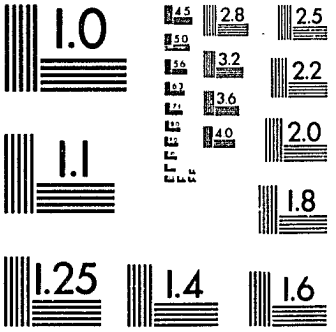

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Shettel-Neuber, Mary Joyce

ZOO EXHIBIT DESIGN: A POST-OCCUPANCY EVALUATION AND COMPARISON OF ANIMAL ENCLOSURES

The University of Arizona PH.D. 1986

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ZOO EXHIBIT DESIGN:
A POST-OCCUPANCY EVALUATION AND COMPARISON OF ANIMAL ENCLOSURES

by

Mary Joyce Shettel-Neuber

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF PSYCHOLOGY

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Mary Joyce Shettel-Neuber entitled Zoo Exhibit Design: A Post-Occupancy Evaluation and Comparison of Animal Enclosures and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

Robert B. Bechtel	1/6/86 Date
W. W. Stein	1/6/86 Date
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KIRBY UCKARD	1/6/86 Date
Thomas Thalhammer	Date

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Robert B. Bechtel	1/6/86
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SIGNED: Mary Joyce Shettel-Neuber

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ABSTRACT

The present study, in contrast with previous work that has isolated one or two important factors influencing the status of the zoo, considered the three important zoo reference groups--animals, visitors, and staff members--and their interrelationships within the zoo environment. Two approaches were used to investigate the system of interactions within the zoo. First, an in-depth examination of a new set of naturalistic exhibits was performed. Second, a comparison of two of these naturalistic exhibits with two older, sterile exhibits which housed the same species at the same zoo was made. Multiple methods were used in the present study and included behavior mapping of visitors, staff, and animals, timing of visitor stays at exhibits, tracking of visitors through the exhibits, a visitor questionnaire, and interviews with staff members. One major finding was the lack of correspondence among the major groups as to the acceptability of exhibits. For example, one exhibit which was considered beneficial to the enclosed animals and was well utilized and positively evaluated by visitors presented staff members with great difficulties in animal containment and exhibit maintenance. Comparisons of naturalistic enclosures and sterile cement enclosures housing the same species revealed no consistent, clear-cut differences in animal and visitor behavior, however, attitudinal

differences were found for staff members and visitors. Visitors and staff members preferred the naturalistic exhibits and perceived them as more beneficial to animals and visitors. These findings were discussed in terms of theoretical and applied issues relevant to zoo design and management and to research in zoos.

CHAPTER 1

INTRODUCTION

Zoological parks provide some of the richest and most complex environments in modern society. The contemporary zoo functions as a home and refuge for exotic animal species from throughout the world, as a workplace for professionals such as scientists, administrators, veterinarians, botanists, and educators, and as an educational and entertainment center for community members and visitors. These multiple functions of zoos are reflected in the four purposes of the American Association of Zoological Parks and Aquariums, which are education, conservation, recreation, and research.

Zoos are unique in that they are some of the few remaining environments that contain people and wild animals in an interactive relationship. Livingston (1974) has suggested that zoos provide a link to nature, from which contemporary individuals have been separated due to urbanization and technological development. Impressions of wildlife primarily are formed through visits to zoos and through information presented on television, in movies, and in written material. As a major source of information about wildlife and nature and as, for most, the only source of direct contact with

wild animals, the zoo and what people learn from their visits there are important aspects of contemporary life (Sommer, 1972).

In order to meet the goals of education, conservation, recreation, and research, zoos have experienced great changes over the past two centuries. The first modern zoos (e.g., Schonbrunn Palace, constructed in Vienna in the mid-eighteenth century) provided the public with a first-hand view of the animals but failed to provide for the behavioral, psychological, and, frequently, physical needs of the animals. These zoos, which Campbell (1984) has characterized as "first-generation" zoos, generally displayed animals in small side-by-side barred cages or in deep, smooth-walled pits. In the early twentieth century, "second-generation" zoo exhibitry was given its model in Carl Hagenbeck's tierpark in Germany, which utilized cement enclosures surrounded by dry or water-filled moats to contain animals. Animals were given more room in their enclosures, visitors' views were improved, and the zoos had more open appearances. The enclosures, however, were cold, sterile, and boring for the animals (Campbell, 1984) and often were the settings for abnormal and stereotyped behavior by the animals.

While these "second-generation" exhibits are most prevalent in U.S. zoos today, some zoos are beginning to construct a "third-generation" of exhibits. The goals of these new exhibits are (1) to facilitate animal behavior similar to that displayed in the wild

by providing physical and psychological stimulation for the animals, and (2) to allow the public to see animals exhibiting natural patterns of behavior in natural settings, and, thus, enhance its appreciation for the animals and their place in nature. Major features of these exhibits are their use of vegetation from the animals' home regions, natural features meant to stimulate and facilitate the behavior repertoires the animals display in the wild, and the display of animals in the species-natural groupings rather than in the traditional zoo's one-male-and-one-female pair.

The third generation of exhibits is expected to improve the zoo environment for those who use it. Proponents of such design discuss its benefits both to the animals and the visiting public. By providing more elements of the species' natural setting, it is expected that the animals' natural behavior patterns will predominate. The presence of food-gathering possibilities (Hutchins, Hancocks, & Crockett, 1984; Markowitz, 1975), social stimulation from companion animals, and the opportunity to retreat from threatening public scrutiny are all expected to combine to facilitate the physical and psychological health of animals (Campbell, 1984; Hutchins et al., 1984), and serve the conservation effort. By observing animals that are more active and engaged in natural patterns of behavior, visitors are expected to have more enjoyable and educational visits and develop greater respect for wild animals (Maple, 1983; Maple & Stine, 1982).

In a system as complex as the zoo, major changes will affect many other parts of the system. Due to the interactive nature of the system, it is possible that improvements in one area that benefit one group may be accompanied by difficulties for another group in another area. In order to understand the pattern of changes which occur throughout the system when a change is introduced, it is necessary to consider the system as a whole rather than focusing on one user group or one aspect of its functioning to the exclusion of others. Such an approach recognizes that zoos serve multiple user groups and address multiple goals, and that all of these interact to affect the zoo system.

In order to examine the zoo environment as a system and determine the success of that system in meeting the zoo goals, the interrelationships of the zoo user groups and the environment need to be examined. Figure 1 presents a framework which indicates the major relationships which exist in the zoo environment and which can be used to structure analyses of zoo functioning. The major elements of this model are the three user groups (animals, staff, and visitors), and the zoo facilities. The model also shows how the zoo goals--education, conservation, recreation, and research--are met through the relationships of these major elements. In Figure 1, the arrows indicate major relationships between the system elements. Within the arrows that link the major elements are listed the zoo goals that are addressed in those relationships.

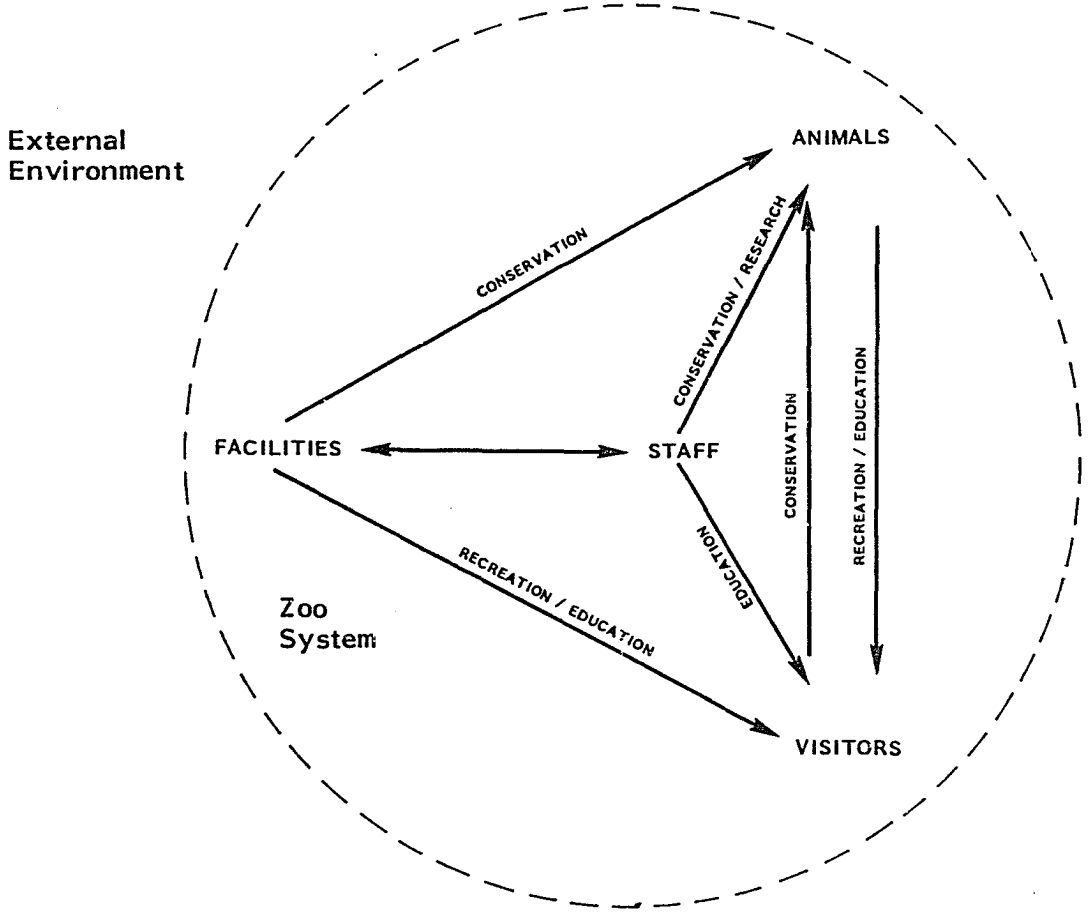


Figure 1. Model of interrelationships within the zoo system.

In this model, the zoo facilities have a direct effect on both animals and visitors. The facilities-staff interaction is bidirectional with staff members affecting the facilities through their design, use, and maintenance, and the facilities having a direct bearing on how people perform their jobs. Staff members' performance of their jobs, in turn, affects the animals. The animals and visitors interact, and both groups' behavior and visitors' attitudes affect that relationship. While other, weaker relationships may exist among the major elements of the zoo system, the model emphasizes the stronger relationships.

The four major zoo goals are primarily achieved through specific interactions among staff, animals, visitors, and the facilities. The goals of conservation and research are addressed mainly in the facilities-animals-staff relationships. The goal of education is met in the facilities-staff-visitors relationship. The goal of recreation is addressed in the interrelationship of facilities, animals, and visitors.

The present approach is seen as an example of an open system model (Katz & Kahn, 1966), in which interactions occur between the system and the external environment and result in the impact of one upon the other. Among the characteristics of open systems is that they: import energy and information from the environment, change information from a given state to another, output information into the environment, are characterized by a cycle of events, are

characterized by negative entropy, have the ability to regulate their activities to maintain the desired direction, require internal integration to preserve the system, provide the capacity to reach the same final state from different paths (equifinality), and have the capacity to rearrange their component parts quickly to maintain system integrity (Knight & McDaniel, 1979). Such a model recognizes the dynamic nature of the open system and its interaction with the environment and suggests the need to study open systems from a broad perspective considering fluctuations in the system over time rather than through restricted considerations of isolated components of the system. The model of zoo functioning used in the present study attempted to structure an examination of the relationships within the zoo system through which major zoo goals are attained. The constituents of the zoo--animals, staff, and visitors--are seen as major components within the zoo system as is the physical environment--facilities. The relationship of the zoo's physical environment to system functioning was of particular interest in the present study. The zoo's physical environment influences the system's functioning, and changes in the system's physical environment are ways in which the system maintains its desired direction in response to internal and external pressures (e.g., exhibit deterioration, the diminution of wild animals to replace captive ones, and competition from other zoos). Due to a desire

to consider the role of the physical environment in zoo functioning in the present study, the model was developed to help structure such an examination.

In the present study, two approaches were utilized to investigate the system of interactions represented in Figure 1. First, an in-depth examination of a set of exhibits representative of third-generation exhibit design was performed. Second, a comparison of two of these third-generation exhibits with two second-generation exhibits which housed the same species at the same zoo was made.

In both cases, a systems approach was used to investigate the interrelationships of the three user groups and the environment. This approach is seen as a viable means of studying phenomena and processes in environmental psychology (Maple, 1983). It is worth noting that a popular definition of environmental psychology is that it is "the study of the interrelationship between behavior and the built and natural environment" (Bell, Fisher, & Loomis, 1978, p. 296). It subsumes under one area of study the zoo's combination of built and natural environment (in the sense of being "unbuilt") and animal and human behavior. In sum, the systems approach is a useful way of studying zoo environments.

To reiterate, the present study was an attempt to understand the interactions of animals, staff, and visitors within a zoo environment and to compare those interaction patterns in second- and

third-generation zoo exhibits. It was designed as the first in a series of studies to develop a preliminary model of zoo functioning. The needs of the three user groups, their interrelationship, and their relationship to overall zoo goals and their attainment were examined to provide information for this model. It was felt that the accumulation of information through research directed by the model could help provide a better understanding of what the zoo experience means to people and animals and thereby facilitate zoo design and management.

CHAPTER 2

REVIEW OF THE LITERATURE

For the most part, previous research has dealt with fragmented aspects of the zoological environment. Rather than studying the interrelationships of zoo visitors, staff, and animals and the environments, previous research in zoos generally has had as its topic one of the three groups and specific aspects of that group's attitudes and/or behavior. For purposes of organization, therefore, relevant previous research will be presented as it relates to the three user groups.

Animals

The earliest research in zoos capitalized on the availability of wild animals to study, and was concerned with learning about the animals. Early attempts to keep wild animals in captivity were basically experimental, and animal mortality rates were high. Research was conducted in an effort to expand the knowledge of wild animals, to improve the animals' health, and to extend their life spans. This research generally was performed by zoo staff members, and it facilitated their efforts in conserving and caring for the animals.

Research concerning the interrelationships of the animals and visitors and the facilities is not as extensive as that regarding animal physiology. While the design of animal enclosures in zoos has

experienced great changes over the past 200 years, little research regarding the differential effects of environments on animal behavior exists (Boice, 1981). Evaluations of quantity and quality of space for animal enclosures and assessments of the impact of the total environment on the animal are scarce.

Some recent research regarding the effects of the zoo environment on animals has been stimulated by the design of third-generation exhibits. These enclosures, which are more naturalistic, have been made possible by advances in the control of parasites on natural surfaces, improved veterinary care, and progressive philosophies of zoo design. Captive environments, however, by their very nature cannot be exact replicas of animals' natural habitats. As Hediger (1950) noted:

> 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 an adequate transposition of natural conditions. (p. 72)

The most prevalent current approach to this challenge of designing naturalistic environments is to create environments which provide many of the physical components of the natural environment in the enclosure. This approach is exemplified by the work of Hancocks (1980) and Hutchins, Hancocks, and Crockett (1983, 1984). They utilize information gathered from field studies to simulate an animal's natural social and physical environment. Their efforts include the

employment of natural materials in animal enclosures (e.g., grasses as opposed to cement), the placement of naturally occurring size groups of animals in exhibits, and controlled lighting, temperature, and humidity to simulate conditions in an animal's natural habitat. Maple (1981, 1983) has discussed many environmental components which provide stimulation for great apes within naturalistic environments. These include browse, honey-pots, movable objects, and access to vertical space.

Since these enclosures are more like the animals' natural environment than grottos or cages, it is anticipated that animal behavior will be affected by these environments. Indeed, recent research has documented improvements in animal behavior in naturalistic environments (Maple, 1981). At the Audubon Zoological Garden in New Orleans, Louisiana, Maple and Stine (1982) noted decreases in aggression and slight increases in interaction in orangutans and gorillas when the animals were moved from an old enclosure of barren steel to a new, complex, naturalistic enclosure. Similarly, a study of adult chimpanzees moved from laboratory cages to a man-made island at a commercial animal park in Georgia revealed dramatic decreases in stereotyped behaviors and increases in clever, creative uses of the environment (Clarke, Juno, & Maple, 1982). Pfeiffer and Koebner (1978) demonstrated the impact of a naturalistic island environment on the resocialization of chimpanzees. After 6 months on the island,

Pfeiffer and Koebner recorded a 70% decrement in the animals' stereotyped rocking behavior.

Some evaluation of exhibits which were specifically designed to elicit naturalistic animal behavior also had occurred. Two enclosures designed utilizing the Hutchins-Hancocks approach were evaluated after the animals were introduced. Timson (1978) observed a pair of caracals in a remodeled exhibit at Woodland Park Zoo and noted the animals' preference for the remodeled enclosure over the adjacent, unmodified, sterile environment. Calip (1978) found that gibbons introduced to a new outdoor facility at Woodland Park Zoo spent more time in terrestrial locomotion than was anticipated by their behavior in the previous indoor enclosure. Contrary to expectations and design elements created for their anticipated behaviors, the gibbons preferred to use bars rather than a suspended net for brachiation. Calip's (1978) research not only documented the animals' behavior in their new environments, but served to assess the degree to which the designed environment met the design assumptions of how the enclosure would affect animal behavior.

An important aspect of enclosures is the impact they may have on reproduction. While a direct relationship is difficult to identify and little research exists, increases in enclosure size and complexity tend to facilitate reproduction in the great apes. A likely explanation for increases in reproduction rate which accompany

increases in the size and complexity of exhibits is that the female is able to exert more control over her interactions with the male (Maple & Hoff, 1982; Maple & Stine, 1982; Nadler, 1982).

Although the visitors are a daily part of the animals' environment, almost no research has been done which examines the effect of visitor behavior on animals. In an innovative study, Scollay (1983) considered the effect that the viewing public had on the behaviors of 12 species of nonhuman primates at the San Diego Zoo. Crowd density and visitor harassment of the animals were the major factors considered. Crowd density was found to be positively related to animal activity, play, and social behavior. Play, sociability, and grooming (which often is considered a stress reliever) all were found to decrease with increasing harassment. Animal activity and object manipulation slightly increased from low to medium levels of harassment, and sharply decreased under high harassment conditions (Scollay & Hayes, in preparation). Scollay (1983) speculated that, contrary to assumptions, crowds and harassment may not induce the predicted levels of social tension in animals, and, in the case of crowd density, may serve to activate the animals. Scollay (1983) suggested that "the collection of quantified data on specific variables influencing captive environments is necessary before we can design a captive environment conducive to the psychological health of the animals who inhabit it." The clear trend among animal environments in zoos is toward naturalistic enclosures.

Visitors

The zoo visitor has been the subject of a substantial amount of previous research. Such studies have ranged from profiles of the typical zoo visitor to studies which utilized multiple research methods to characterize the visitors' behaviors and experiences at the zoo.

Visitor Profiles

Just as the early animal research was aimed at learning more about the animals themselves, one of the initial concerns of zoo visitor research was to profile the people that visited the zoo. One popular approach was to obtain information about visitors and their attitudes through in-house surveys, interviews, or questionnaires. These "market research" type surveys generally requested such things as demographic data, overall impressions of facilities, best/least liked exhibits, and comments or suggestions (e.g., Eason & Linn, 1976; Hill, 1971; Wheeler, 1979). The purpose of such surveys was to identify general visitor characteristics so the "typical" visitor could be targeted for advertising contact by that zoo. Also, knowledge of the most popular exhibits could help identify the most effective topics for publicity. While undeniably useful to museum or zoo personnel, this type of research can be restricted by its brevity, specificity, and possible bias, as well as by public resistance

to participation. Such surveys often had samples which were small in comparison to the total number of visitors, were generally conducted for short periods of time, and did not reflect seasonal differences and changes over time. These in-house surveys have demonstrated some consistent results, however, despite their restrictions to specific sites. Serrell (1980) reviewed in-house visitor surveys from many zoos, including the National Zoo in Washington, D.C., the Brookfield Zoo in Chicago, Woodland Park Zoo in Seattle, and the San Diego Zoo. The results of these surveys portray the zoo visitor as above the U.S. average in education level and income, and as one who spends approximately 2 to 3 hours at the zoo.

A more global form of audience analysis has been conducted in which the sample completing questionnaires or interviews is taken from the population at large. Cheek (1973) conducted interviews with 1,251 adults, representing the total U.S. population, and asked them about their visits to zoos. He divided the respondents into "zoo-goers," who had been to a zoo in the past 2 years (44% of the respondents), and "non-zoo-goers" (56%) and developed profiles of these groups. The "zoo-goers" in Cheek's survey were found to be younger, have more children at home, and have better educations and higher incomes overall than the "non-zoo-goers." The zoo visit was found to be less than an all-day affair for most, with 42% reporting visit times of 2 hours or less, 42% reporting half-day visits, and only 12% reporting they spent the day at the zoo.

In an extensive 3-year study of American attitudes toward and knowledge of natural habitats and wildlife, Kellert (1979) considered major characteristics of zoo visitors. Personal interviews were conducted with 3,107 randomly selected Americans over the age of 18. He found zoo enthusiasts to have slightly more knowledge of animals and ecosystems than the general public, but considerably less than other groups related to wildlife (e.g., birders and back-packers). The zoo-goers' strong humanistic affection for animals was accompanied by their support of more natural habitats for zoo animals, even if substantially higher entrance fees would result (80% agreed or strongly agreed).

Visitor Attitudes and Behaviors

Beyond profiling the zoo visitor, research has also been conducted on visitor attitudes and behavior at the zoo. Research conducted at other recreational/educational facilities, such as aquaria and museums, is often used to supplement zoo research as it is felt that human behavior, perceptions, and general attitudes found in these settings are relevant to zoo environments.

The effect the zoo facilities have on visitors' attitudes and behaviors has been the topic of numerous studies. Both the recreational and educational effects have been considered. One type of study considered visitor orientation or way-finding behavior and provided specific information regarding signage and other orientation

aids. Systematic observations and recordings of the routes taken by various visitors were generally made, and their actions along these routes (e.g., sign-reading and map use) were generally noted. These orientation studies have been conducted at a variety of locations, including a trail at the National Zoo (Kwong, 1977), a cul-de-sac museum gallery (Cooksey & Loomis, 1979), and a major zoo (Meckley, 1983). In a study typical of this type of research, Kwong (1977) analyzed the Crown Crane Trail at the National Zoo through visitor tracking and interviews. She found that few people used the trail markers (animal footprints on the ground) for way-finding from beginning to end of their walk and suggested improvements in the marker system. While some generalities about visitor orientation may be culled from these studies, they primarily are useful to the facility at which they were conducted.

