the zoo and may come under the Ministry of Agriculture or Animal Husbandry. Yearly inspections of the zoos would be necessary. A good resource available online is the "Animal Care and Use Training Manual" published by the University of Texas at Brownsville, USA. While this manual is meant for use with lab animals, it can be a starting point or initial guide for use at the Kuala Lumpur Zoo. Website address: http://www.utbtsc.edu/safety/manuals/animal-care
- Licensing of the zoos and of the animals living in the zoos is also necessary. This would ensure a proper record of all animals (or endangered ones) with their health condition and discourage smuggling or illegal import of certain animals. Private collection of animals, e.g. those owned by individuals or "companies," may also be certified by the relevant government agency.[10]
- Increased budget coming from the government or alternative sources including relevant NGO's and other organizations—this would need good public relations, advertisements and communication skills on the part of the zoo administration. A joint effort with the local newspaper, magazine, or TV channel may help raise funds for zoo expansion or renovation.
- Ethical handling and treatment of animals is yet another area neglected unless written rules and inspections or surprise visits by the authorities become a regular practice at the zoos.
- It is important to phase out the cages and expand the enclosures Consultation with bigger and more modern

Table 1 includes the symptoms, causes, and proposed treatment of depression in captive animals.

Symptoms	Causes	Treatment
Passive behaviors (including decreased aggression for animals like the tigers) and decreased social interaction	• Lack of opportunity to interact with the natural environment including the need to hunt • Dependence on routine lowers motivation resulting in decreased activity • Limited space for movement • Death or loss of a companion • Dysfunction of the central nervous system	Modify environment to reflect natural habitat and add animals of same species for increased social interaction—see discussion below Environmental enrichment for increased activities that facilitate expression of species-specific behavior Veterinary treatment
Stereotyped behaviors (repetitive behavior patterns that have no obvious function or goal—such as, pacing, self-biting, bar biting, repetitive vomiting and re-ingestion of food, polydipsia, etc.)	• Anxiety, annoyance, anger, fear, frustration, etc., from being in an artificial environment • Changes in the zoo environment (Draper & Bernstein, 1963) • Drugs and dysfunction of the central nervous system (Mason & Turner, 1993) • Surgical interference or brain injury • Inadequate nutrition • Lack of space in the cages or attempts to escape (Morris, 1964) • Sexual motivation	Environmental enrichment—related to the cause of stereotypes Treatment by stimulant drugs or tranquilizers Work with interdisciplinary teams for accurate diagnosis and treatment. This stage must precede before or simultaneously with veterinary treatment
Loss of appetite/weight loss Abnormal eating patterns	• Death or loss of a companion • Lack of food or choice of food • Physical illness	Replace companion with another (although acceptance may take time) Provide sufficient food and alternate/ alternative food menu
Decreased courting/mating behaviors	• No companionship • Forced companionship • Physical illness • Medication	Consultation with interdisciplinary team
Physical illness (depression is also indicated via physical illness). This may be indicated through breathing difficulties, urination, defecation, movement problems, appearance, general weakness and excessive discharges—nasal, eye, anal, and reproductive tract.	• Unnatural environment • Abuse by other animals or neglect/ abuse by the zookeepers and often by the visitors • Diet problems • Lack of proper diagnosis and medication	Consultation with interdisciplinary team

zoos would help. This aspect is currently underway at the Kuala Lumpur Zoo.

- New toys and games for the animals should be introduced. Operant cages, activity wheels and accessories, photo-beam activities, startle systems, mazes, and animal exercise systems should be encouraged. See website: http://www.lafayetteinstrument.com/animal/htm that contains modern equipment for animal activity and training. Items for smaller animals can be modified to suit the needs of larger animals.
- There is a dire need to develop research programs at the Kuala Lumpur Zoo on animal disease and medication and for animals' emotional problems. Encouraging psychological research is also essential. This is of course, not possible for places where psychology is itself is a low priority or there is a lack of psychologists in the country or where psychologists are not interested in animal behavior research.
- The above point leads us to the recommendation that there should be interdisciplinary academic programs on animal behavior at the local universities, e.g. joint programs offered by psychology and the zoology departments. Such programs would lead to creation of jobs at the university, research centers, and animal facilities.
- It is also crucial to encourage volunteerism from the public and especially younger students to develop their understanding and sense of care for the animals.
- Getting sponsorships from private parties and the humane society at national and international levels may also help in meeting funding needs. Local companies and willing families, private citizens or groups may sponsor an animal of their liking. This practice is currently available in some of the larger zoos in the U.S.
- There is a need to involve the schoolteachers at the local zoo to study the animals and share their knowledge with their class. This would increase awareness and interest in the schoolchildren who could then pursue their interest for improved animal research and welfare in the future.
- Involving members of animal protection groups may also be considered for the sake of improving quality and services at the zoo. See for instance, http://o.webring.com/hub?ring=humane, the homepage of the Humane Society and Animal Welfare Ring that links this site to many other homepages of humane societies and animal welfare organizations around the world.