Other studies which involve following visitors on their visits to zoos or similar recreational facilities have captured more generalizable aspects of visitor behavior. Timing of the length of visitor stays often accompanies these studies. Melton (1972) summarized his early work in museums and listed some major characteristics of visitor behavior. These findings include the propensity of visitors to turn right upon entering the museum gallery, the attraction of the exit which pulls visitors away from displays, the steady decrease in time that is spent at each exhibit as the visit progresses ("museum

fatigue"), and the fact that increases in the time spent at an improved exhibit were accompanied by decreases in time spent at other exhibits in the same room. Gilman (1916) tried to determine the major reasons for "museum fatigue" by photographing an individual's attempts to view an exhibit and attributed it to physical strain and fatigue. Physical strain, however, does not completely explain the fatigue effect that Melton found. Robinson (1928) observed "museum fatigue" in subjects who viewed copies of paintings while seated at a table in a laboratory experiment. In a time motion study at the Shedd Aquarium, Serrell (1977/1978) found decrements in time spent at successive tanks, which did not necessarily vary in the effort required to see them. Visitors also were found to spend more time at larger tanks with exotic or less familiar fish. The studies which demonstrated fatigue effects were conducted in environments in which visitors viewed a series of similar exhibits in one room (e.g., fish, art works). Such an effect of decreasing viewing times has not yet been documented for visitors who view a varied presentation of exhibit objects or animals.

The amount of time spent at specific exhibits is also a topic of considerable research (e.g., Rosenfeld, 1979; Wheeler, 1979). Brennan (1977) found that more than 80% of visitors studied spent less than 2 minutes at either an open-moated grotto for six lions or a series of cages along a west outside wall of a primate house.

Rosenfeld (1979) found that the average time a family spent in front of animal exhibits was 70 to 90 seconds, regardless of the time of the total visit or the number of exhibits visited. Cone and Kendall (1978) investigated factors affecting viewing time and found (1) a high correlation between most memorable exhibit and viewing time at it, (2) that little attention was given graphic displays, and (3) with time the number of exhibits viewed, the time spent at exhibits, and the amount of group interaction all decreased.

Visitor Learning

The educational aspects of exhibits also have been considered with researchers observing how visitors utilize educational presentations. For example, Brennan (1977) found that less than half of the visitors he studied read an exhibit sign ("reading" was defined as gazing at the sign for 4 seconds or more). An approach known as exhibit design evaluation (Screven, 1969, 1976, 1979) has been primarily used in reference to educational aspects of exhibits. In that approach, behavioral responses to the environment are monitored and the environment is modified until the desired responses are obtained. Most of this type of study considered the effectiveness of graphic aids (Kwong, 1977; Rabb, 1969; Serrell, 1979; Stearns, 1981). Such studies revealed the success of large print, catchy titles and text which references the exhibit in keeping visitors' attention, but demonstrations of actual differences in learning have

not been shown conclusively (Serrell, 1980). Screven (1979) discussed how this testing of the impact of exhibits can fit into a scheme of design and modification of exhibits. While such an approach can be restrictive and open to criticism for its view of the museum or zoo visit as a "testable" experience (O'Reilly, Shettel-Neuber, & Vining, 1981), it can be a valuable component in a multiple-method research program of exhibit evaluation.

Naturalistic Evaluation of Visitor Experiences

While such experimental studies have helped characterize the zoo visitor's response to zoo facilities, they have been criticized for emphasizing a small controllable part of the visitor's behavior rather than providing an overview of the total visitor experience. In response to the restriction of such studies, a more naturalistic approach to museum and zoo evaluation has been utilized. Wolf and Tymitz (1979) and Rosenfeld (1979) advocated such an approach to obtain a better overview of a visitor's experience in such environments. They felt a more accurate picture of the museum or zoo experience could be obtained through the use of observation and informal interviews. Their work addressed such questions as why the visitor came to the zoo, what he/she learned, what overall impact the visit had on him/her, and what the visitor would like to experience. Wolf and Tymitz (1981) found that visitors to the National Zoological Park gravitated to active animals and were disappointed

with inactive ones. They also found that visitors were concerned with the animals' enclosures; visitors accepted artificial enclosures if the animals' behavior seemed normal, but attributed aggressive or abnormal behavior to the unnatural environment. Visitors in the study also desired more information about animals, preferably from guides or keepers in the vicinity of the exhibits. Rosenfeld (1979) found that interactive activities enhanced visitors' experiences and that people spent the most time at exhibits where the animals interacted with each other or the visitors. He found zoo visitors often initiated interaction with the animals, through feeding (although prohibited), petting, and mimicking.

Effect of Enclosures on Perceptions of Animals

Sometimes the visitor-animal interaction involves animal abuse. Hediger (1950) discussed the various forms of physical abuse that he had observed at zoos. Such cases of visitors inflicting harm on the animals and the observations that visitors sometimes verbally deride the animals has led to some preliminary research on visitors' respect for animals. A great deal of discussion exists regarding the effect of different enclosures on visitors' behavior and perceptions of the animals. "One of the most depressing aspects of a visit to a zoo is the amount of petty sadism and exhibitionism displayed by the visitors. . . . These unfortunate but all too common occurrences make it evident that, by itself, the sight of caged animals does not

engender respect for animals" (Sommer, 1972, p. 26). Hutchins et al. (1984) noted that people visiting a naturalistic habitat for lowland gorillas were quiet and did not make the typical jokes or ribald comments overheard in an older, sterile environment. Maple and Stine (1982) suggested that successful propagation and conservation efforts require public support and that naturalistic presentations can serve to educate the public and enlist their support. Maple (1983) suggested that:

> (p)oor 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. (p. 296)

The effect of the animals' enclosures on visitor attitudes toward the animals has been considered in a laboratory and a field study. In a laboratory study investigating attitudes toward zoo animal enclosures, Rhoades and Goldsworthy (1979) showed introductory psychology students slides of the same animals in a natural, semi-natural zoo, and a caged zoo environment, and asked the subjects to rate the slides with 20 semantic differential scales. Subjects' ratings of animals significantly decreased on freedom, happiness, dignity, comfort, and naturalness for animals seen in a natural versus semi-natural zoo setting and decreased again from the semi-natural

zoo setting to the caged zoo setting. This suggested that the type of enclosure in which an animal is displayed will affect the visiting public's attitudes toward the animal.

Finlay, Woehr, and Maple (1984) addressed the issue of the enclosure's effect on visitors' perceptions of animals in a study which examined perceptions of exhibits and animals at two zoos. In their study, visitors at the Atlanta Zoo and the Audubon Park Zoo in New Orleans were asked to rate orangutans and their enclosures on two scales developed by the researchers, an environmental description scale and an animal attitude survey. Significant differences were found on the environmental description rating scales, with Audubon Park Zoo's open, moated exhibit with grass and trees being rated more positively on all descriptive pairs than the small, barren cages at the Atlanta Zoo. Ratings of the orangutans, however, revealed no significant differences between perceptions of the enclosed animals. Whether the lack of differences in the ratings of the animals at the two zoos is the result of a lack of sensitivity of the measurement instrument or a reflection of an actual lack of differences is open to further consideration.

Multiple Research Methods

While most studies of zoo visitors have utilized one evaluative technique to study visitor attitudes or behavior, some recent investigators have employed multiple research methods to study the visitor's

experiences at the zoo. The use of multiple methods to assess visitor attitudes and behaviors provides a great deal of information about a zoo environment and allows for the integration of the results from each of the methods. By using several types of evaluation, the researcher can capitalize on the merits of each one and can obtain convergent validation of findings when the findings of one method parallel those of another. While Wolf and Tymitz (1979, 1981) advocated the use of observation and informal interviews to obtain a more global view of the visitor's experience, other researchers have used these less formal approaches in combination with experimental methods. For example, Rosenfeld (1979) utilized visitor interviews, tracking, and timing to study visitor behavior and attitudes at the zoo. O'Reilly et al. (1981) evaluated an old and the new aviary which replaced it through the use of several methods, including behavior mapping, interviews, timing of visitor stay, and observation and categorization of visitors' approaches to a bench. From this evaluation, they were able to compare behaviors in the old and new aviary, identify zones which were heavily used and those which were underutilized in the new aviary, make suggestions for improvements through redesign, and investigate visitors' propensity to approach a bench when it was occupied or unoccupied. Not only did the use of multiple methods address several topics, but their repeated administration addressed the importance of trends over time.

In a study of a public zoo in Arizona, Martin and O'Reilly (1982) utilized informal observations; surveys administered to parents, teachers, and children; timing; and visitors' cognitive maps to assess a child's visit to this city zoo. They provided suggestions for design changes which could improve the child's experience at the zoo. Swensen (1984) utilized multiple methods to compare visitor attitudes and behaviors at four zoo facilities which ranged in naturalism of exhibitry from a wild animal park to a menagerie zoo with small, barren cages. Unobtrusive observations at lion and primate exhibits at the four zoos revealed that visitors spent more time at the large naturalistic exhibits in the wild animal park than at the smaller zoo's artificial enclosures. Group size, animal activity, and sign-reading all positively influenced time spent at an exhibit. Structured interviews were conducted before and after visits to the four facilities. Visitors were found to prefer exhibits with active animals and ones affording the greatest opportunity for interaction with animals and staff. Swensen (1984) found that while visitors felt animals should have spacious enclosures (even at the expense of the good view visitors desired) and appear healthy and content, they were not as aware and supportive of the animals' needs for naturalistic enclosures, social groupings similar to those in the wild, and the opportunity to hide from view. Swensen's collection of data at the four zoos not only allowed comparisons

among the four, but strengthened the generalizability of those findings which were consistent across the zoos.

Summary of Visitor Research

From the research that has been done, a general profile of the zoo visitor and his/her visit to the zoo has begun to emerge. To summarize, the majority of zoo visitors are younger than, are better educated than, have higher incomes than, and have more children at home than the general public (Cheek, 1976; Kuehl, 1976). These individuals are likely to have a concern for and an interest in animals but their depth of knowledge about animals only slightly exceeds that of the general population (Kellert, 1979). The zoo visit is generally perceived as recreational (Kuehl, 1976) and is an excursion for groups of friends and/or relatives (Chambers, 1982). Time at the zoo is spent in watching animals, interacting, watching people, eating, photographing, sign-reading, and looking at the scenery (Chambers, 1982; Cheek, 1976). The average visit is a half day or less (Cheek, 1973; Serrell, 1980), and the average time spent at an exhibit has been estimated to be 70 to 90 seconds (Rosenfeld, 1979). Studies at a museum and an aquarium showed decrements in the amount of time spent at successive exhibits, which also may be characteristic of zoo visits (Cone & Kendall, 1978; Melton, 1972; Serrell, 1977/1978).

Visitors search for interaction with animals and other people and prefer exhibits with active animals and a close view (Rosenfeld, 1979; Wolf & Tymitz, 1981). Visitors tend to spend more time at interactive exhibits than at ones with passive animals (Rosenfeld, 1979). The ability to talk to and observe staff members also is desired (Wolf & Tymitz, 1981). The majority of visitors do not read the signs (Brennan, 1977), especially ones with lengthy text, and a minority do abuse the animals, possibly in an attempt to interact.

The effect of the animals' enclosure on visitors' attitudes and behavior is not clear-cut (Finlay et al., 1984; Rhoades & Goldsworthy, 1979). Visitors are concerned about animal care and containment and are upset by animals that appear physically and psychologically unhealthy (Wolf & Tymitz, 1981). They only are aware of some of the characteristics of enclosures which lead to healthy animals; they are more likely to see the need for exhibit space quantity than quality (Swensen, 1984).

General information has been collected on the zoo visitor, mainly detailing who he/she is, why he/she visits the zoo, and in what activities he/she engages at the zoo. Visitor behavior and attitudes, the educational effects of the zoo visit, and the effectiveness of zoo design in optimizing the visitor's experience are areas which still need to be examined fully.

Zoological Parks Staff Research

One user group of the zoo, the staff, has received little, if any, attention in terms of systematic research documenting the group's interaction with the environment and other user groups. Zoo staff members have tended to be the informal de facto evaluators of their environments, rather than the subjects of research concerning the ability of the zoo's design to suit their purposes. Reports of new construction at zoos included mention of problems with buildings or enclosures (e.g., Toovey & Brambell, 1976), and innovations in new exhibits frequently were a direct response to problems the staff had experienced with older exhibits (Turnage & Hewitt, 1984). Previous attempts to construct new exhibits or fine-tune existing ones generally have relied on the ability of staff members to communicate their concerns and desires for changes in consulting and staff designers. Discussions of the design process indicate the need for staff input to designers (e.g., Faust & Rice, 1978), but structured procedures for gathering such information often are not presented. Systematic evaluations of the staff-environment fit could provide valuable information to zoo designers, as well as help assess the functioning of the specific exhibits under consideration, and provide suggestions for improvement. Areas worthy of consideration include how the zoo environment facilitates staff pursuits (e.g., ease of

maintenance, animal care, security, and public relations) and how staff attitudes and behavior affect the zoo's physical environment, social environment, and general functioning.

While a body of research exists regarding zoo animals and visitors, there clearly is a need for additional research on visitors, animals, and staff, and their interrelationship to provide information for optimizing zoo design and management. Previous research and speculation has identified certain types of information which are relevant in studying the zoo system. Ongoing research will not only provide more information about these identified factors, but also will serve to identify additional factors which are meaningful and to help them tie them together into a more systematic model of the zoo environment.

CHAPTER 3

THE PRESENT STUDY

In order to address the research issues presented in Chapter 1, a site for the research was selected, a research approach was adopted, and research questions and hypotheses were generated.

The Research Site

The present study was conducted at the San Diego Zoo in San Diego, California. Both the second- and third-generation exhibits were located on Bird and Primate Mesa (see Figure 2), which is centrally located on the zoo grounds (see Figure 3), and is one of the most heavily trafficked areas in the zoo (Meckley, 1984). The exhibits selected to represent third-generation enclosures, the Whittier Southeast Asian exhibits, were recently constructed and had been open a little over 1 year at the time of the study (see Figure 4). Primates and birds were displayed in the exhibits. Due to animal management conditions at the time, Bornean orangutans and Pigmy chimpanzees were being displayed in these new exhibits, as well as in older exhibits, the Great Ape Grottos, representative of second-generation design (see Figure 5). The older cement grotto enclosures and the new naturalistic enclosures, which housed these

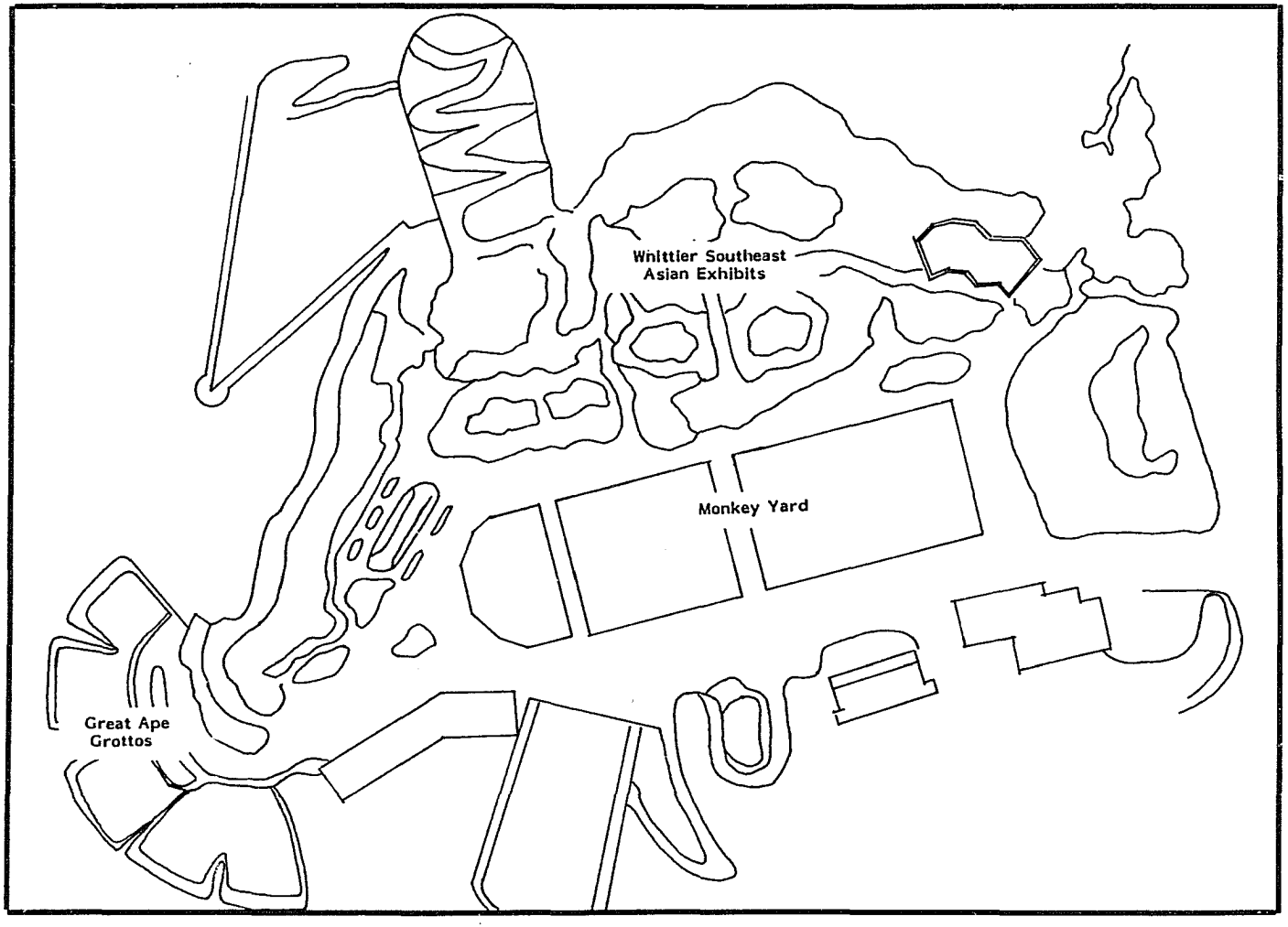


Figure 2. Plan of Bird and Primate Mesa.

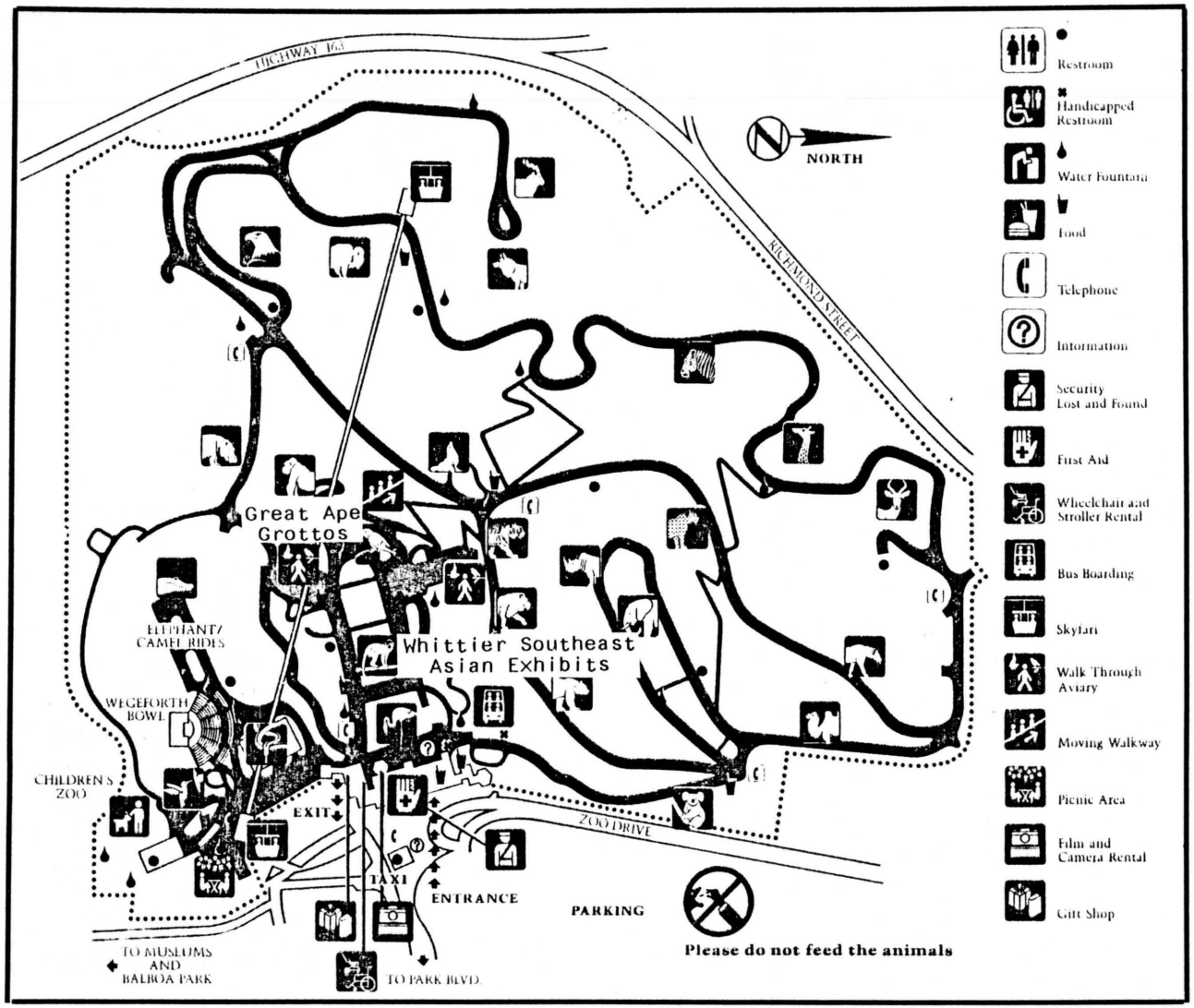


Figure 3. San Diego Zoo grounds.