- It is also possible to merge some of the smaller zoos with the larger ones for cost saving purposes. In Malaysia, there are many zoos of a variety of sizes are types. There are theme parks with animals, reptile parks, bird parks, insect parks, aquaria, and animal shows. If some of these are incorporated in larger zoos, it would not only save expenditure but may prevent animal neglect at smaller animals farms or parks or privately owned animal shows that are purely for profit and never monitored by government agencies.

While this study was interesting and meaningful, it did have limitations. First, the study period was short because it was meant to be a class project. Longer observations may have yield detailed results and more information on these animals or additional challenges at the zoo. Second, even after interviewing the zookeepers, most of the data remained speculative. There is hardly anyway that physiological measures on depression on animals can be obtained in the open. Such observations are presently available in the laboratories only and mostly in western countries. A longitudinal study may be more appropriate. Such factors need to be considered in future psychological research on zoo animals. A growing area of concern is the rising numbers of animal rights organizations, which oppose the concept of zoos and favor release of all animals to their natural habitats. While this philosophy seems too idealistic, it may also deprive us from the benefits provided to the citizens from decent and rule complying zoos. If the society is willing to play a responsible role in animal research and conservation, zoos can be an excellent source of public education.

Conclusion

Research studies on depression in caged animals are far and few. While many zoos exist in developing countries, animal care and welfare programs continue to be a low priority. The problem is exacerbated due to a lack of professionals interested in animal research and lack of zoo monitoring regulations. While the Kuala Lumpur Zoo may be considered a modern and relatively well-financed zoo in the region, many problems need to be addressed to ensure continuous quality improvement and welfare of animals. This paper examined the existing nature of the problems and outlined recommendations for consideration by the zoo and government authorities. The recommendations given may also prove meaningful for similar facilities in other countries.

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Foot notes:

[1] In his recent book, *Wild Minds: What Animals Really Think,* animal cognition researcher Marc D. Hauser (2000) writes that it is unhelpful to ask whether animals think because such questions are vague. However, it is scientifically proven that animals exhibit emotions, which "…prepare them for action, for approaching good things and avoiding bad things." (p.xviii).

[2] A habitat is basically the place where an animal finds what it needs to survive. A habitat should provide all opportunities and challenges including climate, competition, companionship, food, predators, etc. This concept is beautifully expressed by Benyus (1992), "…through the wonders of natural selection, each survival machine is custom crafted to excel in its particular constellation of living conditions. It's body and behavior echo the habitat it evolved in" (p 21-22).

[3] This act was signed into law in 1966 and has been amended four times. These regulations are published each year in Code of Federal Reugulations, Title 9, Chapter 1—commonly known as 9CFR. The complete regulations can be found on the internet: http://www.aphis.usda.gov/ac/publications.html

[4] Although, these criteria are used to diagnose abnormality in humans, they can also reveal useful information about the animals. Research indicates that the capacity for subjective emotional experience is similar in humans and animals (Wemelsfelder, 1993). Neurological explanations of anxiety and depression also show that impairment of the septohippocampal system can be responsible factors in humans and animals alike (Gray, 1982).

[5] A related term in 'zoonosis', a disease that humans may get from animals, especially when the animals are not well-cared for. See website http://medicine.bu.edu/dshapiro for the disease that each animal can pass on to the humans.

[6] An instance of a lion's full-throated roar is indicative of its communiqué up to a five mile radius that this territory belongs to that lion. Most modern zoos however, are smaller than this area that is an average size of a natural habitat for the king of the beasts. UK's Captive Animals Protection Society (www.captiveanimals.org) opposes the incarceration of animals for entertainment purposes and believes that zoos do not educate but misinform the public and use up the funds that can be better utilized in conserving animals in their natural habitats. In a survey of 100 zoos in the UK, this animal protection organization discovered that the space provided to animals in the zoos are from 100 to 1,000 times smaller than the animal's home range. With regards to the cages and cement slabs, it should be noted that in the 1960s, zookeepers found it difficult to control the diseased that spread in the soil and in the grass that were also passed on to the animals. Consequently, the zookeepers at that time believed that unnatural enclosures were better for animals' physical health if not for its spirits (Benyus, 1982).

[7] Elephant expert Joyce Poole believes that elephants do grieve the loss of their loved ones. She has seen elephants keeping vigil over their dead compatriots. She describes every part of their expression —on their faces, eyes, and mouths, the way they carry their ears, heads and bodies and they way they walk all suggesting depression. She also writes that elephants are often observed to stop when walking past a place where a companion died and give a silence pause that could last for minutes or more. For details, see http://www.peta.org. There is yet another source of information by Masson and McCarthy (2004) in which they raise an interesting point of animal emotions—the idea of anthropomorphism. This terminology is also referred to as personification or prosopopeia or attributing human characteristics to inanimate objects, animals or forces of nature. Masson and McCarthy contend that reflecting human emotions onto animals changes the way humans view other species that may take away animal individuality as separate beings.

[8] An excellent resource on animal behavior with pictorial illustrations is a book by Janine M. Benyus (1992) that can be used for zoo staffs' general education.

[9] In the interest of "protecting fauna and preserving biodiversity", the Environment Ministry of Italy has passed a decree recently mandating licensure for Italain zoos in order to ensure the "well-being of the animals they host." See http://www.agi.it/english/news. Such regulations have existed in the US from the 1960s.

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