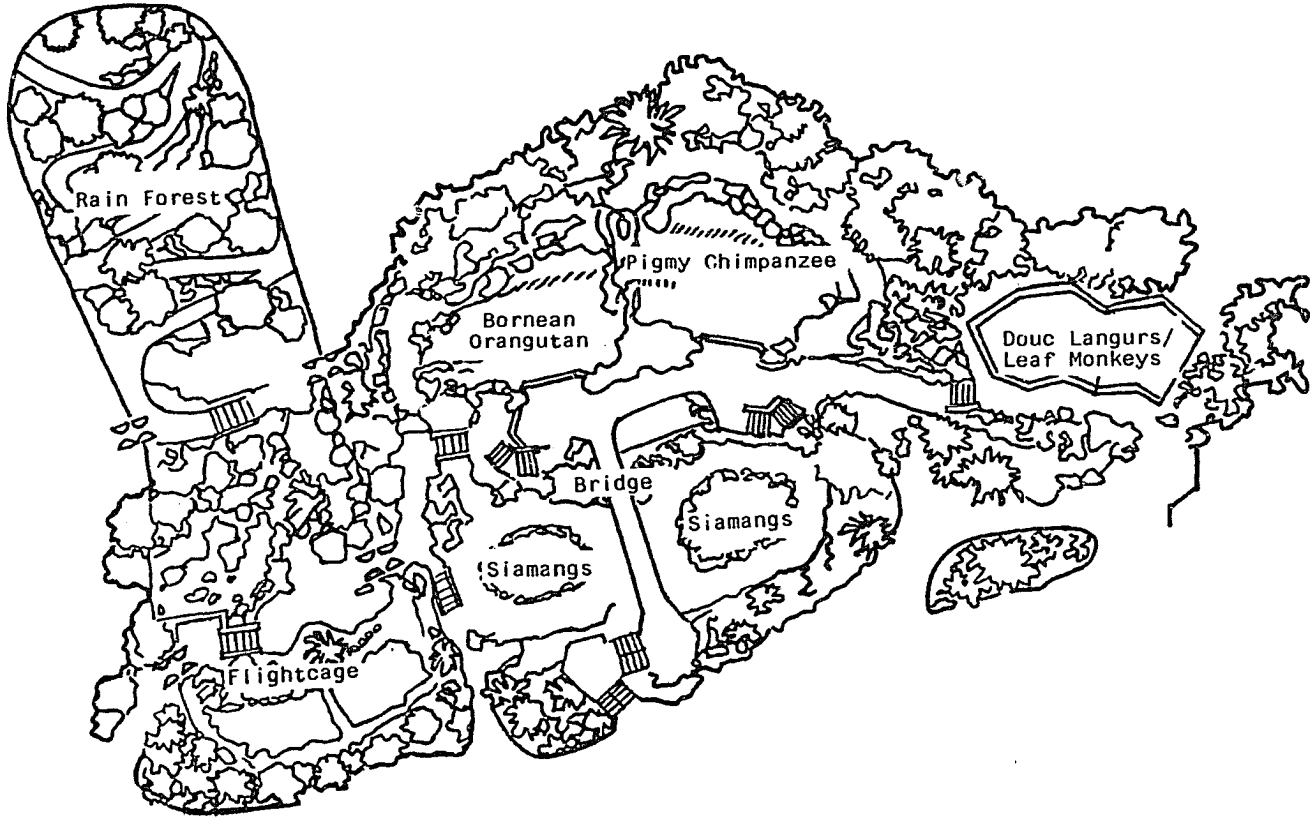


Figure 4. Plan of Whittier Southeast Asian exhibits (third-generation exhibits).

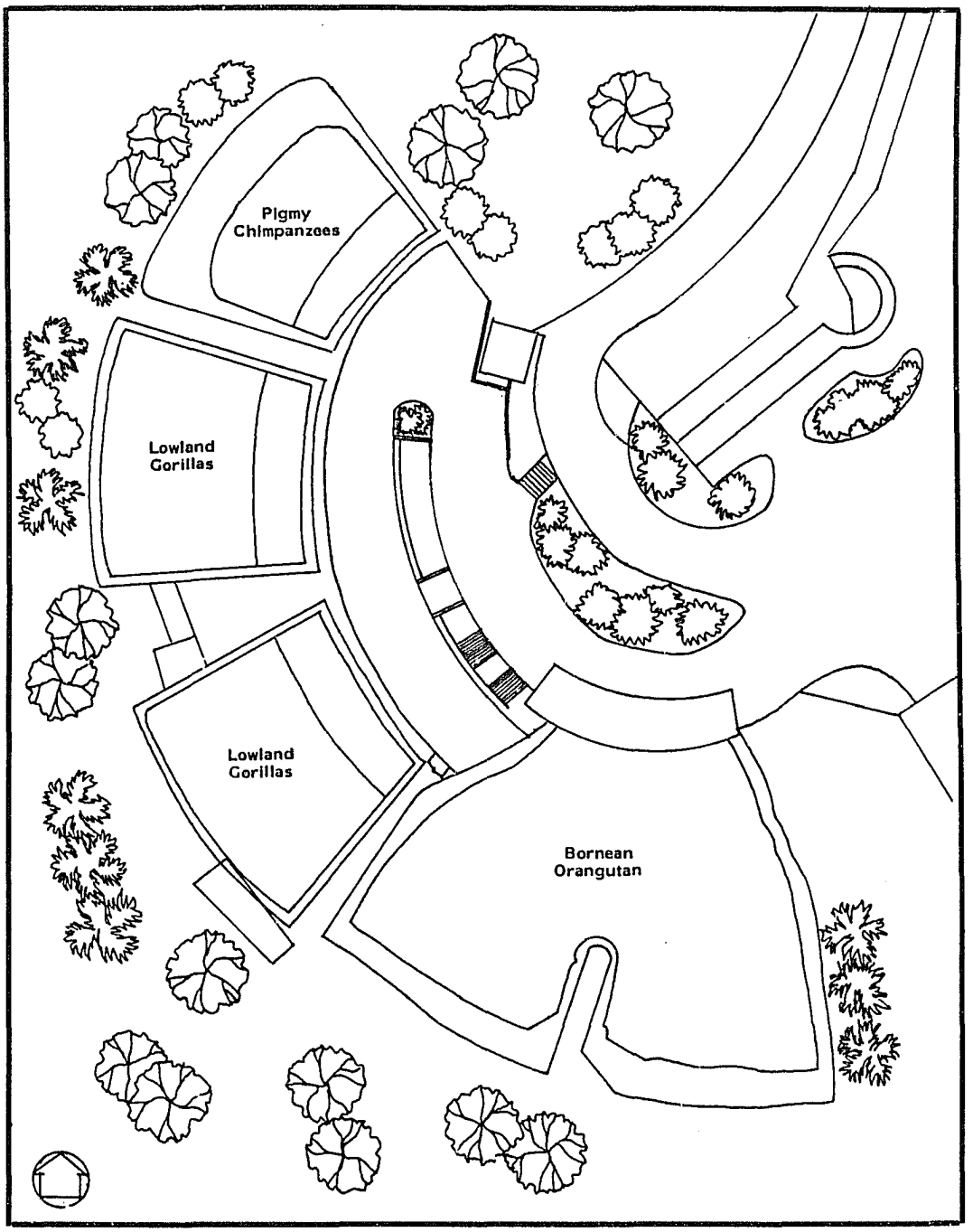


Figure 5. Plan of Great Ape Grottos (second-generation exhibits).

two species, were used as examples of second- and third-generation zoo exhibitry, and visitor, staff, and animal responses to them were compared. Photographs of the exhibits in the two areas are presented in Appendix A.

The Approach

In order to structure the identification of research topics and guide the selection of measurement techniques, the model of the zoo system, which was presented in Figure 1, was used. Based upon previous research and speculation as to the interrelationships within the zoo environment, topics for investigation were identified for each of the interactions between staff, visitors, animals, and the facilities. These topics for investigation were used to elaborate on Figure 1, and are shown in Figure 6. To examine the effect of the facilities on the animals, conservation and research goals were targeted for investigation through consideration of animal behavior, animal health, propagation, and the presence and activity level of animals. For the effect of the facilities on visitors, topics for investigation related to the education and recreation goals were visitor staying time at exhibits, the routes visitors took through exhibits, ease of viewing exhibits, and visitor enjoyment of exhibits. In the interrelationship of facilities and staff, areas for investigation were the staff's ease of maintaining the exhibits, the exhibits'

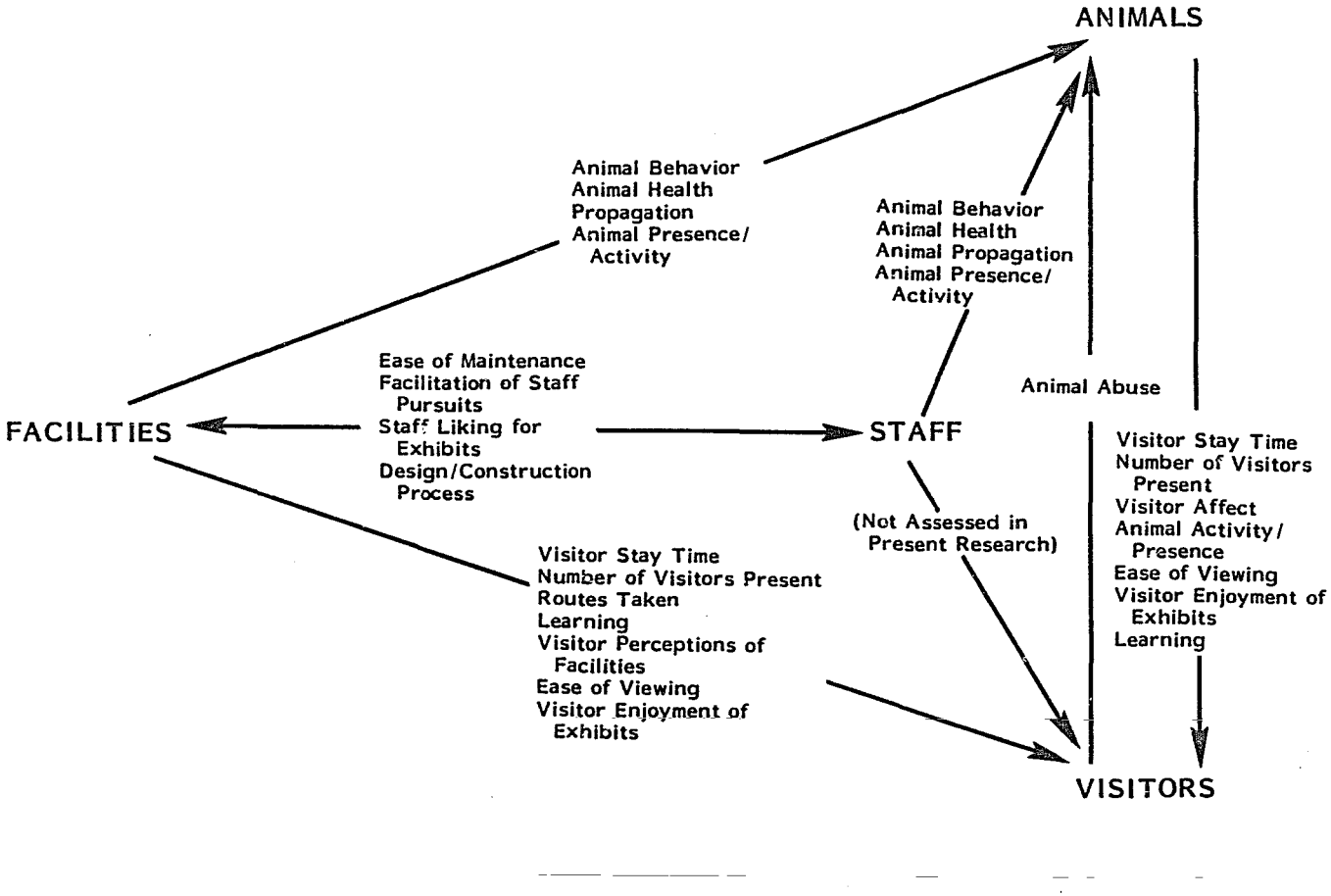


Figure 6. Key areas for investigation of interrelationships within the zoo system.

facilitation of the various staff members' jobs, staff liking for the exhibits, and their involvement in the design and construction process. In the staff-animal relationship, the goals of research and conservation were considered through determinations of animal behavior, animal health, propagation, and the presence and activity level of the animals. In the interrelationship of animals and visitors, the direct effect of visitors on animals, which reflects the conservation goal, was targeted for consideration through a determination of animal abuse. Finally, in the educational/recreational effect of the animals on the visitors, topics for investigation were visitor affect, animal presence/activity, visitor ease of viewing the animals, visitor enjoyment of the animals, and visitor learning.

The interactive nature of the zoo environment and the large number of research topics generated to assess interrelationships within the zoo called for a research strategy which would reflect a systems approach to studying the zoo environment. To do this, multiple methods which examined the various user groups and their interrelationship within the zoo facilities were utilized. When this combination of research methods is applied to studying an environment, it is often referred to as a post-occupancy evaluation, or POE (Friedmann, Zimring, & Zube, 1978; Zimring & Reizenstein, 1980). In this approach, questionnaires or surveys, behavioral observation, experimental manipulation and naturalistic research are all tools

which can be combined to characterize the interrelationship of behavior and the environment. O'Reilly et al. (1981) presented several advantages of the use of the post-occupancy evaluation in museum and zoo research. These included: (a) the ability to measure visitors' behaviors and attitudes without defining a "good" or educational visit, (b) the objective collection of data minimizing data-collector bias, and (c) the comprehensive picture of the environment-behavior interaction provided by a multimethod approach.

Such an approach was taken for the present research to gather information about the interrelationships within the zoo environment and develop the model of the zoo system presented in Figure 6. Further, to examine differences in the zoo system which exist between second- and third-generation exhibits, the same multi-method research approach was utilized to collect information about both settings.

Hypotheses

Research questions and hypotheses regarding the results of the POE and comparison of second- and third-generation exhibits were generated based upon the topics for investigation presented in Figure 4. Due to the fact that the present research was largely exploratory in nature, it was anticipated that this investigation could serve to identify important evaluative dimensions which could be added

to the model of zoo functioning. Also, while some evaluative dimensions were identified, the lack of previous research on those topics made the generation of specific hypotheses about all of them impractical for the present study. Research questions and hypotheses are presented below for the POE of third-generation exhibits and for the comparison of second- and third-generation exhibits.

Post-Occupancy Evaluation of Third-Generation Exhibits

The major interactions of the three user groups and the zoo facilities and how they served the attainment of the four zoo goals were addressed in the POE. Conservation issues were considered to most directly affect the zoo animal. The animals' physical and psychological health should be fostered by the zoo, and the environment should be conducive to propagation of the species. The goal of research also affects the animals in that they may benefit from the results of behavioral and physiological research conducted at zoos and the performance of research can affect their daily lives. The animals' physical and psychological well-being were identified as important research issues for the assessment of third-generation exhibits. In the present study, the animals' well-being was addressed through staff and consultant assessments of the animals' behavior and physiological functioning. While some behavioral observations of the animals were conducted, they were not designed to assess the animals' behavioral functioning, but rather to record what

visitors saw when viewing the animals. The tendency for birds and primates to reproduce in the third-generation exhibits was identified as another key research issue for third-generation exhibits, and also was examined through staff assessments.

Visitors were felt to be most affected by the goals of recreation and education. It was recognized that the zoo sought to provide the visitor with an enjoyable and educational experience. In order to examine the attainment of these goals, measures were obtained of the number of people present at each exhibit in the new area, the length of time visitors spent at each exhibit, their expressed liking for the exhibits, their behavior at exhibits (e.g., laughing, smiling), the extent to which visitors read signs at exhibits, and their understanding of what the exhibits represented. Research questions regarding recreational and educational aspects of the exhibits involved whether visitors would report that they enjoyed the exhibits and remember what part of the world the exhibits represent, as well as the extent to which behavioral observations of visitors indicated their enjoyment and learning. Visitors were asked how easy it was for them to see the animals, and the actual visibility of the animals over time was recorded. Due to the increased opportunities for animals to escape public view in third-generation exhibits, it was expected that visitors would report that it was difficult to see the animals.

To examine the visitors' overall use of the new exhibits, visitors' trips through the exhibits were observed to see what parts of the exhibits were used, the routes visitors selected, the total time spent in the area, factors which might affect time spent at each exhibit, relative time spent at successive exhibits, and total time spent in the area. Due to previous research in other zoos, museums, and aquaria, three hypotheses were developed:

H_1: As visitors move through the third-generation exhibits, the length of time spent at each exhibit will, on the average, decrease (fatigue hypothesis).

H_2: Total time spent in the exhibits will be affected by group size.

H_3: Total time spent in the exhibits will be affected by sign-reading.

The activity level of the animals also was expected to affect visitors' behavior at exhibits.

H_4: There will be a greater number of visitors at exhibits where the animals are more active than at ones where they are less active.

Staff members were concerned with all four goals of the zoo due to their responsibility to meet those goals. Depending upon their individual roles, staff members were concerned with providing an enjoyable, educational presentation to the public of animals and

plants, preserving and ensuring the health of the animals, and performing research to increase knowledge and benefit animals and people. The present study sought to determine the extent to which the new exhibits facilitated individual staff jobs and met the goals of third-generation zoo exhibitry. Topics to be covered in staff interviews included their evaluations of the aesthetics of the exhibits, the exhibits' facilitation of visitor recreation and education, the exhibits' ability to stimulate and maintain the health of the animals, the required maintenance of exhibits, the exhibits' facilitation of staff jobs, the design and construction of the exhibits, and staff members' suggestions for the design of future exhibits. While favorable staff and consultant responses to the exhibits were anticipated, due to the lack of previous research in the area, no specific hypotheses were made.

Comparison of Second- and Third-Generation Exhibits

The comparison of second- and third-generation exhibits was expected to reveal differences in staff, animal, and visitor responses to the exhibits. One anticipated benefit of third-generation exhibits is that they would stimulate more animal activity.

H_5: Animals will be more active in the third-generation exhibits than in the second-generation exhibits.

While expected increases in animal activity in third-generation exhibits may attract more visitors, other aspects of third-generation exhibits

may contribute to visitors' perceptions of and behavior while visiting them. For example, third-generation exhibits present animals in their species-natural groupings and are representative of the animals' natural habitat. Three hypotheses, reflective of the anticipated visitor preference for third-generation exhibits, were generated.

H_6: Visitors will stay longer at the third-generation exhibits than at the second-generation exhibits.

H_7: There will be a greater number of visitors at third-generation exhibits than at second-generation exhibits.

H_8: Visitors will like the third-generation exhibits more than the second-generation exhibits.

New exhibits also may foster greater respect for the animals, which would be demonstrated in fewer negative visitor behaviors directed at the animals.

H_9: Fewer instances of animal abuse will be observed at the third-generation exhibits than at the second-generation exhibits.

One aspect of third-generation exhibits is that they provide animals with more opportunities to escape from public view, possibly resulting in visitors having more difficulty seeing the animals in the new exhibits.

H_{10}: Visitors will report more difficulty seeing the animals in the third-generation exhibits than in the second-generation exhibits.

The anticipated benefits of third-generation enclosures for animals were examined through staff reports of animal well-being. One hypothesis was generated regarding the animals' physical health.

H_{11}: Staff members will report that the animals in the third-generation exhibits have fewer instances of illness than those in the second-generation exhibits.

The new enclosures also were expected to stimulate behavior more typical of that found in the wild.

H_{12}: Staff members will report that the animals display more naturalistic behavior in the third-generation exhibits than in the second-generation exhibits.

Finally, if the benefits to animals and visitors listed above were true, it would facilitate the zoo staff's performance of their jobs of caring for animals and providing recreation and education for the public. It was expected, however, that the use of more naturalistic materials in the enclosures would increase the daily maintenance of those enclosures.

H_{13}: Staff members will report that the third-generation exhibits are more difficult to maintain than the second-generation exhibits.

CHAPTER 4

METHOD

Multiple methods were used to gather information for the post-occupancy evaluation of the third-generation exhibits and for the comparison of the displays of Pigmy chimpanzees and Bornean orangutans at the second-generation and third-generation exhibits. The methods used were behavior mapping (Ittelson, Rivlin, & Proshansky, 1970), timing of visitors' stays, tracking (Weiss & Boutourline, 1962; Winkel & Sasanoff, 1970), questionnaire administration to visitors, and interviews with staff members. With the exception of the tracking method, which was a technique to obtain information for the POE, the methods provided information for both the POE and the comparison of second- and third-generation enclosures. Table 1 summarizes the multiple-method strategy of data collection.

Data were collected during the months of February through July of 1983. During February and March 1983, when the data involving visitors were collected, the weather was exceptionally good with daily high temperatures ranging from 64 to 80° and mostly sunny days.

Behavior Mapping

Behavior mapping was performed to investigate the presence and activity of animals at exhibits, the number of visitors present

Table 1. Summary of data collection organization for the present study.

Type of data	Method of data collection	Source of data	Location of data collection/ topic of data: Second-generation exhibits	Location of data collection/ topic of data: Third-generation exhibits
Behavioral	Behavior mapping	Visitors/ staff (N = 6,248) Animals	X	X
	Timing	Visitors (N = 496)	X	X
	Tracking	Visitors (N = 25)		X
Attitudinal	Questionnaire	Visitors (N = 94)	X	X
	Interviews	Staff/ consultants (N = 33)	X	X

at the various exhibits, visitor behavior and affect while at exhibits, and the occurrence of animal abuse by visitors.

Subjects

Subjects were those individuals who were present at exhibits during the randomly selected time periods for behavior mapping. A total of 6,248 people were observed. Some staff members and one experimenter were included in the sample, but most subjects were visitors. Summary information regarding the sex and role of people observed during behavior mapping is presented in Appendix B and difficulties in the collection of this information are discussed in Chapter 5.

Materials

The experimenter utilized a standardized form to record information (see Appendix C). For each of 11 locations, information regarding the number of visitors and their behavior was recorded. Time, day of the week, date, weather conditions, the presence of wheelchairs, strollers, and maintenance carts also were recorded. The animals' presence or absence and activities were noted.

The 11 sites for behavior mapping were the major areas for viewing animals displayed within the Whittier Southeast Asian exhibits and the Bornean orangutan and Pigmy chimpanzee exhibits at the Great Ape Grottos. Specific boundaries to the behavior mapping

areas were identified so that entry and exit points for visitors were clear-cut (see Figures 7 through 17). Boundaries were drawn to enclose the visitor areas from which the animals could be seen. In the case of the bridge, the view was primarily of the siamang islands but it is not the only vantage point from which they can be seen. Behavioral mapping of the bridge, thus, was not a complete indication of the number of people viewing the siamangs, but did provide information regarding use patterns of the bridge. For purposes of comparing use patterns within the flightcage, it was divided into two sections for behavior mapping.

The size of each behavior mapping area varied due to the size and shape of visitor viewing areas at each enclosure. Table 2 presents the estimated area for each site. Comparisons of the number of visitors present at each site may be affected by the fact that some areas can accommodate more people than other areas.

Procedure

Behavior mapping was performed during February and March 1983. Data were collected for each of the 9 hours that the Zoo was open (9 a.m. to 5 p.m.). Each hour period was represented by four randomly selected data-collection times, two on weekends and two on weekdays for a total of 32 hours, or 64 mappings.

Twice each hour, beginning at 5 minutes after the hour and 5 minutes after the half-hour, the experimenter completed a standard

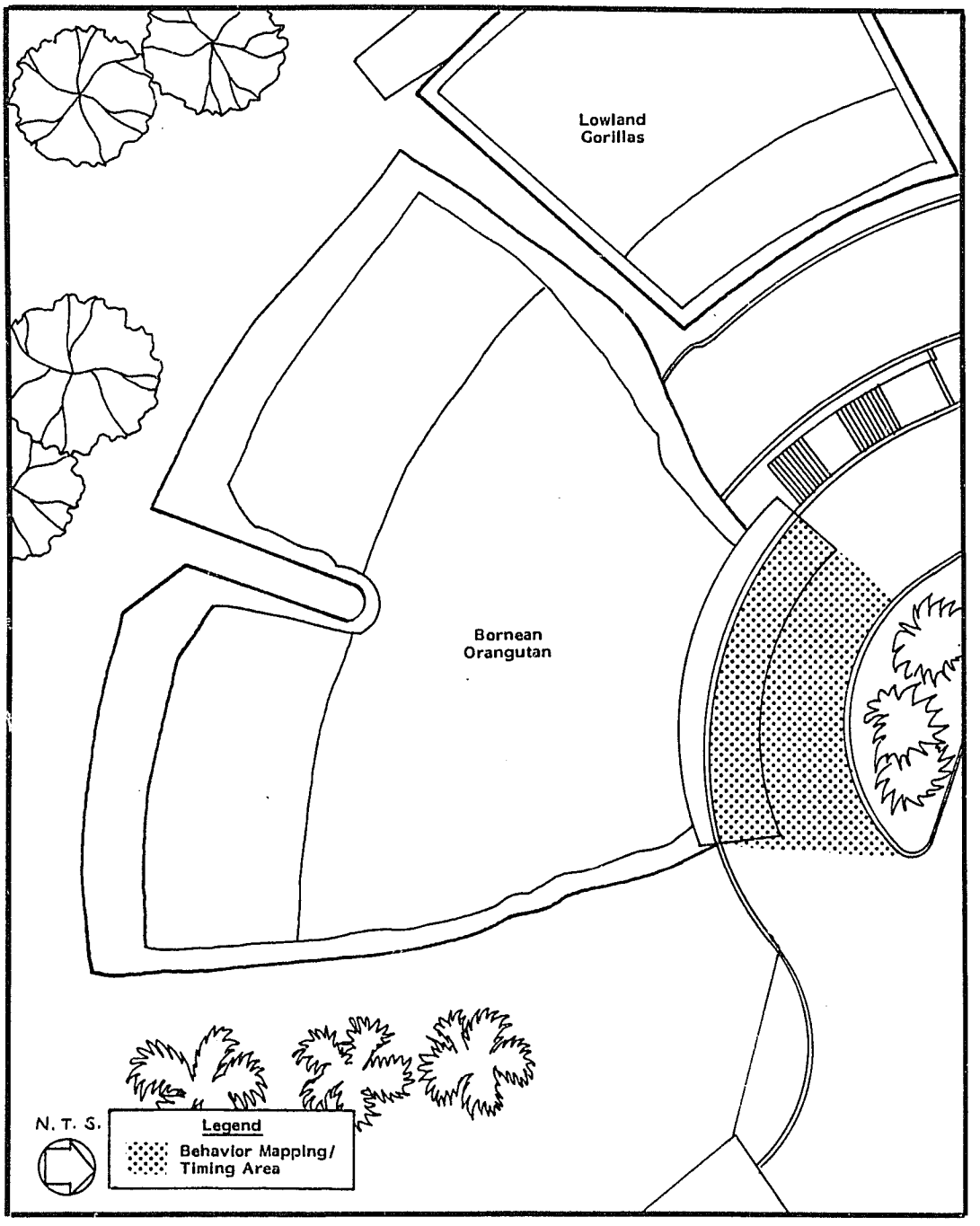


Figure 7. Plan of Bornean orangutan exhibit (second-generation exhibit).

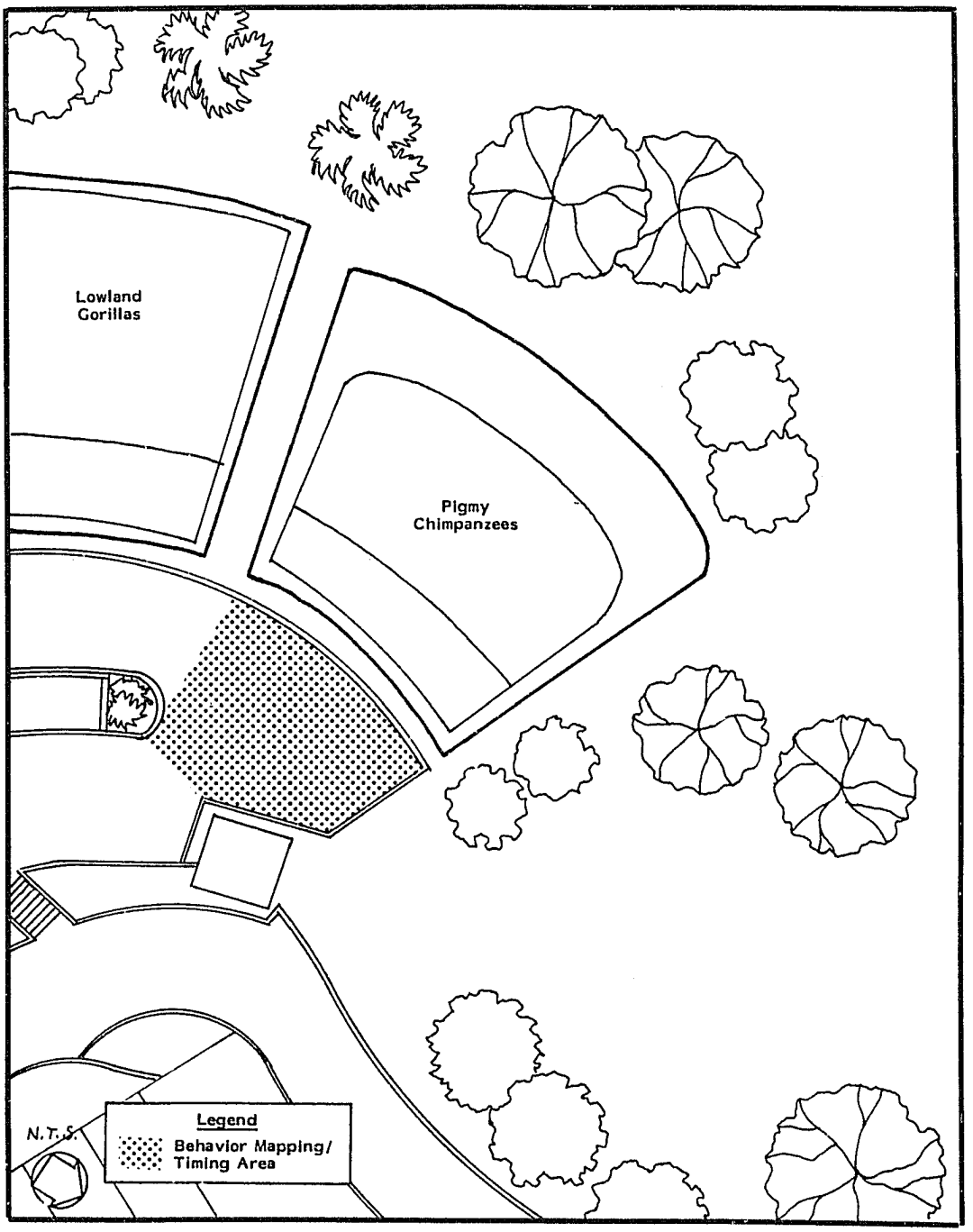


Figure 8. Plan of Pigmy chimpanzee exhibit (second-generation exhibit).

Figure 9. Plan of south side of flightcage (third-generation exhibit).

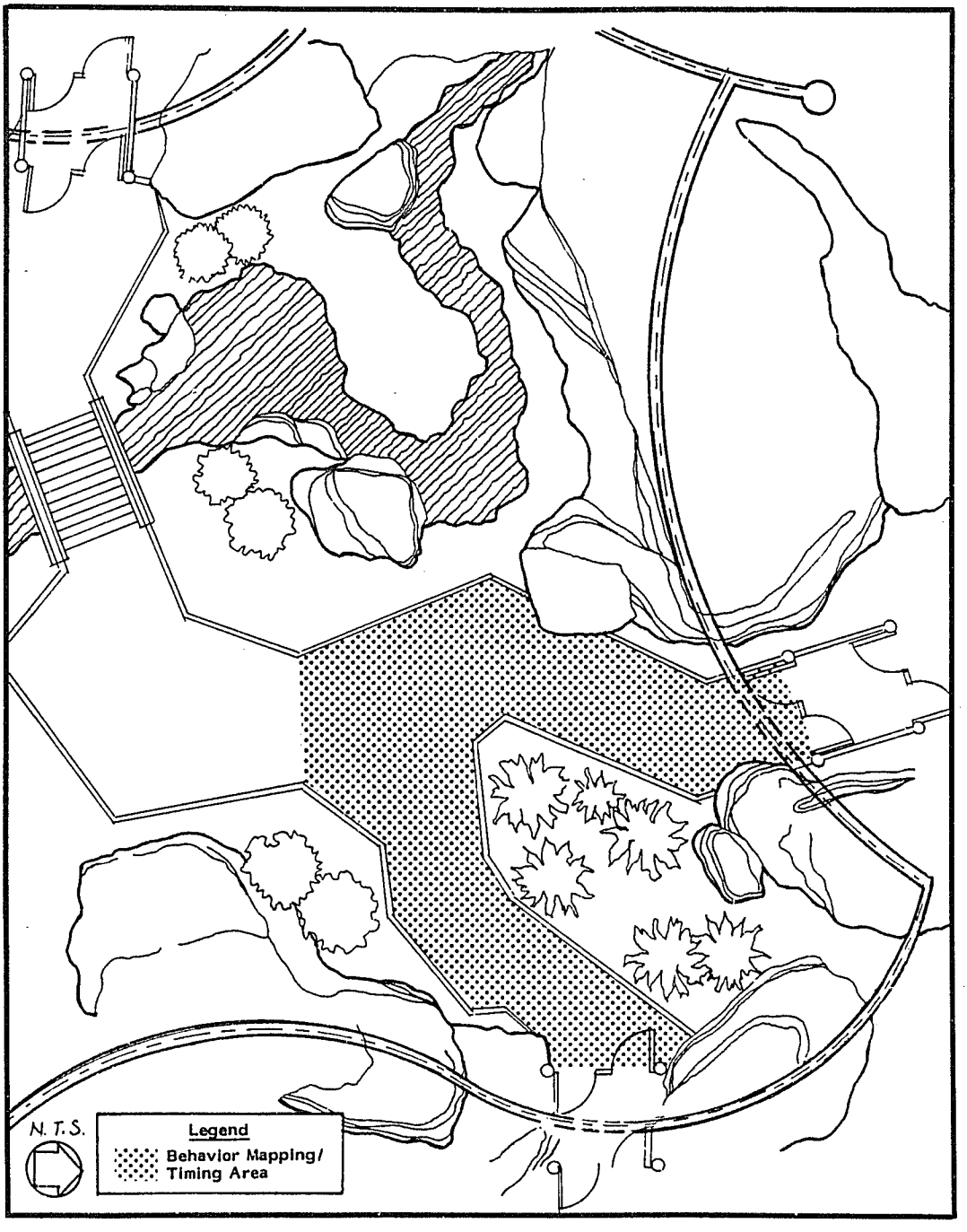


Figure 10. Plan of north side of flightcage (third-generation exhibit).

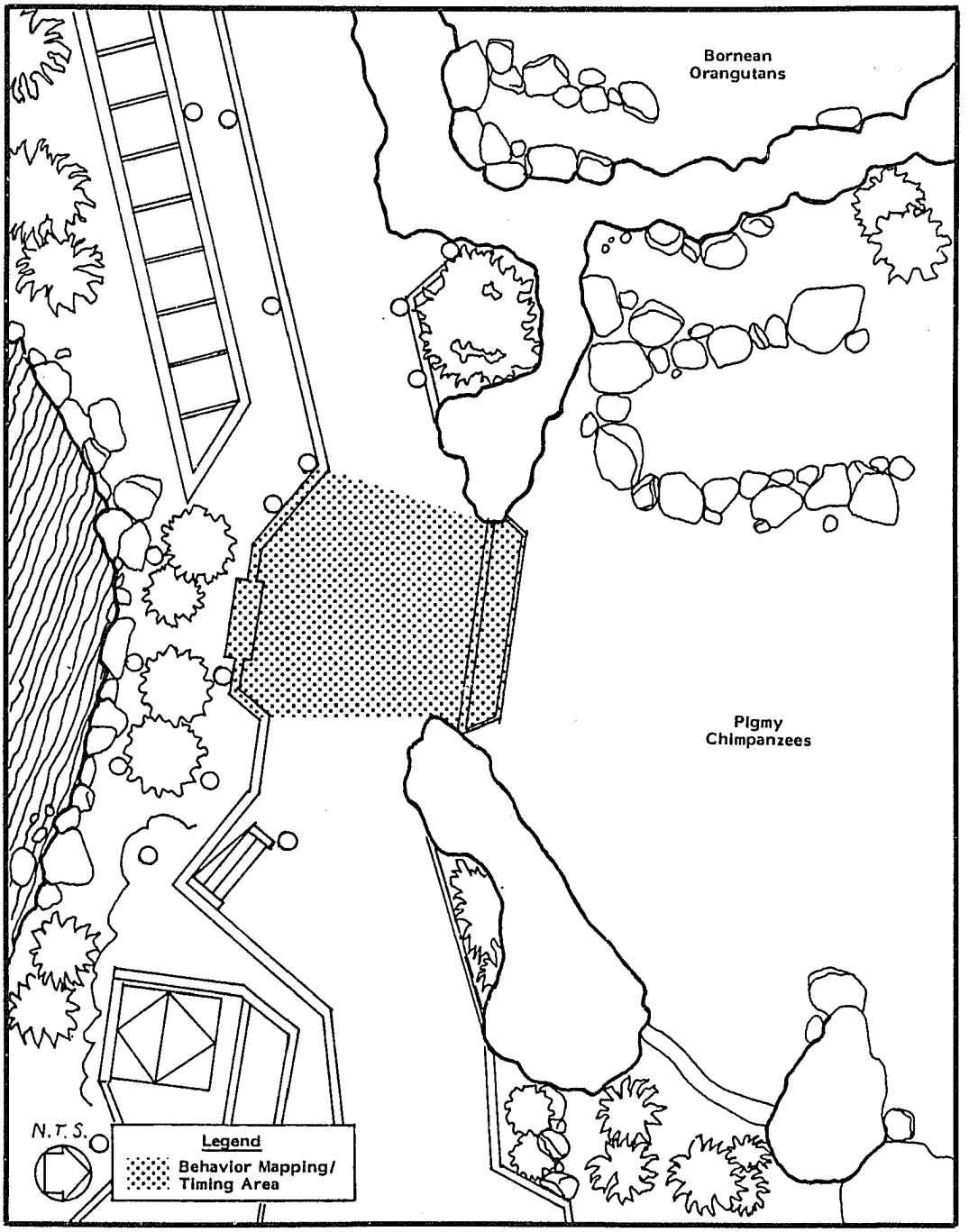


Figure 11. Plan of lower level of Pigmy chimpanzee exhibit (third-generation exhibit).

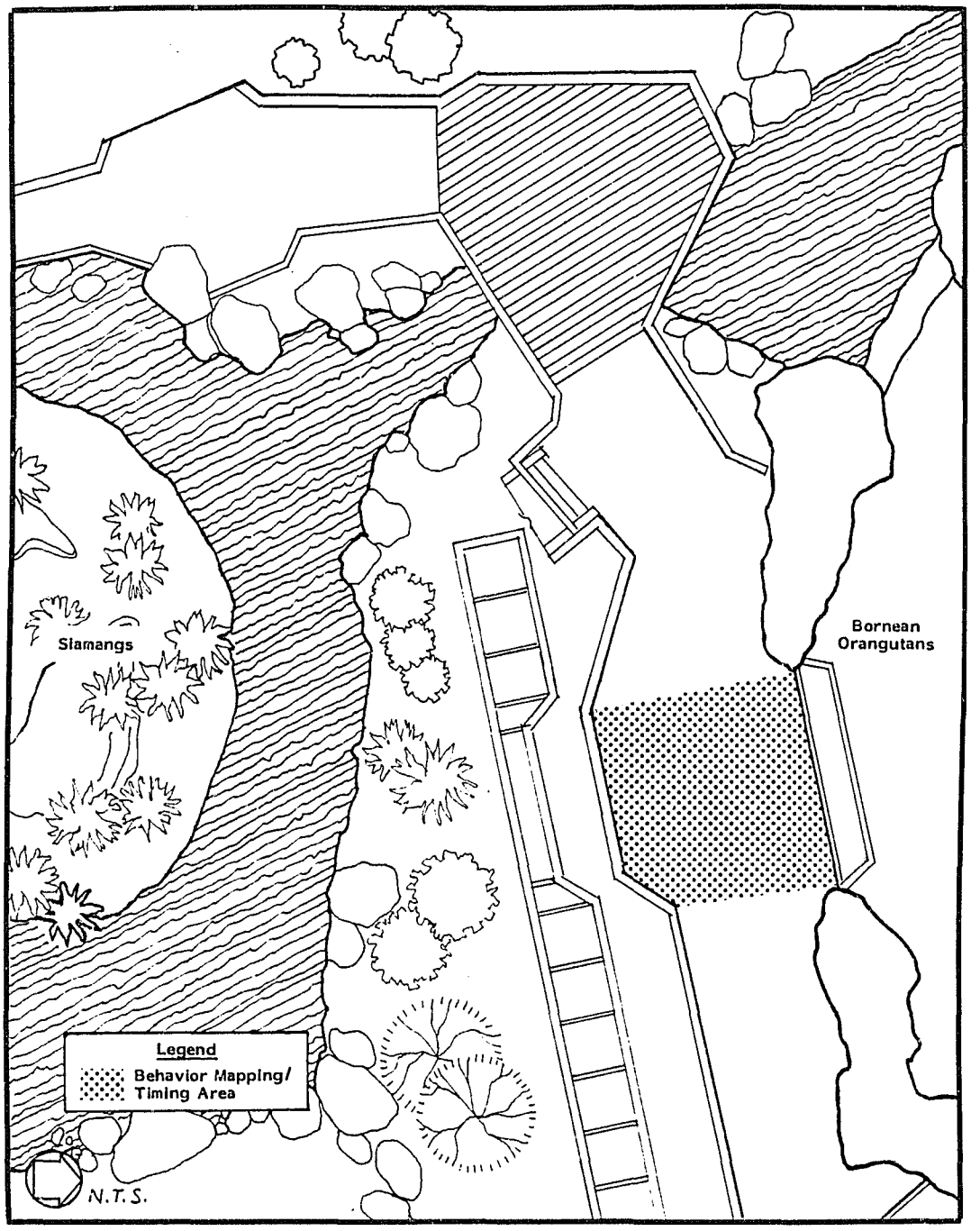


Figure 12. Plan of lower level of Bornean orangutan exhibit (third-generation exhibit).

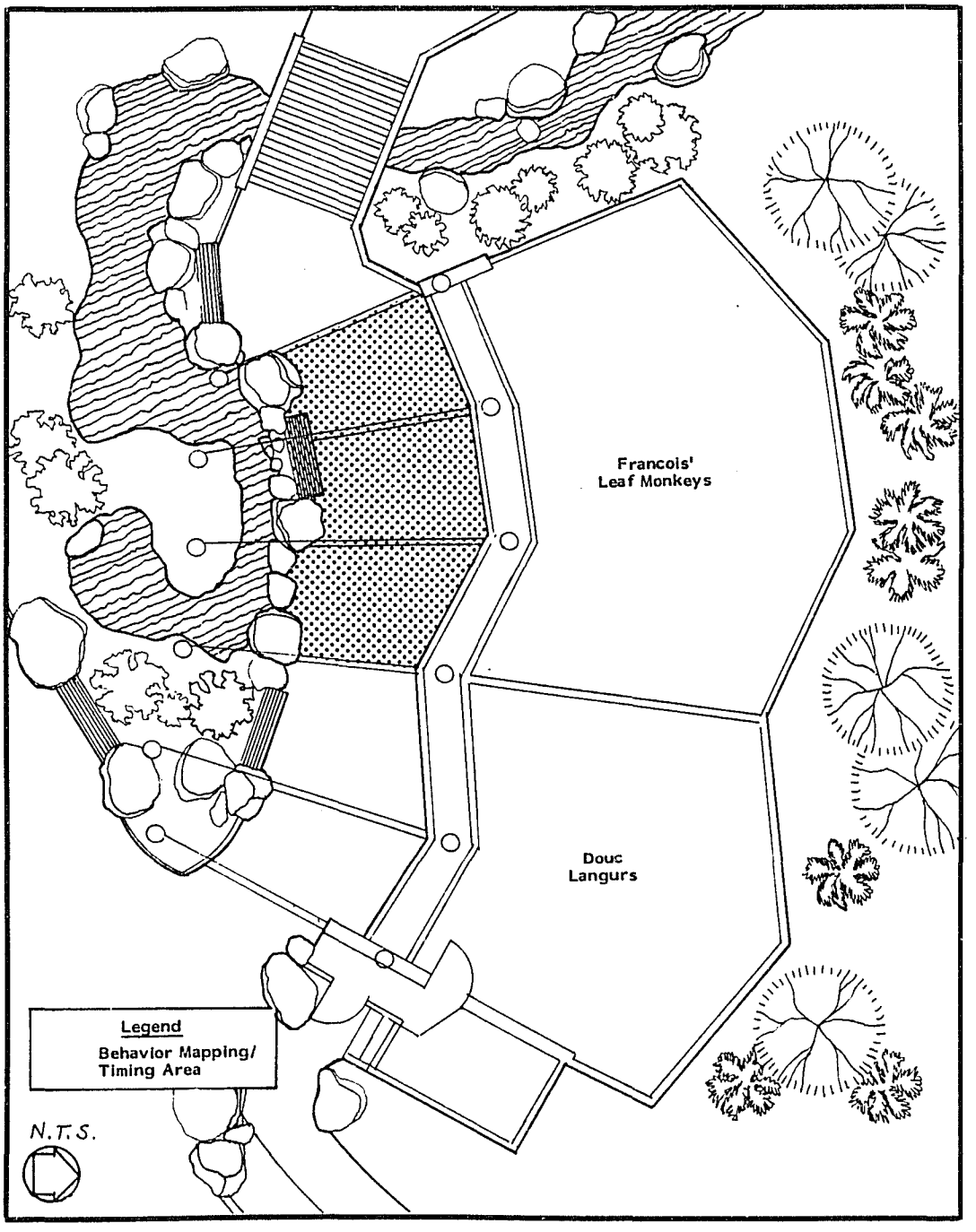


Figure 13. Plan of Francois' leaf monkey exhibit (third-generation exhibit).

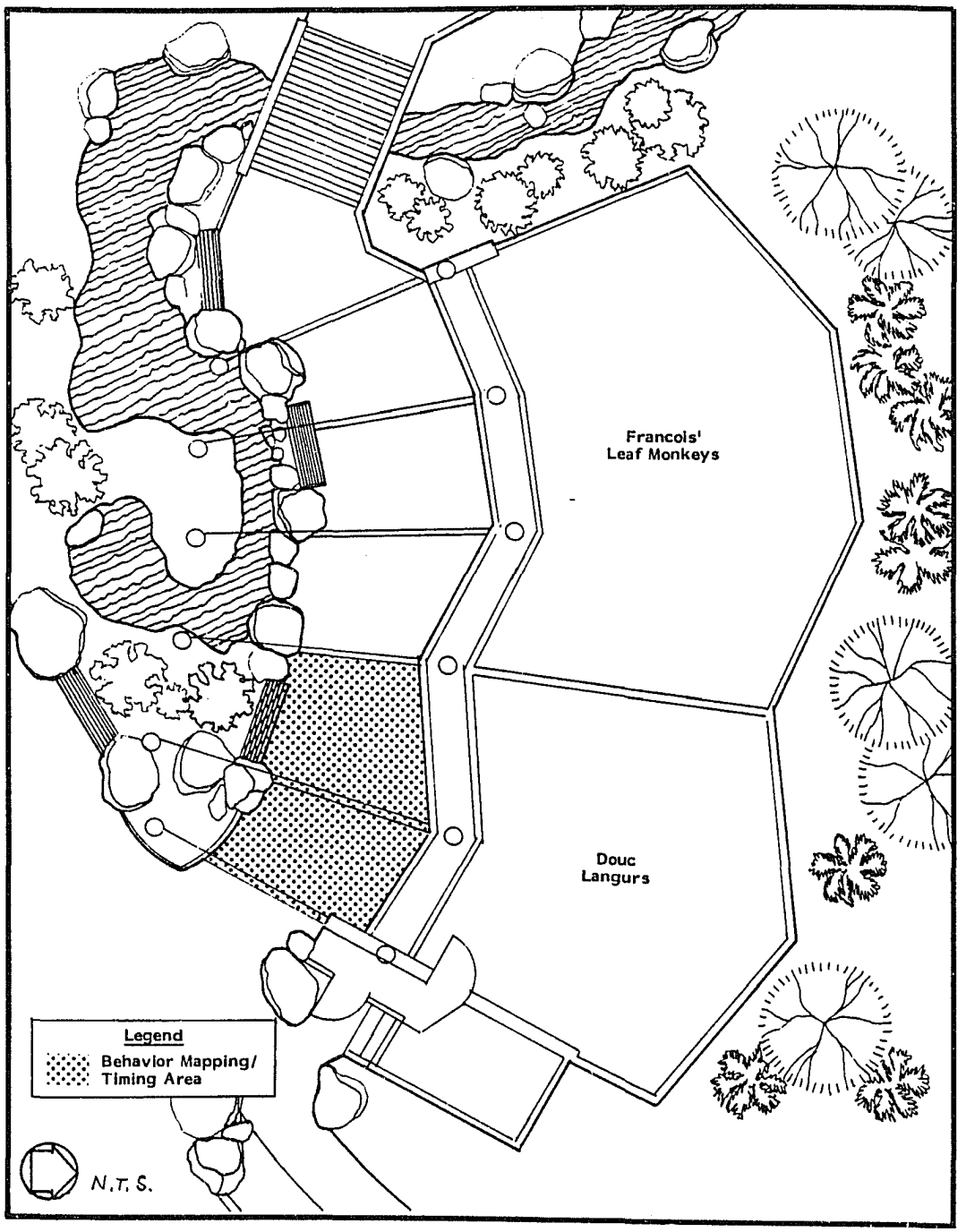


Figure 14. Plan of Douc langur exhibit (third-generation exhibit).

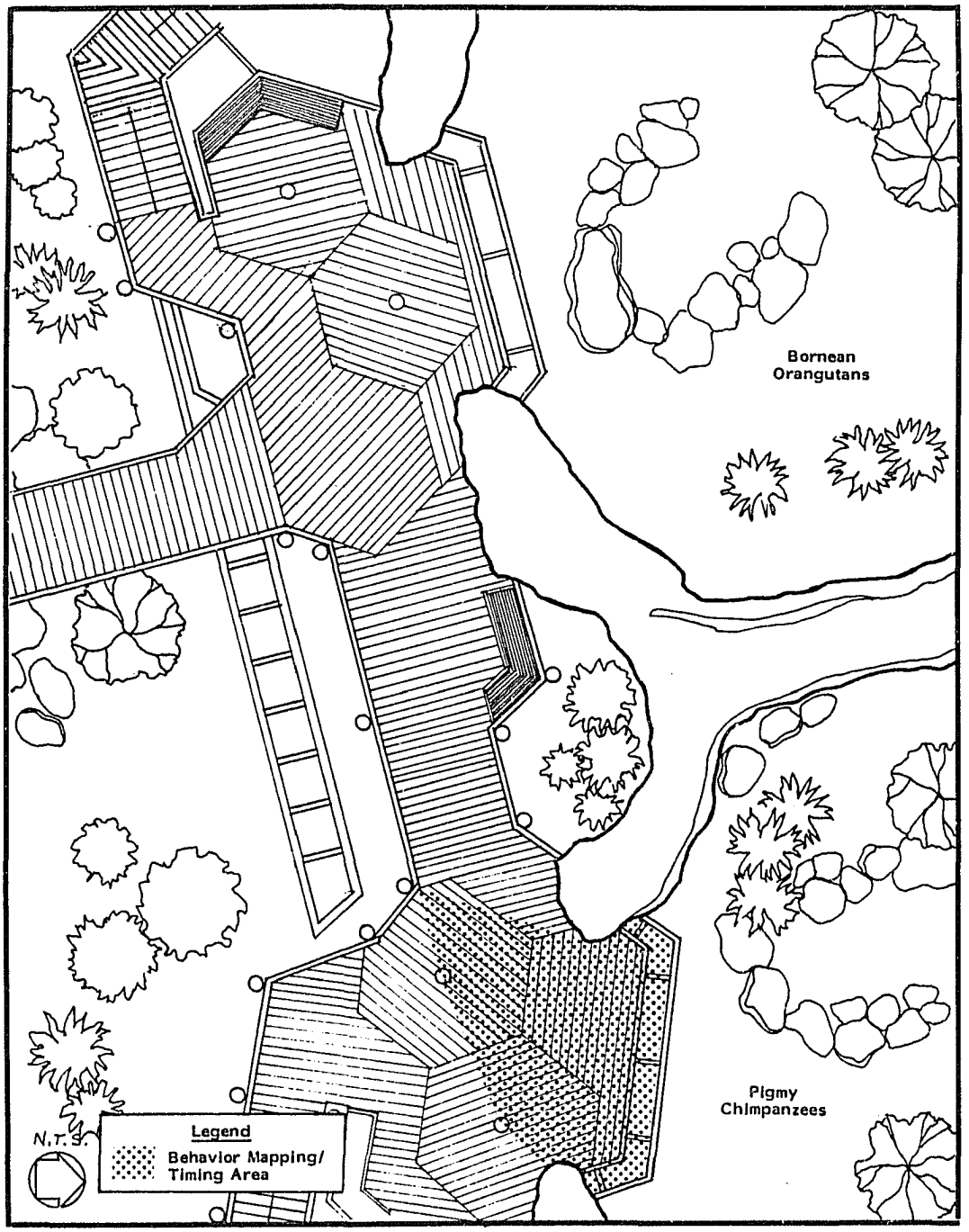


Figure 15. Plan of upper level of Pigmy chimpanzee exhibit (third-generation exhibit).

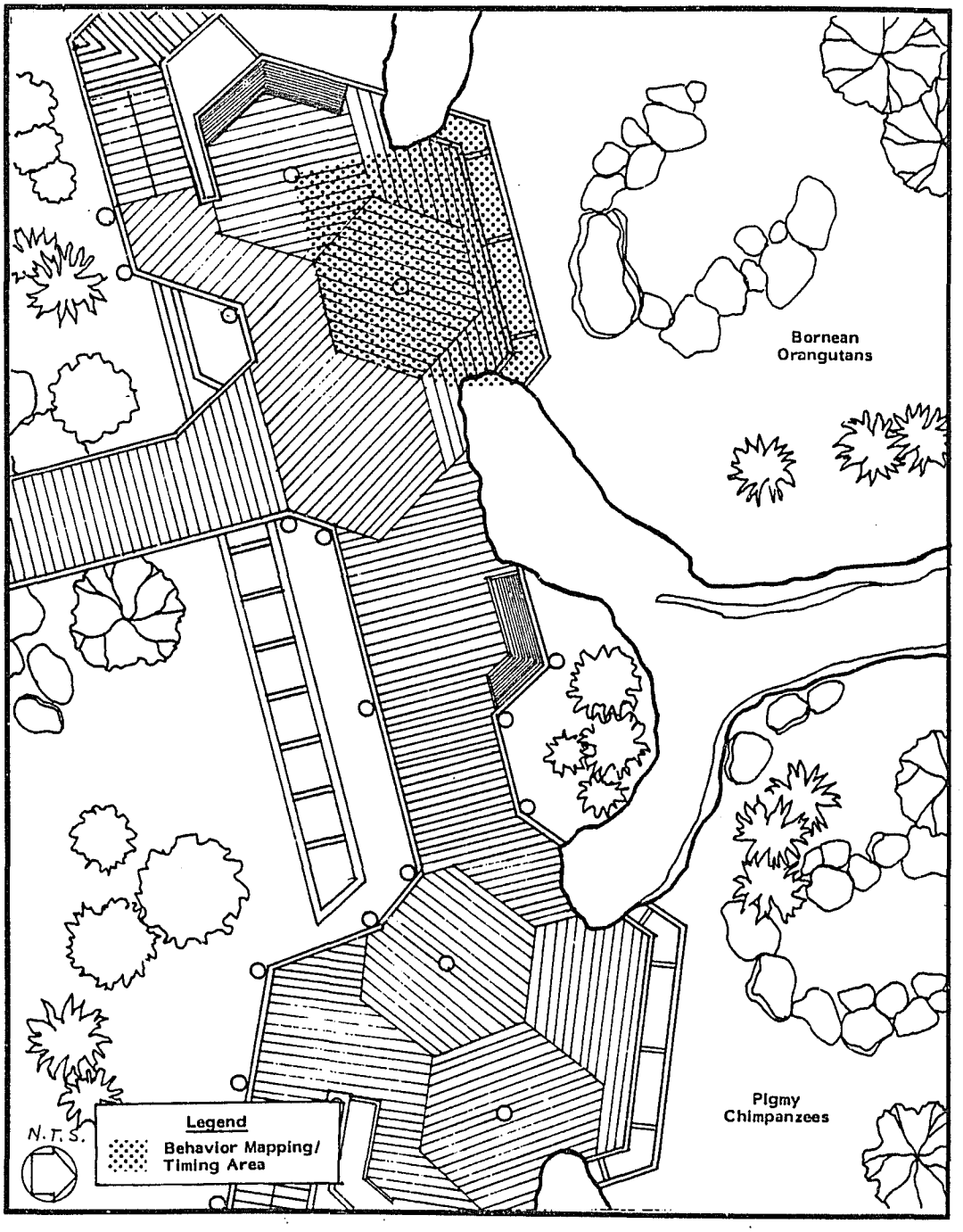


Figure 16. Plan of upper level of Bornean orangutan exhibit (third-generation exhibit).

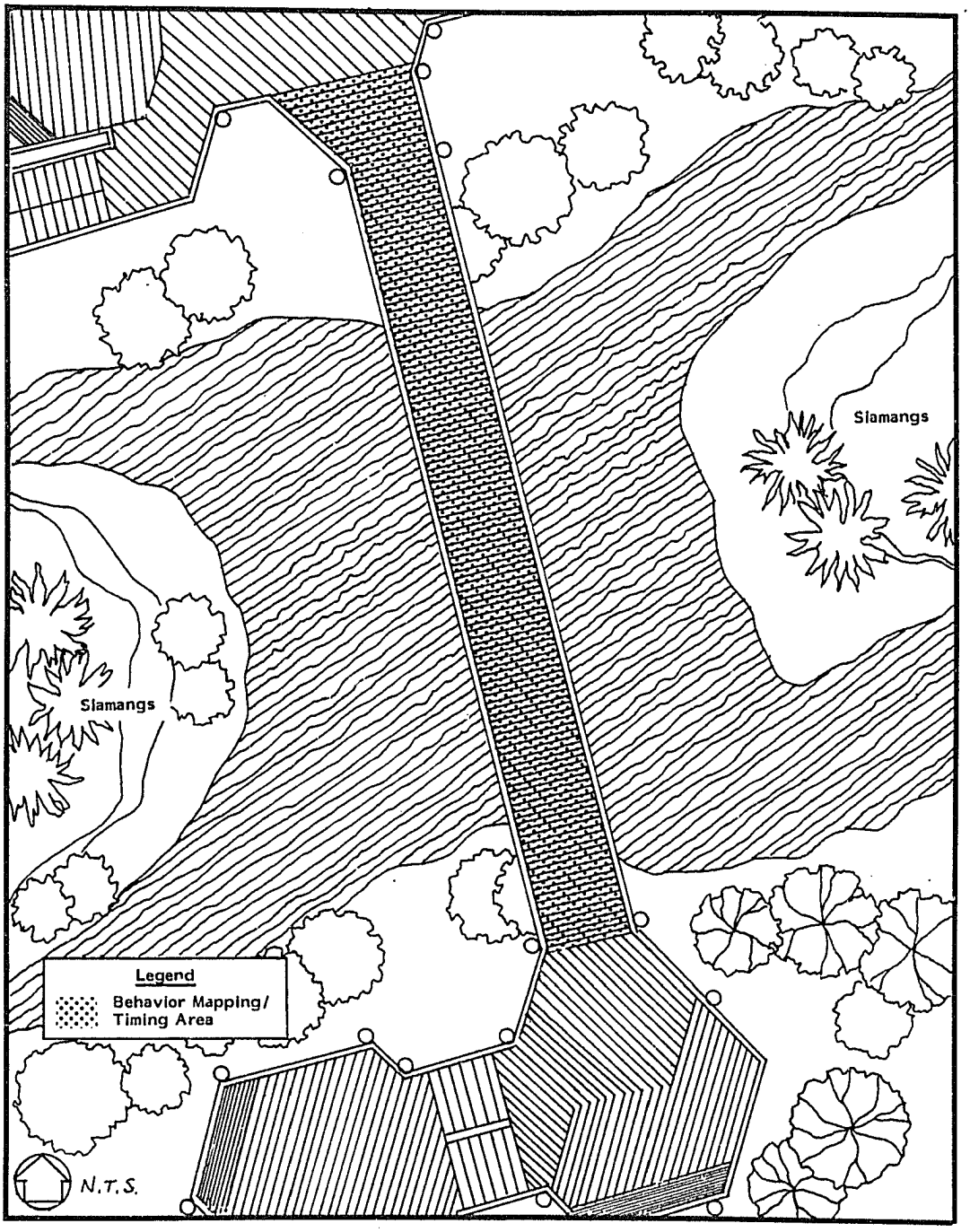


Figure 17. Plan of bridge (third-generation exhibit).

Table 2. Estimated sizes of behavior mapping areas.

Site	Estimated square feet
Second-Generation Exhibits	
Bornean orangutan	960
Pigmy chimpanzee	705
Third-Generation Exhibits	
Bornean orangutan	
Lower level	303
Upper level	280
Pigmy chimpanzee	
Lower level	360
Upper level	336
Flightcage	
South side	847
North side	642
Francois leaf monkey	400
Douc langur	310
Bridge	600

route through a total of 11 behavior-mapping sites. The route is indicated on Figure 18. The two second-generation exhibits were in the Great Ape Grottos:

1. orangutan viewing
2. Pigmy chimpanzee viewing

The other sites were in the third-generation, Whittier Southeast Asian exhibits:

3. flightcage - south side
4. flightcage - north side
5. lower orangutan viewing
6. lower Pigmy chimpanzee viewing
7. Francois' leaf monkey viewing
8. Douc langur viewing
9. upper Pigmy chimpanzee viewing
10. upper orangutan viewing
11. bridge

A standard route was followed each time data were recorded for the 11 areas. The experimenter began at the first area (the Great Ape Grottos where the Bornean orangutan was displayed) at 5 minutes past the hour and half-hour, recorded all information, proceeded to the second area listed above, recorded all information, and continued through the circuit until all areas were mapped. Depending on the number of people present at each site, the recording of data for the 11 sites took from 10 to 25 minutes.

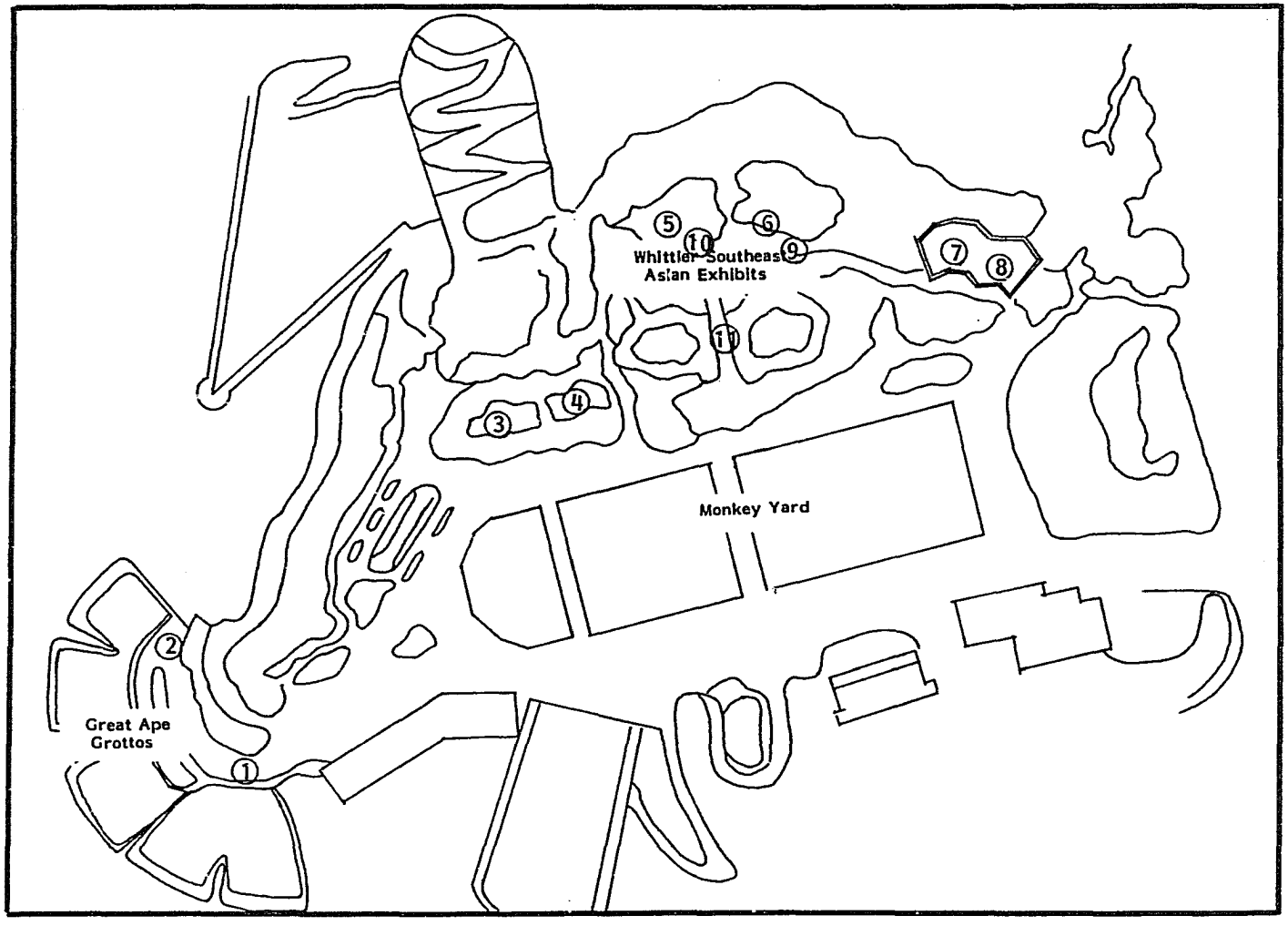


Figure 18. Plan of Bird and Primate Mesa with sequence of behavior mapping indicated.

The particular route was chosen due to the fact that it progressed through the Whittier Southeast Asian exhibits in a direction opposite to the major traffic flow. This reverse route was selected to avoid following and observing the same people from one exhibit to the next.

The experimenter recorded the time (hours and minutes) upon entering each area and completed the information outlined on the behavioral mapping form. In instances when there were large numbers of people present in a given area, it was not possible to record all information. In those cases, priority was given to obtaining an overall count of the number of people present, the animals' activities, the visitors' general activities, the number of mechanical devices present (e.g., strollers, wheelchairs), and the weather conditions. Specific breakdowns by such things as sex and gross motor activity were not recorded when large numbers of people (such as 60 to 80 in one area) were present.

Timing

The length of time visitors spent at exhibits was considered through systematic timing of their visits to various enclosures.

Subjects

Subjects were those visitors who were present during randomly selected timing sessions at each of the 11 sites. Timing took place throughout the 9 hours that the zoo was open. In order to supplement

the data which were obtained through the scheduled timing sessions, timing also was performed during the hours scheduled for behavior mapping, while the actual mapping was not being done. Visit length was recorded for 496 people, all of whom were visitors. Summary information regarding the sex and estimated age of visitors observed during timing is presented in Appendix B.

Materials

The length of time visitors spent in the exhibits was established by recording entry and exit times in hours, minutes, and seconds by the use of a Casio wrist watch. Total visit time was calculated from these figures.

Procedure

The 11 sites within the Whittier Southeast Asian exhibits and the Great Ape Grottos where timing was performed were the same ones at which the behavior mapping was performed, and they are listed above. The same boundaries as used for the behavior mapping also were used for the timing.

When the timing session began, the fourth person to enter the area from any direction was timed. After that timing was complete, the experimenter again waited for the fourth person to enter the area and timed his/her visit. The experimenter continued this pattern until the timing period was over.

The time when the visitor first stepped into the timing area was recorded in hours, minutes, and seconds. When the subject stepped out of the timing area, the hours, minutes, and seconds again were recorded. The visitor's sex and approximate age were noted, as well as factors that would affect the length of the visit (e.g., animals were off exhibit, visitors talked to the experimenter). The experimenter stood in the area and attempted to be as unobtrusive as possible. If visitors inquired as to the purpose of her presence, the experimenter explained that she was studying the exhibits and timing visitors' stays there. Based on many casual comments by visitors, most assumed that the experimenter was observing the animals.

Tracking

In order to consider routes taken by visitors in the third-generation exhibits, a sample of visitors was tracked through the exhibits.

Subjects

Subjects were every fourth person to enter the Whittier Southeast Asian exhibits during eight randomly selected hours from one of four entrances: (a) the east end of the building housing the Douc langurs and Francois' leaf monkeys, (b) the stairway entrance across from the monkey yards, (c) the sidewalk between

the siamang islands and flightcage, and (d) the flightcage entrances from the Rain Forest or south doorway. The four entry points are identified in Figure 4. Subjects were 16 males and 9 females. Estimated ages of the subjects are presented in Appendix B.

Materials

Subjects' routes and the amount of time spent by subjects at each of the 11 major areas (identified under behavior mapping) were recorded. Entrance and exit times were determined by the use of a Casio wrist watch and were recorded in hours, minutes, and seconds.

Procedure

Eight hourly time periods were randomly selected for the tracking, two 1-hour periods for each of the four entrances. During these times the experimenter stood near one of the entrance points and identified the fourth person to enter at that point. The person was followed through the exhibits, with the experimenter trying to avoid letting the subject know that he/she was being followed. The subject's route was noted by the experimenter, and the subject's length of stay at the 11 major areas was recorded. Notes also were made on the subject's specific behavior, such as sign-reading, during his/her trip. After the subject exited the Whittier exhibits, the experimenter returned to the entrance being studied for the period

and again waited for the fourth person to enter the area and tracked him/her. This process was repeated until the timing period was complete. Of the 25 subjects, one male seemed to know he was being followed as he repeatedly looked back at the researcher. He did not appear to tell his companions, however, and his tour of the exhibits was not remarkably long or short.

As discussed under Behavior Mapping, the relative sizes of the 11 timing areas varied. These size differences would be expected to have a particularly strong impact on viewing times in exhibits at which the area is distributed along a path requiring a visitor to walk an extended way in order to pass through the area. This situation was present at the Rain Forest, the flightcage, and the bridge, where the larger viewing areas were comprised of long, narrow corridors through which the visitors passed. At other sites, the area varied but the visitor viewing areas were consolidated in one large space. Relative size of the viewing areas should be considered in comparing viewing times at the exhibits.

Visitor Questionnaire

To examine the effects of exhibits on visitor attitudes and knowledge, questionnaires were administered to a sample of visitors. The questionnaires addressed visitor learning, visitor perceptions of the facilities, the ease with which visitors reported they could see the animals, and visitors' expressed enjoyment of the exhibits.

Subjects

Subjects were visitors who were exiting the zoo during randomly selected hours for questionnaire administration. Every fourth group of people who approached the experimenter standing near the exit were asked to participate in a brief survey about their visit to the zoo. Thirty-four visitors declined to participate, and a sample of 94 visitors completed the questionnaire. Summary information about visitors' sex, size of group with which they were visiting the zoo, history of zoo visits, home residence, and membership status is presented in Appendix F.

Materials

The questionnaire which was administered to visitors is shown in Appendix D. The interviewer read the questions to the visitor and recorded his/her responses. A group of photographs which represented the areas in question was used to orient the subject to the area about which questions were asked.

Procedure

Administration of the questionnaire was completed just before visitors left the zoo. The exit site was selected, as opposed to a site near the exhibits, to maximize the likelihood that the visitors had been to both the Whittier and the Great Ape Grotto exhibits. An interviewer stood just in front of the exit to the zoo. During scheduled times,

the interviewer approached every fourth group of visitors exiting the zoo and asked if they would be willing to complete a brief questionnaire regarding their visit. If the visitors asked, they were told the interview would take approximately 5 to 10 minutes. After the subject or subjects completed the questionnaire, the interviewer again waited for the fourth group of visitors and requested their participation.

The technique of selecting every fourth group of visitors (rather than every fourth person, for example) was used due to the fact that this selection technique had been used in previous surveys conducted by the zoo. Due to the fact that the questionnaire was used to provide information to support and aid in the interpretation of the behavioral data and it was recognized that the limited sample of visitors was not representative of the zoo visitor population, this selection method was considered acceptable.

Interviews

Interviews with staff members and consultants were conducted to determine their perceptions of animal health, animal behavior, propagation, animal abuse by visitors, ease of maintaining the facilities, whether the facilities helped staff members perform their jobs, their liking for the exhibits, and the design and construction process.

Subjects

Subjects were staff members at the zoo and consulting specialists concerned with the exhibits. The interviewees included the following people:

President, Board of Trustees

Building and Grounds Chairperson, Board of Trustees

Education Chairperson, Board of Trustees

Public Relations Chairperson, Board of Trustees

Architect from design form that co-designed the Whittier exhibits

Architect, landscape architect, and consulting biologists from the firm which proposed modifications to the Whittier exhibits

Curators for primates, birds, and general collection

Keepers, birds (3), large primates (2), and small primates (2)

Manager of Animal Care

Director of Research and two primate specialists in the Research Department

Director, Education Department

General Manager

Executive Director

Finance Director

Director, Architecture and Planning Department

Horticulturist

Director, Security

Building and Grounds Maintenance employees (2)

Construction and Maintenance, supervisor and employee

A total of 33 people were interviewed; 27 were males and 6 were females. All personnel directly involved in the daily functioning of the exhibits (e.g., keepers, maintenance employees) were included in the sample, as were individuals from organizatoinal areas concerned with the design, construction, and management of the second- and third-generation exhibits in question.

Materials

The interviewees' comments were recorded in the form of notes taken by the interviewer. A pre-formatted interview form was not used.

Procedure

Interviews lasted approximately 1 hour and were conducted at the zoo or at the home or local office of the interviewee. The interviews were open-ended, with the interviewer asking the interviewee to describe his/her involvement in the design and functioning of the exhibits, his/her assessment of the exhibits, the animals' behavior in the exhibits (if appropriate), his/her suggestions for future exhibit design projects, and his/her wishes for future involvement in zoo construction projects.

Subjects were assured that comments would not be credited to specific individuals. They also were informed that results would be presented in the experimenter's dissertation and in a less formal report for the zoo, both of which would be made available to them.

CHAPTER 5

RESULTS

Analyses were performed on the data obtained from each of the research methods. Results are grouped by research method.

Behavior Mapping

The average number of individuals observed at the various exhibits varied (see Table 3) with the second-generation Pigmy chimpanzee exhibit, the third-generation upper-level Pigmy chimpanzee viewing, and the bridge characterized by large numbers of visitors present on the average and the flightcage, Francois' leaf monkey, and Douc langur exhibits characterized by few visitors present. The number of visitors present at each exhibit to some extent corresponded to the size of the different exhibits, however, the large number of visitors at the upper-level Pigmy chimpanzee viewing and the small number of visitors observed in the flightcage run counter to this relationship.

Frequencies of visitors present in the second- and third-generation exhibits of Pigmy chimpanzees and Bornean orangutans were analyzed by means of the chi-square test. The 2 x 3 contingency table (see Table 4) was partitioned to examine possible differences

Table 3. Frequencies of visitors present during behavior mapping.

Site	N	M	Minimum	Maximum
Second-Generation Exhibits				
Bornean orangutan	723	11.30	0	41
Pigmy chimpanzee	1,224	19.13	0	86
Third-Generation Exhibits				
Bornean orangutan				
Lower level	583	9.11	0	39
Upper level	584	9.13	0	30
Pigmy chimpanzee				
Lower level	447	6.98	0	51
Upper level	903	14.11	0	66
Flightcage				
South side	347	5.42	0	26
North side	220	3.44	0	12
Francois' leaf monkey	285	4.45	0	29
Douc langur	205	3.20	0	19
Bridge	727	11.36	0	44
Total Observed	6,248			

Table 4. Contingency table of number of visitors present at second- and third-generation exhibits for Bornean orangutans and Pigmy chimpanzees

	Third-generation exhibit		Second-generation exhibit	Totals
	Lower level	Upper level		
Bornean orangutans	583	584	723	1,890
Pigmy chimpanzees	447	903	1,224	2,574
	1,030	1,487	1,947	4,464

between upper and lower levels of the third-generation exhibits and between second- and third-generation exhibits (Castellan, 1965). Table 5 presents the results of the chi-square analyses. Overall differences were significant, as were the partitioned comparisons. Comparisons of visitors present at upper- and lower-viewing areas in the third-generation exhibits revealed significant differences. While the numbers observed at the upper and lower orangutan viewing were almost equal, over twice as many visitors were observed at the upper viewing than lower viewing for Pigmy chimpanzees.

Table 5. Chi-square table for number of visitors present at second- and third-generation exhibits for Bornean orangutans and Pigmy chimpanzees.

Source	df	χ^2	p
Level of third-generation exhibit	1	43.90	< .01
Generation of exhibit	1	38.32	< .01
Total	2	82.22	< .01

Significant differences were found for comparisons of the number of visitors observed at the second- and third-generation exhibits. Larger numbers were observed at the third-generation exhibits (lower and upper levels combined) than at the second-generation exhibits, with differences especially pronounced for the Bornean orangutan exhibits. These results should be interpreted carefully due to the results of tracking, which indicated that a certain percentage of visitors (25% in the sample in this study) go to both upper and lower viewing areas for the same species. While the samples in the present study at upper- and lower-viewing areas were independent, the sample may be representative of a population in which some visitors go to both upper and lower levels. While more visitors may be present at the third-generation exhibits, therefore, the numbers may not necessarily represent all unique visitors, but some who go to both levels of viewing. Concerns about the relative size of visitor viewing areas being compared through behavior mapping are alleviated to a great extent in these partitioned comparisons due to the fact that upper and lower levels in the third-generation exhibits and second-generation and combined third-generation areas are quite similar in size.

It was intended that visitors' role and gross motor activity be recorded during the behavior mapping, however, it was discovered during data collection that it was not possible to record this information for each visitor. Pretesting of the behavior mapping technique

was done on winter weekdays when crowds were small and such recording was possible. When the weather improved and crowds were larger, the technique was less accurate and large portions of the data were not collected. Due to the fact that up to 74% of the data regarding sex and role of the visitor and up to 52% of the data regarding gross motor behavior were missing for certain sites, the data were not considered sufficiently complete to draw conclusions. It was determined that data regarding observable behaviors (e.g., the number of people laughing, gesturing) were even more difficult to collect. Even when crowds were small, it was often difficult to see facial expressions and determine the source of laughter or comments. When it was discovered that these difficulties in data collection existed, primary emphasis was placed on obtaining a count of the number of people present, the presence of strollers, maintenance carts, or wheelchairs, and the animals' activity. Gross motor activity, sex, and role were recorded when possible.

During the behavior mapping times, no maintenance carts were present at either the old or new exhibits, but fairly large numbers of strollers and some wheelchairs were observed. Strollers were observed in all areas, which required that they be carried up the stairs in the Whittier exhibits. No wheelchairs were observed in areas accessible only by stairs (i.e., on the bridge or on the upper Pigmy chimpanzee and orangutan viewing decks) (see Table 6).

Table 6. Presence of strollers, wheelchairs, and maintenance carts during behavior mapping.

Site	Frequencies		
	Strollers	Wheelchairs	Carts
Second-Generation Exhibits			
Bornean orangutan	20	3	0
Pigmy chimpanzee	19	4	0
Third-Generation Exhibits			
Bornean orangutan			
Lower level	25	3	0
Upper level	5	0	0
Pigmy chimpanzee			
Lower level	32	0	0
Upper level	4	0	0
Flightcage			
South side	14	1	0
North side	12	1	0
Francois' leaf monkey	9	1	0
Douc langur	6	1	0
Bridge	4	0	0

Instances of abuse toward the animals also were recorded. Verbal abuse or making fun of the animals was observed more frequently than abusive behaviors directed at the animals. Table 7 presents the frequencies of abusive acts and comments by visitors. The instance of abuse at the older Bornean orangutan exhibit involved an older man rapping his cane on the enclosure rail and yelling at the animal to awaken it. At the new Pigmy chimpanzee exhibit, a man threw a piece of ice to the chimpanzee. While it was done in fun and the crowd roared with laughter when the animal caught it, the possibility of passing germs to the animal did exist. Verbal abuse was directed at the Bornean orangutan and generally referred to the animal's appearance, which often was compared to a friend's or relative's appearance. Both verbal and behavioral abuse were infrequent during the observation periods; a total of eight instances of both types of abuse were observed during 64 behavior-mapping periods at all sites. Too few instances of abuse were observed to perform statistical comparisons of visitor abuse at the various exhibits.

The presence and activity level of the animals were recorded in behavior mapping. Written descriptions of the animals' behavior were subsequently coded using a four-point scale. The scale was developed to represent a range of animal activity in terms of its interest to the viewing public, rather than to represent specific animal behavior. For example, a scale value of 3 represented a

Table 7. Frequency of animal abuse observed during behavior mapping.

Site	Animal abuse	
	Behavioral	Verbal
Second-Generation Exhibits		
Bornean orangutan	0	3
Pigmy chimpanzee	0	0
Third-Generation Exhibits		
Bornean orangutan		
Lower level	0	3
Upper level	0	0
Pigmy chimpanzee		
Lower level	0	0
Upper level	1	0

high level of animal activity or interest and might have been achieved by the animals' eating, actively playing, climbing, or using tools.

The scale for animal activity level was defined as follows:

0 = animals not present or visible

1 = animals visible and asleep

2 = animals present and moderately active (e.g., sitting, walking)

3 = animals very active or engaged in interesting activity (e.g., eating, climbing, swinging, "clowning," dragging browse, playing with a ball)

The scale was not based on previous use, but was developed based on informal observation of what types of animal behavior did or did not stimulate visitor interest. Table 8 presents the percentage of time orangutans, Pigmy chimpanzees, leaf monkeys, and Douc langurs were engaged in the various degrees of activity in the new third-generation exhibits and the older, second-generation exhibits.

Animals' activity levels observed at the third-generation upper- and lower-level viewing areas and at the second-generation exhibits were compared through the use of the chi-square test. Due to extremely low frequencies in the category of animals sleeping in their enclosures, frequencies for animals not present or visible and animals sleeping were combined, resulting in a 3 x 3 contingency table for both Bornean orangutans and Pigmy chimpanzees.

Table 8. Animal activity observed during behavior mapping.

Site	Animal activity			
	Not visible/ present	Asleep	Moderately active	Very active
Second-Generation Exhibits				
Bornean orangutan	5%	11%	61%	23%
Pigmy chimpanzee	28%	0	62%	10%
Third-Generation Exhibits				
Bornean orangutan				
Lower level	22%	0	65%	13%
Upper level	29%	0	48%	23%
Pigmy chimpanzee				
Lower level	35%	0	46%	20%
Upper level	19%	0	52%	29%
Francois' leaf monkey	15%	0	73%	12%
Douc langur	42%	0	49%	9%

Chi-square analyses were not significant for Bornean orangutans ($\chi^2(4, \underline{N} = 165) = 5.08, \underline{p} > .05$), nor for Pigmy chimpanzees ($\chi^2(4, \underline{N} = 161) = 7.75, \underline{p} > .05$).

To examine the relationship of animal activity and the presence of visitors, the numbers of individuals present were grouped into intervals of 10. Appendix E presents the numbers of visitors present during the different types of animal behavior. These data indicate a tendency for more visitors to be present at times when animals were more active. Due to the large number of empty cells, no statistical tests were performed on these data.

Timing

Visit length was recorded for 496 visitors at the 11 areas. Times for people who merely walked through the exhibits to get elsewhere or who were there when animals were not present were excluded, leaving a sample of 433. Average visit lengths varied (see Figure 19) with longest mean viewing times recorded at the Rain Forest, third-generation upper-level viewing for Pigmy chimpanzees, second-generation Pigmy chimpanzee exhibit, and the bridge. The Francois' leaf monkey and Douc langur exhibits were characterized by short mean viewing times.

Of those visit lengths which were excluded from the analyses due to the animals not being present or the visitor

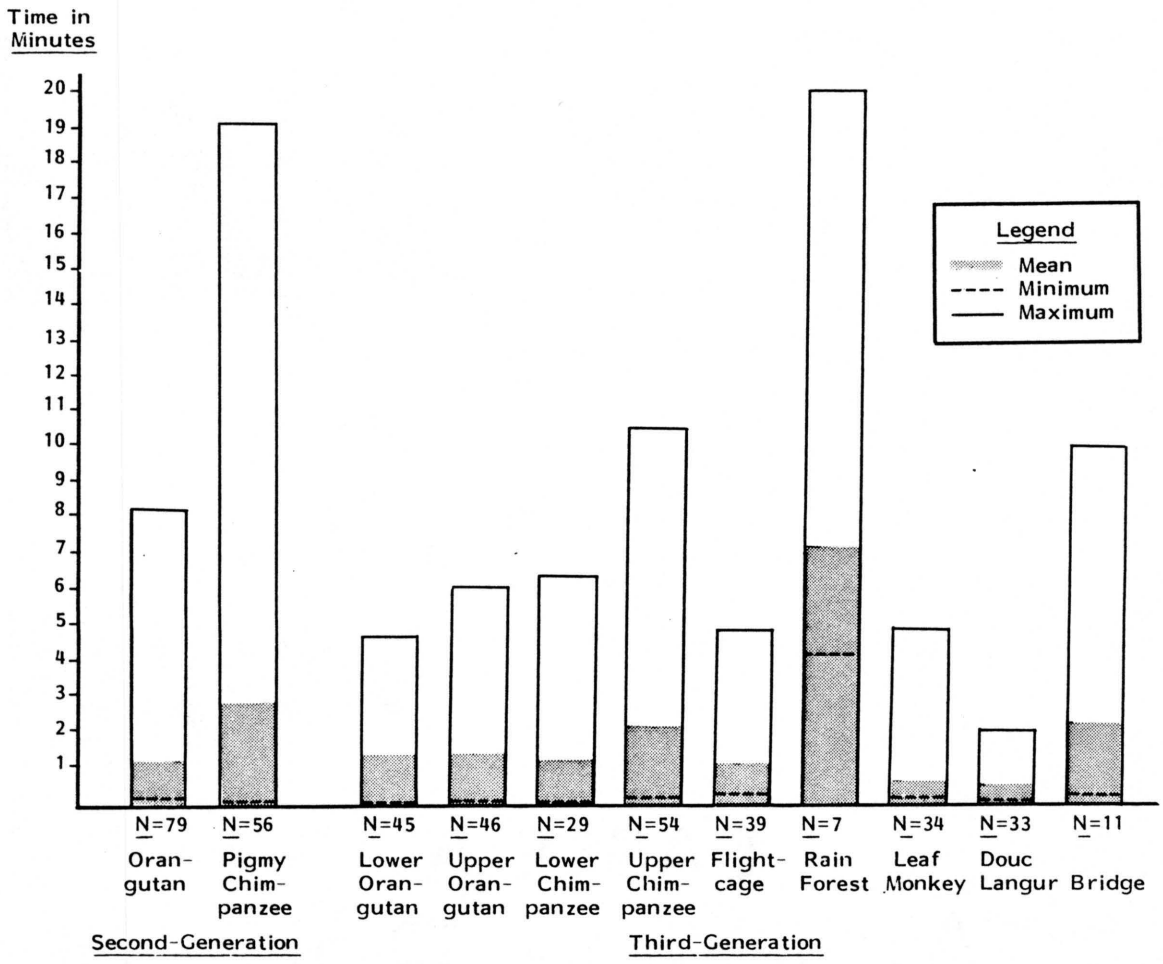


Figure 19. Mean, minimum, and maximum viewing times at exhibits.

merely passing through the exhibits and not looking, most occurred during early morning hours or late afternoon hours. Pigmy chimpanzees were the animals most frequently not visible or not on display (see Table 9). This was especially apparent in the new lower-level viewing where 51.7% of the visitors who went there during the time periods were not able to see the animals.

Visitor activities were noted during timing of their stays at the various exhibits. Of the total sample of timed visitors, few were observed to read signs or photograph the animals. Table 10 presents frequencies of sign-reading and photographing. Some of the areas did not have signs available for the visitors to read, and signs varied from small plates naming the animals to large displays with graphics and detailed text.

A 2 x 3 analysis of variance was performed to examine differences among viewing times at the second- and third-generation (lower and upper levels) exhibits for Bornean orangutans and Pigmy chimpanzees. Mean viewing times are presented in Table 11. Significant differences were found for comparisons of species, with the Pigmy chimpanzee exhibits characterized by longer visitor viewing times (see Table 12). Differences between the locations were not significant. The species/location interaction was significant, with the upper level third-generation and second-generation viewing areas stimulating long visitor viewing times.

Table 9. Occurrence of animal abuse during timing periods.

Site	Animal absence	
	Frequency	Percentage of sample
Second-Generation Exhibits		
Bornean orangutan	0	0.0
Pigmy chimpanzee	8	20.5
Third-Generation Exhibits		
Bornean orangutan		
Lower level	1	2.2
Upper level	2	4.3
Pigmy chimpanzee		
Lower level	15	51.7
Upper level	0	0.0
Francois' leaf monkey	0	0.0
Douc langur	3	9.1

Table 10. Frequency of sign-reading and photographing during timing periods.

Site	Sign-Reading		Photographing	
	Frequency	Percentage of sample	Frequency	Percentage of sample
Second-Generation Exhibits				
Bornean orangutans	2	2.5	3	3.8
Pigmy chimpanzees	0[a]	0.0	0	0.0
Third-Generation Exhibits				
Bornean orangutan				
Lower level	0[a]	0.0	0	0.0
Upper level	1	2.2	0	0.0
Pigmy chimpanzee				
Lower level	0	0.0	1	3.5
Upper level	8	14.8	0	0.0
Flightcage	2	5.1	0	0.0
Francois' leaf monkey	1	2.9	0	0.0
Douc langur	5	15.2	1	3.0

[a]No signs in area.

Table 11. Mean viewing times (in seconds) at three exhibit locations for Bornean orangutans and Pigmy chimpanzees.

Species	Location			Totals
	Third-generation exhibits		Second-generation exhibits	
	Lower level	Upper level		
Orangutan	87.87 (N = 45)	96.28 (N = 46)	64.38 (N = 79)	79.23 (N = 170)
Pigmy chimpanzee	77.10 (N = 29)	132.43 (N = 54)	168.20 (N = 56)	135.29 (N = 139)
	83.65 (N = 74)	115.80 (N = 100)	107.44 (N = 135)	104.45 (N = 309)

Table 12. Source table of analysis of variance of viewing times at three exhibit locations for Bornean orangutans and Pigmy chimpanzees.

Source	SS	df	MS	F
Main effects	270616.374	3	90205.458	5.772
Species	224504.100	1	224504.100	14.365**
Location	30236.861	2	15118.431	0.967
Two-way interactions				
Species location	163184.232	2	81592.116	5.221*
Explained	433800.606	5	86760.121	5.551
Residual	4735553.866	303	15628.891	
Total	5169354.472	308	16783.618	

*$p < .01$
**$p < .001$

Tracking

A total of 25 visitors were tracked during their visits to the Whittier exhibits. The length of time each visitor stayed in the exhibits and the number of exhibits seen by each person varied greatly.

Of the 25 subjects, 16 were male and 9 were female. Group size ranged from 1 (17%) to 6 (4%), with the mode being 2 (28%). Most groups (60%) did not include children. Of the 25 subjects, three were using strollers and one had a wheelchair.

Visit lengths for the individual exhibits were included in the timing data, so the times obtained from tracking are a subset of those timing data. They represent a similar pattern of variations in time spent at the individual exhibits. Visit lengths ranged from 1 minute, 16 seconds to 24 minutes, 5 seconds. The mean visit length in the Whittier area was 9 minutes, 42 seconds. The number of exhibits visited by an individual ranged from 1 to 8, with 5 (24%) and 2 (20%) exhibits occurring most frequently. Visitors' presence at the various exhibits was fairly equally distributed, with the most people being observed in the lower orangutan (N = 15) and lower Pigmy chimpanzee (N = 14) exhibits. The average time spent at exhibits varied widely, with a low of 14 seconds at the Douc langur exhibit (N = 11) and a high of 2 minutes, 14 seconds (N = 8) in the Rain Forest. The size of the Rain Forest

was one factor influencing the long viewing times there. Of the other exhibits, the lower orangutan (M = 1 minute, 4 seconds) and the upper Pigmy chimpanzee exhibit (M = 56 seconds) had some of the longer mean viewing times.

An analysis of variance was performed to determine whether the entrance selected by visitors affected their total viewing time in the Whittier exhibits. While the mean times varied considerably, differences between means were not significant, $F(4, 20) = 64$, $p > .05$. The effect of entrance choice on subsequent exhibits viewed was examined through the use of branching diagrams. While the choice of entrance was not significantly related to total time spent in the exhibits, it does appear to differentially affect the number of exhibits seen and the sequence in which they are seen. Figure 20 presents the branching diagrams of viewing sequences of exhibits after entering through the four major entrances. Those entering through the flightcage journeyed to few of the exhibits, mainly the two bird exhibits. Those who entered at the Douc langur building and at the sidewalk had fairly similar sequences of viewing the exhibits to the others entering at the same point. Those who entered at the main stairway had the most varied trips through the exhibits.

Simple and multiple correlations were calculated to determine the relationship between group size, entrance selected, estimated

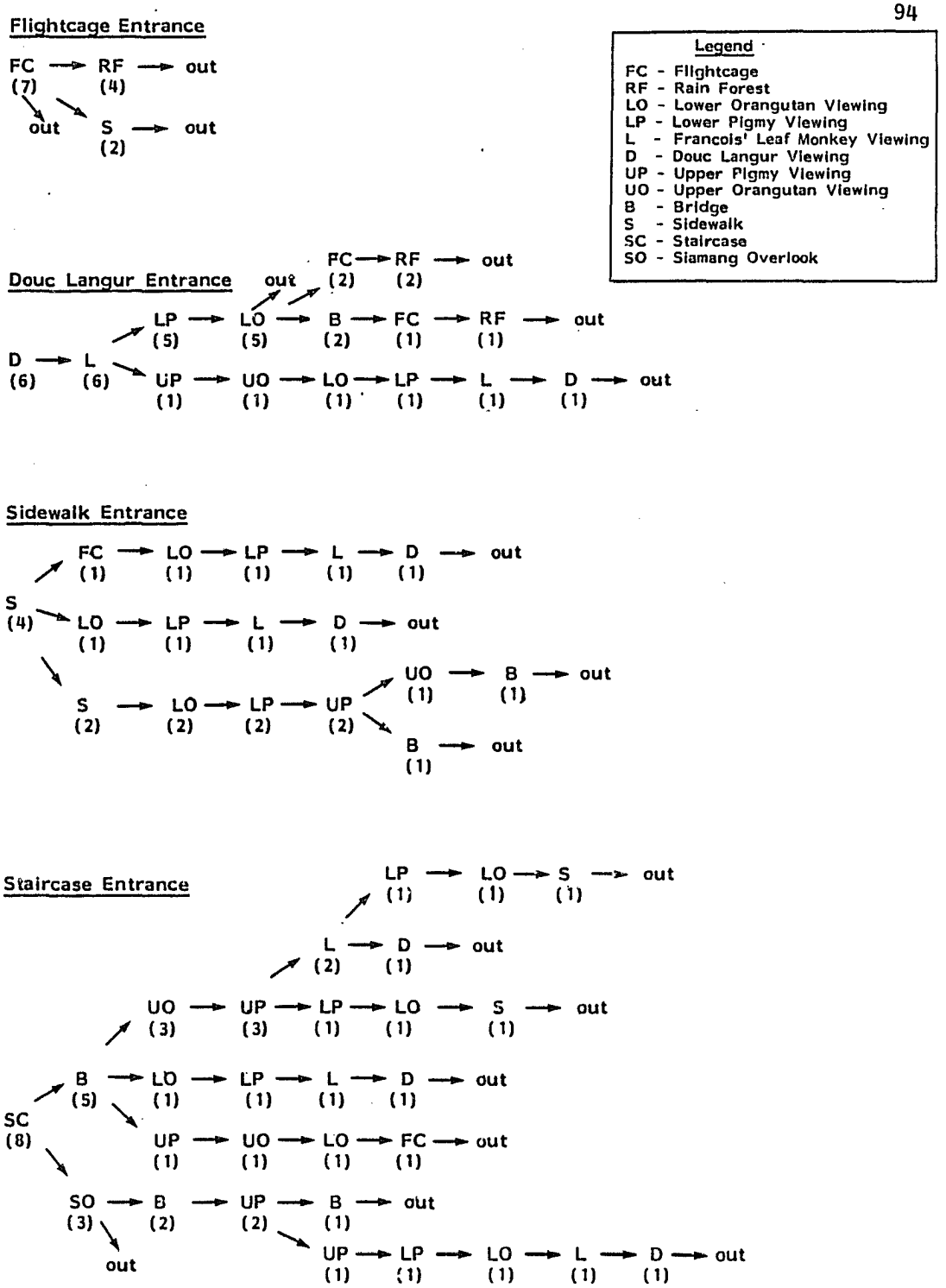


Figure 20. Branching diagrams.

age of the visitor, visitor sex, children in the group, and the presence of a wheelchair or stroller, and the total time spent at the exhibits. Table 13 presents the results of those calculations. Group size and entrance were associated with the most unique variance in total visit time, however, none of the correlations were significant.

Examination of the tracking data regarding time spent at exhibits and sequence in which they were viewed revealed that there were not consistent decrements over time in visit length at each exhibit. Figure 21 presents graphs of time spent at successive exhibits. Successive times followed a pattern of peaks and valleys with longer viewing times at the more popular exhibits. Due to the limited amount of data and the variability in the number of exhibits seen by visitors, no formal tests of significance were performed.

The majority of visitors tracked did not utilize both upper and lower viewing for the orangutans and Pigmy chimpanzees displayed in the Whittier area. Of the 25, five went to both the upper and lower viewing areas for both the orangutans and chimpanzees, one person went to upper and lower orangutan viewing, but not to the Pigmy viewing, and one person went to upper and lower chimpanzee viewing, but not to the orangutan viewing.

Table 13. Relationship of visit characteristics and total time spent at third-generation exhibits.

Characteristic	r	R	R^2	Increase in R^2	F (Increase in R^2)
Group size	.28	.28	.08	.08	1.09
Entrance	-.23	.43	.18	.10	1.87
Estimated age	-.08	.43	.19	.01	.04
Children in group	.16	.44	.19	.00	.00
Strollers/wheelchairs	.08	.46	.21	.02	.01
Sex	.16	.49	.24	.03	.52

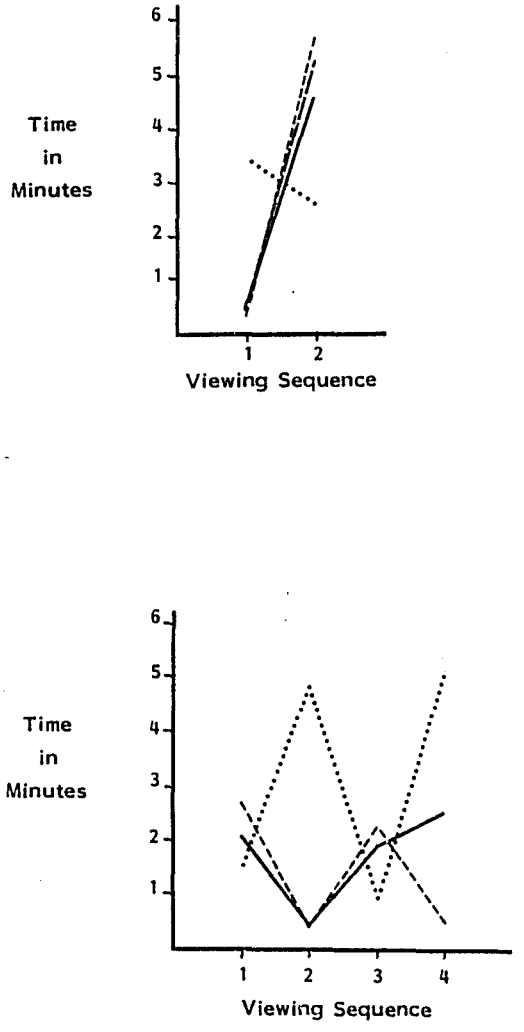
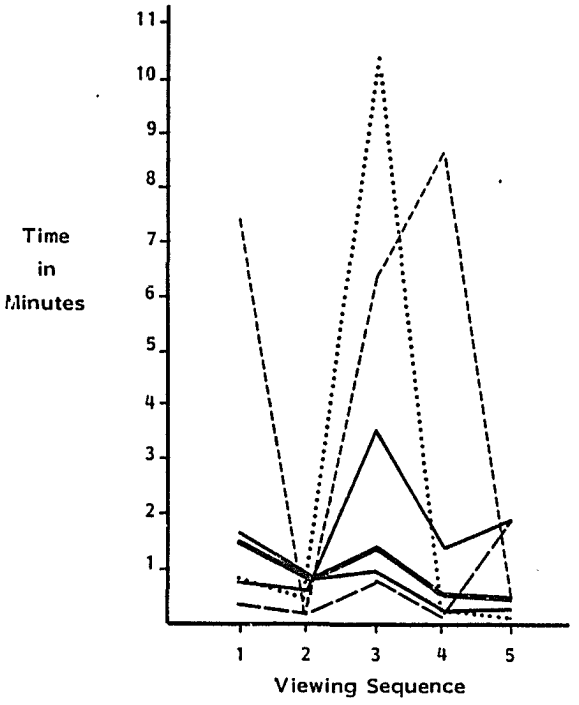


Figure 21. Time spent by visitors at successively viewed exhibits.



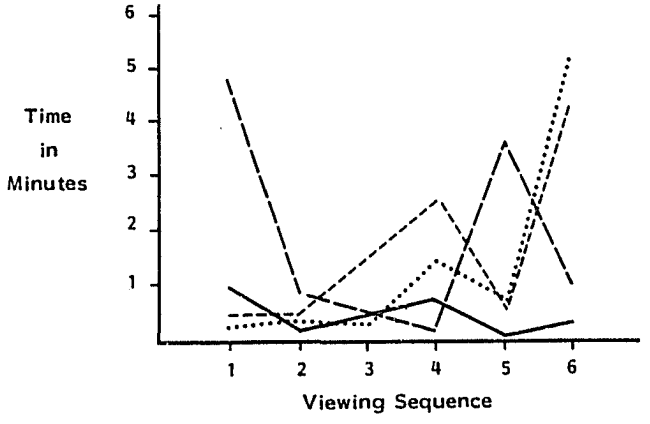
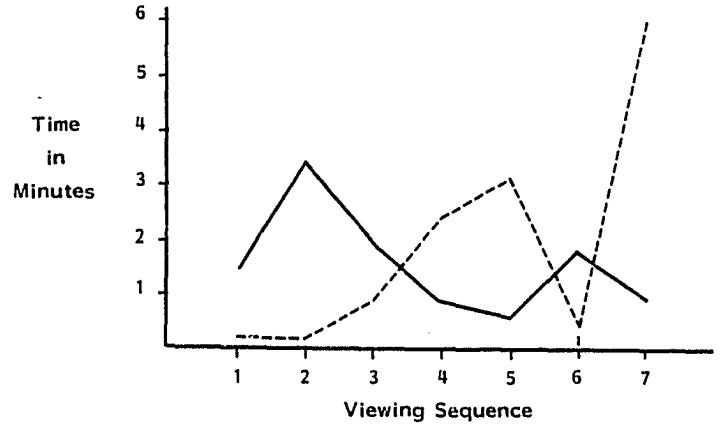


Figure 21 (continued).



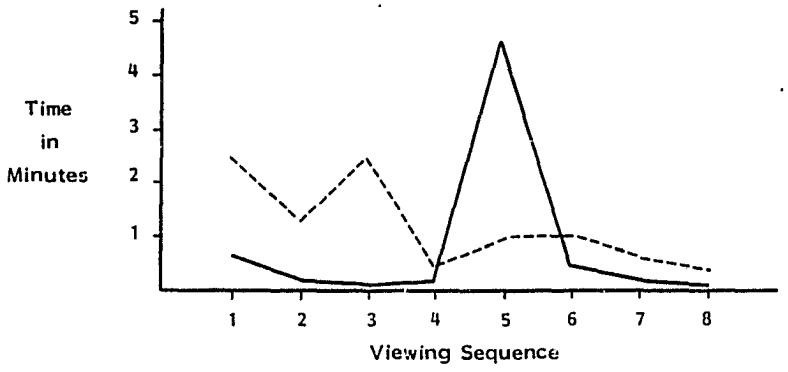


Figure 21 (continued).

Visitor Questionnaire

Frequencies of responses to the visitor questionnaire are presented in Appendix F. A total of 94 visitors completed the questionnaire.

Independent samples *t* tests were performed on responses to the questions of the extent of liking for the Pigmy chimpanzee and orangutan exhibits and ease of seeing those exhibits for the second- and third-generation exhibits. Visitors were found to like the Whittier Pigmy chimpanzee and orangutan exhibits ($M = 4.1$) significantly more than the Great Ape Grotto Pigmy chimpanzee and orangutan exhibits ($M = 3.8$), $t(73) = -2.62$, $p < .01$. No significant differences were found between visitor reports of ease of viewing the Whittier exhibits ($M = 4.2$) and the older exhibits of Pigmy chimpanzees and Bornean orangutans ($M = 4.2$), $t(71) = 0.0$, $p > .05$.

Staff Interviews

Key comments from interviews conducted with staff members and consultants were grouped as they related to the three user groups, the facilities, and the interrelationships of those groups. A total of 507 comments were extracted from the interviews and categorized. The Facilities categories contained the most comments

(N = 132). Many comments referred to interrelationships of the environment and the three user groups, with 91 about the Facilities-Staff interaction, 131 about the Facilities-Animals interaction, and 106 about the Facilities-Visitors interrelationship. Fewer comments referred to the Animal-Visitor interaction (N = 7), Staff (N = 32), Animals (N = 5), and Visitors (N = 2). Table 14 presents the categories and examples of responses which fell into each of those categories.

The Facilities-Animals category contained comments regarding the exhibits' facilitation of the animals' physical and psychological health, animal containment, and the durability of the exhibits. While overall the exhibits were seen as beneficial to the animals and a great improvement over the previous exhibits in the area, the staff and consultants still felt the exhibits should be improved. While animal health in the exhibits was considered good, certain aspects of the animals' behavior were troublesome to staff members. For example, the orangutans spent a good deal of time at the lower glass pressing their lips against the glass and "mugging" for the visitors. While visitors loved it, staff members were concerned that it was not encouraging natural behaviors on the part of the animals and that it might not be creating the desired visitor perceptions of the orangutan. Probably the greatest concern expressed by the interviewees regarding the Facilities-Animals relationship was with

Table 14. Examples of interviewees' comments grouped by topic.

Facilities-Animals
Need to get adult and juvenile Pigmy chimpanzees together (4)[a]
Siamangs had a baby on remodeled island so it must work (2)
Bedrooms are bad for siamangs--no improvements (2)
Good environment for Doucs
Cage wire in Douc langur bedrooms too flimsy for animals (3)
Plants and monkeys in an exhibit do not mix (4)
Orangutan play structure needs smaller poles for brachiation (3)
Moats present drowning danger (2)
Orangutan enclosures won't contain animals (3)
Orangutans use and enjoy play structure
Whittier exhibits enhance animals' emotional well-being
Mechanical elements need to have shields added to prevent animals from damaging them
Facilities-Visitors
Reflection of 3-D sign in Rain Forest is a problem
Pigmy chimpanzee area provides a choice of viewing
Bridge between siamang islands provides a great view

[a]Indicates multiple responses.

Table 14 (continued)

Facilities-Visitors (continued)
Bridge between siamang islands shouldn't be there due to cross-viewing (2)[a]
Visitors need more educational aids in flightcage
Bridge attracts Douc langurs up and they're hard for visitors to see (7)
Public bangs on the glass in front of the Doucs
Glare/reflection on glass at Douc langur/leaf monkey building is a big problem (8)
Lower orangutan viewing--great to get people up close (2)
No access to upper orangutan viewing for handicapped (2)
People walk in planters (3)
Glass in exhibits is slanted wrong for viewing and photographing
Whittier exhibits are a great success for the public (2)
Facilities-Staff
It is impossible to clean pools with river rocks
Douc langur/leaf monkey bedrooms clean up well
Douc langur/leaf monkey bedrooms need food slots; keepers have to open doors to feed them
Orangutan bedroom layout is good for animal handling

[a]Indicates multiple responses.

Table 14 (continued)

Facilities-Staff (continued)
Orangutan bedroom door openers are great (3)[a]
Walls leak on orangutan bedrooms and present a danger to staff (5)
Orangutan drinker system is impossible to clean and purify (3)
Wood is hard to maintain (3)
Keepers have to walk below and behind exhibits to check water valves
Animals-Staff
None
Animals-Visitors
In Rain Forest, visitor is in the same environment as the birds
Pigmy chimpanzees are delightful for viewers
Animals in the Whittier area are more active so the public doesn't abuse them
Visitors rarely bother birds in the flightcage
In the Whittier exhibits, the Pigmies gain more respect; visitors throw in fewer things
Pigmies' tree climbing in the Whittier area dumfounds visitors

[a]Indicates multiple responses.

Table 14 (continued)

Facilities
Flightcage provides a wonderful milieu
Flightcage is too high tech, too engineered
Moats leak (2)[a]
Whole moat system is too complex (3)
Like the small and compact feel of the flightcage
Douc langur/leaf monkey building is out of proportion/scale to animals and surrounding buildings (7)
Douc langur/leaf monkey building animal areas are a desolate zone between lush Fern Canyon and the visitor areas (4)
Bornean orangutan exhibit is state-of-the-art
Like the greenery, stone, and wood in the orangutan exhibits
Whittier exhibits overall were aesthetically well-done (2)
Like exhibits overall (2)
Timbers in Whittier exhibits are too big
In future should steer away from artificial materials (even glass)
Staff
In Whittier project all people were not adequately coordinated
In future, remember consultants are worth their fees (2)[a]

[a]Indicates multiple responses.

Table 14 (continued)

Animals
There are few adult animals in the Whittier area
In future exhibits, breeding and family should be emphasized
In future exhibits, animal needs should be responded to
Visitors
Visitor participation should be zoo aim
Need education to stop visitor abuse and change misconceptions

[a]Indicates multiple responses.

the exhibits' failure to contain the animals. Staff members reported difficulties in containing both the primates and the birds in the new exhibits, and these problems had led to the removal of some animals from the Pigmy chimpanzee, Bornean orangutan, and siamang exhibits to prevent their escape.

The Facilities-Visitors category contained mainly comments which related to the visitors' ability to see the animals in the new exhibits. Exhibits at which the visitors could get close to the animals and get a good view while still being contained in the visitor areas were positively assessed. Some boundary problems existed for visitors, as well as animals. Modifications to the exhibits were made to prevent visitors from climbing in planters and out onto the rock walls which surrounded the orangutan and chimpanzee exhibits. Visitor abuse of the animals was discussed and was not seen as a large problem in the new exhibits. The educational aspects of the exhibits were another topic of interest, and staff members were concerned that visitors may not be obtaining the maximum educational benefit of the exhibits.

The Facilities-Staff category contained comments related to the maintenance of the exhibits and exhibits' facilitation of their various jobs. Various pros and cons of the exhibits were discussed. The biggest concern expressed by staff members was the difficulty in escape-proofing the exhibits. The moat and related water system

provided the greatest maintenance difficulties for staff members. Many features within the underground bedroom area were positively assessed by staff members (e.g., door openers, skylights) and some were even considered beyond what they actually required to perform their jobs (i.e., the kitchen was larger and contained more cupboards than were being used at the time). Another major topic of discussion was the design and construction process. Many staff members felt that more input on their part during the design process could have avoided some of the perceived deficiencies in the various exhibits.

The Animals-Visitors category contained staff impressions of the visitors' responses to the animals. The opportunity for visitors to see the Pigmy chimpanzees climbing to great heights in the trees and to see the orangutans on the other side of the glass at the lower viewing were aspects of the exhibits which staff members felt were particularly impressive. Staff members also commented on the fact that the exhibits seemed to engender more respect for the animals on the part of visitors.

The Facilities category contained comments which were mainly evaluative in nature. Many concerned aesthetic evaluations or liking for the exhibits, while others referred to the functional aspects of the exhibits. The Staff category contained comments about staff interaction during the design and construction of the new exhibits. Many comments in this category were in the form of

suggestions for the future. There was a strong concern on the part of staff members to be involved in the design and construction process and to have their suggestions considered seriously. Comments in the Animals category, for the most part, were very general (e.g., the need to respond to animal needs).

For purposes of comparing the second- and third-generation exhibits, comments regarding animal abuse, animal health, animal behavior, breeding, and exhibit maintenance were examined. Comments were grouped into these five topics and categorized as positive, negative, or neutral.

Those comments related to animal abuse indicated that most felt the new exhibits fostered less abuse (see Table 15). One interviewee did mention the difficulty of having visitors positioned above the animals, as at the upper-viewing decks in the Whittier area, because it made it easier for visitors to drop things in the exhibits without being detected. In the Grotto exhibits, people had to throw things in to the animals, and that behavior was more noticeable to other visitors and security personnel. Several interviewees mentioned the difference in abuse rates between the monkey yard cages and the other more open enclosures, including the Great Ape Grottos and the new Whittier exhibits. Far more abuse had been observed by staff members at the cages than at the open exhibits.

Table 15. Summary of interviewees' comments regarding animal abuse.

Type of comment	Type of exhibit	
	Second-generation exhibit	Third-generation exhibit
Positive	It is more visible when people throw stuff in so it discourages them	150% better--less abuse because people are closer
		Animals are more active so public doesn't abuse
		In the Whittier exhibits, the Pigmies gain more respect; visitors throw in fewer things
Negative	Biggest problem is people throwing stuff in	
Neutral	No difference in abuse at second- and third-generation exhibits	
	More abuse in monkey yards (2)[a]	
	More abuse in cages to get animals' attention	

[a]Indicates multiple responses.

Most staff members felt the orangutans and chimpanzees were healthier in the third-generation exhibits than in the second-generation exhibits (see Table 16). Direct physical evidence of differences (i.e., more instances of illness in one group) was not available, and it was explained that the type of stress-related illness produced by inadequate environments is often not found until necropsy (e.g., ulcerated stomachs). Again, the higher incidence of illness and death for animals housed in the monkey yards was noted.

Staff assessments of animal behavior in the second- and third-generation exhibits were mixed (see Table 17). While comments about the second-generation exhibits were uniformly negative, some comments about the new exhibits were negative and some were positive. The behavior of the juvenile Pigmy chimpanzees in the new exhibits was specifically mentioned as problematic.

The only comments about breeding referred to the siamangs and the birds in the flightcage, who had produced offspring. Staff members were pleased with the siamangs' breeding and felt their island environment had facilitated it. The animals under comparison in the second- and third-generation exhibits, the Bornean orangutans and Pigmy chimpanzees, could not be compared for breeding activity because the male and female orangutans were separated between old and new exhibits and the only chimpanzees in the new area were juveniles.

Table 16. Summary of interviewees' comments regarding animal health.

Type of comment	Type of exhibit	
	Second-generation exhibit	Third-generation exhibit
Positive		Animals are healthier and happier Enhances emotional well-being Animals are healthier
Negative	Grotto lends itself to illness	
Neutral	In Whittier exhibits, more possibility for disease but less stress Can't know physical effects until necropsy	

Table 17. Summary of interviewees' comments regarding animal behavior.

Type of comment	Type of exhibit	
	Second-generation exhibit	Third-generation exhibit
Positive		There is more for the animals to do
		There is less aggression and atypical behavior; animals can get away from each other
		Animals are more active and there is less fighting
Negative	Grotto is cold, stereotyped; animals are bored and have trouble breeding	Animal boredom is #1 problem--especially for chimpanzees
	Animals can't escape from the stares of the public	In lower levels, animals are dull, lifeless, bored, unhappy, and disinterested
	There is drumming, slapping, sliding, begging, and the animals have abraided coats	Juvenile chimpanzees sit by glass and stare and engage in self-directed acts (e.g., head-banging, rocking, caprophagy)

Staff comments on exhibit maintenance suggested the new exhibits were more difficult to maintain than the easily-hosed Grotto exhibits (see Table 18). While materials in the new exhibits presented both short- and long-term maintenance challenges (e.g., glass, wood), the use of natural elements in the exhibits was not seen as an extra burden during daily cleaning. The grassy enclosures were merely raked out as opposed to hosing as in the Grottos' exterior display areas. The plants and trees to which the animals had access, however, were difficult to sustain. The plants on the floor in the Douc langur/leaf monkey building died and it was subsequently cemented, and if the Pigmy chimpanzees had not been moved to another exhibit, staff members predicted the trees in their enclosure would have died. The biggest maintenance problem for staff members was the extremely complex moat, water, and pump system in the new area, which was the source of great frustration for staff members when compared with the dry moat in the older exhibits.

Table 18. Summary of interviewees' comments regarding exhibit maintenance.

Type of comment	Type of exhibit	
	Second-generation exhibit	Third-generation exhibit
Positive	Bedrooms clean faster	
Negative		Pools/pumps are major problems
		Wood is hard to maintain (3)
		Nails work up in wood
		Wood decks have lower life expectancy
		Drinker system impossible to clean and purify (3)
		Ground is settling and sheering pipes
		Water valves are 10-16 feet underground--hard to fix
		Transfer tunnel is hard to hose out
		Had to shield mechanical equipment
		Hard to clean moats (2)
		Moats harder to clean and it's done less often

Table 18 (continued)

Type of comment	Type of exhibit	
	Second-generation exhibit	Third-generation exhibit
Negative (cont'd)		Impossible to clean pools with river rocks (Rain Forest)
		Upkeep for Douc langur/ leaf monkey building is out-of-sight, especially glass cleaning
		Skylights are hard to clean
		Water spots on glass from sprinklers are hard to clean
Neutral	Wood decks take longer to clean, but it's no problem	
	Cleaning animal display areas is no different	

CHAPTER 6

DISCUSSION

This discussion will present several themes related to the present study. It will present a discussion of the results of several research methods to provide an integrated assessment of the set of third-generation exhibits from the perspective of the model of zoo functioning. The same model, which considers exhibit functioning from the standpoint of animals, staff, and visitors, will structure a comparison of third-generation exhibits and second-generation exhibits housing the same species. These discussions will include an elaboration of the findings from the post-occupancy evaluation and comparison of second- and third-generation exhibits as they relate to the hypotheses which were made. Finally, the applied and theoretical implications of this study for the design and management of zoos and for the study of zoos will be discussed.

The present study took a global approach to the assessment of the zoo environment and utilized numerous methods to examine zoo functioning. The results of these methods were combined with those from other methods to form conclusions from convergent sources. To aid the reader in this discussion of the results of several research methods, Tables 19 and 20 provide summaries of the research methods

Table 19. Summary of research methods used to consider issues regarding zoo functioning.

Focus of analysis	Content of analysis	Research method
Facilities-Animals	Animal behavior	Staff interviews
	Animal health	Staff interviews
	Propagation	Staff interviews
	Animal presence/activity	Behavior mapping
Facilities-Visitors	Visitor stay time	Timing
	Number of visitors present	Behavior mapping
	Route taken	Tracking
	Learning	Questionnaire/ tracking
	Visitor perceptions of facilities	Questionnaire
	Ease of viewing	Questionnaire/ behavior mapping
	Enjoyment	Questionnaire
Facilities-Staff	Ease of maintenance	Staff interviews
	Facilitation of staff pursuits	Staff interviews

Table 19 (continued)

Focus of analysis	Content of analysis	Research method
Facilities-Staff (cont'd)	Staff liking for exhibits	Staff interviews
	Design/construction process	Staff interviews
Staff-Animals	Animal behavior	Staff interviews
	Animal health	Staff interviews
	Propagation	Staff interviews
	Animal presence/activity	Staff interviews/ behavior mapping
Animals-Visitors	Animal abuse	Behavior mapping/ staff interviews
	Visitor stay time	Timing
	Visitor affect	Behavior mapping
	Number of visitors present	Behavior mapping
	Animal activity/presence	Behavior mapping
	Ease of viewing	Behavior mapping/ questionnaire
	Enjoyment	Questionnaire
	Learning	Behavior mapping/ questionnaire

Table 20. Summary of research methods used to consider hypotheses.

Hypothesis	Research method
1. Viewing time at successive exhibits will decrease (fatigue effect)	Tracking
2. Total time at exhibits affected by group size	Tracking
3. Total time at exhibits affected by sign-reading	Tracking
4. More visitors at exhibits with more active animals	Behavior mapping
5. Animals more active in third-generation exhibits than in second-generation exhibits	Behavior mapping
6. Visitors stay longer at third-generation exhibits than at second-generation exhibits	Timing
7. More visitors at third-generation exhibits than at second-generation exhibits	Behavior mapping
8. Visitors like third-generation exhibits more than second-generation exhibits	Questionnaire
9. Less animal abuse at third-generation exhibits than at second-generation exhibits	Behavior mapping/ staff interviews
10. Animals harder for visitors to see at second-generation exhibits than at third-generation exhibits	Behavior mapping/ questionnaire

Table 20 (continued)

Hypothesis	Research method
11. Less animal illness in third-generation exhibits than at second-generation exhibits	Staff interviews
12. More naturalistic behavior in third-generation exhibits than at second-generation exhibits	Staff interviews
13. Third-generation exhibits more difficult to maintain than second-generation exhibits	Staff interviews

used in the present study. Table 19 provides a list of major relationships within the model of zoo functioning, aspects of those relationships which were examined, and the research methods used to examine them. Table 20 lists the 13 hypotheses made in the present study and the research methods used to examine them. Of those hypotheses, the first four relate to the POE of third-generation exhibits and the remaining nine concern the comparison of second- and third-generation exhibits.

Assessment of Third-Generation Exhibits from the Standpoint of the Three User Groups

The post-occupancy evaluation of the new exhibits provided information regarding the exhibits' functioning for the animals, staff, and visitors. This information served to identify aspects of the exhibits which worked well from the standpoint of each user group, as well as to suggest areas which could benefit from improvements. Further, an integration of the findings of the exhibits' appropriateness for each of the user groups considered the extent to which the exhibits suit the combined needs of all users.

Exhibit Functioning for Animals

Overall assessments of the animals' responses to the new environments were positive, with some areas of concern expressed by staff members. The health of the animals was considered good. The animals had adjusted to their new environments and some

breeding had occurred. For the most part, the animals' behavior was considered good, but interviewees were concerned about certain aspects of some of the primates' behavior (e.g., Pigmy chimpanzees, Bornean orangutans, and, to some extent, the Douc langurs). Staff members were concerned that these animals required more stimulation, and that some of their current behaviors were not typical of those observed in noncaptive environments. Plans were underway to modify some of the enclosures and change animal groupings to alleviate some of these concerns.

One major difficulty with the animals and their new facilities was the failure of certain exhibits to contain the animals. Difficulties with birds flying out of the flightcage, although not extensive, existed. The greatest containment difficulties existed with the chimpanzees, orangutans, and siamangs. At the time of the study, the siamang exhibits had been modified, minor modifications had been made to the orangutan and chimpanzee exhibits, and more substantial changes in the enclosures were planned. Containment is an important issue regarding all zoo enclosures, but it was particularly critical for these exhibits housing primates, whose intelligence and climbing and swinging abilities make them well-suited for escape.

Exhibit Functioning for Visitors

Visitor responses to the exhibits were positive overall. The results of several methods of data collection combined to reveal

a pattern of varying visitor preference for the exhibits. Certain exhibits were consistently high in visitor use, such as the number of people present and time spent at exhibits, as well as rated favorably by questionnaire respondents. Popular exhibit areas included the upper-viewing deck for Pigmy chimpanzees, the upper and lower Bornean orangutan viewing, the bridge, and the Rain Forest. The primates in these exhibits were especially entertaining for the public. The juvenile Pigmy chimpanzees generally were very active and often put on great displays of their climbing abilities in the tall trees. The orangutans delighted the public when they came to the lower viewing glass and sat directly in front of the glass; visitors often were four to five deep at this area. The siamangs' vocalization, which occurred several times a day, filled the bridge and upper-viewing decks with visitors. The large Rain Forest pleased visitors with its collection of colorful and exotic birds, as well as with the tropical environment in which it immersed visitors.

In contrast, certain exhibits were underutilized by visitors. The Douc langur/leaf monkey building was characterized by relatively few visitors, short viewing times, and little expressed preference by questionnaire respondents. Light relationships between the animals' and visitors' sides of the exhibit were poor, and the glare on the glass made viewing and photographing difficult. This problem combined with the fact that the Douc were

frequently not visible and were fairly tranquil compared to primates in adjacent exhibits, resulted in an underutilization of these exhibits by visitors. Similarly, the flightcage often received only a quick walkthrough by visitors. Visitors were frequently heard to comment that there were no birds in the enclosure. Factors which might have affected the time spent by visitors in the flightcage were the wide path cutting through the middle of the flightcage and the lack of benches for lingering, which many consider essential for the full enjoyment of a walk-through aviary.

Examination of the use of the Whittier area revealed that it stimulated a variety of visits. The area can be entered from a variety of locations and the sequence of viewing exhibits is dynamic with a variety of routes taken. Some visitors chose to spend long periods of time in one or two exhibits, while others spent shorter periods of time at most of the exhibits. The free-flowing relationships between exhibits, as opposed to exhibits positioned side-by-side along a trail, seemed to be effective, and, based on casual observation, seemed to work for both experienced and first-time visitors. The multiple levels and vantage points for the exhibits seemed very positive and well-used by the visitors. For example, when the siamangs began to hoot, visitors at the adjacent upper and lower viewing areas would turn, walk a few paces, and have a good view of the siamangs.

While the double-level viewing helped provide visitors with choices in a more dynamic space, it was found that most visitors did not go to both upper and lower vantage points at the same animal enclosure, often because animals were only visible from one level. The fact that the animals generally could not be viewed simultaneously from both levels affected the visitors' ability to see the animals in two ways. First, the upper deck is not easily accessible to handicapped visitors, so their viewing is limited to the lower-level viewing areas. This may mean that they are not able to see the animals at all during certain times. Second, if only one of the viewing areas provides a view of the animals, the viewing space available to visitors can be quite limited. Where the animals were visible revealed that they made different use of their enclosures. The Pigmy chimpanzees were more likely to be visible from the upper deck, and they often were observed in the trees or climbing structure. The orangutans, on the other hand, frequently were at the lower front of the exhibit by the glass. Since the exhibits were designed for Sumatran and Bornean orangutans and the Pigmy chimpanzees now have been moved to another exhibit, the design of these exhibits may improve visitors' views if the orangutans divide their time more evenly between the ground and canopy levels.

Other factors which influenced visitors' experiences during their visits were examined. Consistent patterns of decreases in

consecutive viewing times at successive exhibits viewed, the fatigue effect, were not found for visitors touring the Whittier area. Hypothesis 1, thus, was not supported. Rather, the time spent at successive exhibits viewed revealed a pattern of more time spent at popular exhibits and shorter visit times at the less popular exhibits. Previous studies in which decrements in time spent at successive exhibits were found, involved sequences of similar exhibits. This fatigue effect may not hold in areas, such as the Whittier exhibits, where a variety of birds and animals are interspersed and where visitors have more options as to the sequence in which they view exhibits. This corresponds with Robinson's (1928) concept of discontinuity, a change in pace of stimuli.

Examination of the amount of time visitors spent in the areas and its relationship to factors such as the size of the group visiting, the entrance selected, sex of visitors, and sign-reading, revealed no significant relationships. The hypothesized effects of group size and sign-reading on the length of a visitor's stay (hypotheses 2 and 3), therefore, were not supported. The data obtained in the study suggested a possible relationship between animal activity and the number of visitors present, however, the nature of the data did not allow this relationship to be tested statistically. Hypothesis 4 was not confirmed in the present study.

While the educational aspects of the visitor experience were not emphasized in this research, indications were that there was

room for improvement. Sign-reading was rarely observed and less than one-third of visitors interviewed remembered the area of the world represented by the Whittier exhibits. Staff members expressed concern for the impact of the graphics and presentation of educational materials.

Overall, the public liked the new exhibits and felt they were conducive to viewing the animals. Visitor comments about more naturalistic exhibitry were very positive.

Exhibit Functioning for Staff Members

Staff assessments of the Whittier exhibits referred to their liking for them, the exhibits' facilitation of staff members' performance of their jobs, and the process through which the exhibits were designed and constructed. Maintenance was a major issue with many comments about it generated in staff interviews. Day-to-day and long-term maintenance both were addressed. Daily maintenance did present difficulties to staff members in some areas. The biggest difficulty was the excessively complex wet moat and pool system, which required frequent, difficult-to-perform maintenance and repair. Another problem was keeping the glass clean in the primate exhibits. Maintenance of clean windows in the Douc langur/leaf monkey building was particularly difficult due to the large amounts of glass. The Bornean orangutan and Pigmy chimpanzee exhibits' glass was cleaned more quickly, but generated frustration due to the rate

at which it became dirty again. Orangutans also had damaged the glass by digging up rocks to scratch it with and by pulling filler out at the angled seams. The bedrooms for orangutans and chimpanzees also were considered difficult to clean, but the exterior animal display areas were cleaned in a different (but no more difficult) manner. Staff members were very concerned about keeping all areas in the zoo extremely clean, and were frustrated when they felt they could not do so.

Long-term maintenance also concerned staff members, and it related to the materials used in the exhibits. The extensive use of wood in the area raised the issues of shorter "life expectancies" for the wood exhibits than for concrete ones, the potential for fire, and increases in the need for routine painting, staining, and preventive maintenance (e.g., reseating nails that work loose). Wood and glass in the exhibits required modifications in daily maintenance (e.g., sweeping versus hosing; aiming sprinklers away from wood and glass). In contrast, the new flightcage was praised for the durability of the stainless steel mesh canopy, which was considered virtually maintenance-free for years to come.

The Whittier exhibits were seen as facilitating most other staff pursuits (e.g., animal handling, food preparation) quite well. Specific comments were made about how certain aspects could be modified in future exhibits. One interesting comment referred to designing exhibits that would facilitate research by staff members.

In order to observe animals in their enclosures, a vantage point, other than that used by visitors and one providing a good view of the enclosure, was desired.

Overall, staff members liked the new exhibits, saw them as a great improvement over what had been in the area, and liked the trend toward more natural materials and surfaces in the animal enclosures. Most controversial from an aesthetic viewpoint were the flightcage and the Douc langur/leaf monkey building. Interviewees were virtually equally divided between those who loved and those who hated the design of the flightcage. The view from the inside was appreciated by all, but the outside view was the source of controversy. The general consensus on the Douc langur/leaf monkey building was that it was too large scale and "built" for the area.

One topic involving staff members which proved to be very important was that of the design/construction process. Staff members had definite ideas about the type of involvement they wanted, and felt they should be allowed and encouraged to contribute the benefit of their experience to optimize exhibits. Even over a year after the exhibits opened, staff members were concerned with the design process, their involvement in it, and its effect on the functioning of the exhibits.

Integrated Assessment of Exhibit Functioning for All User Groups

The assessment of the third-generation exhibits from the standpoint of animals, visitors, and staff members revealed that the various exhibits had aspects which varied in the extent to which they were successful for each group of users. The POE also demonstrated that the zoo system was highly interactive in nature and that exhibit features that were beneficial for one user may be detrimental to another.

A striking feature of the POE and the examination of major issues in the model of zoo functioning was the interactive nature of the issues. A difficulty or benefit regarding one aspect of the zoo system affected other related aspects. For example, the difficulties with animals escaping from the enclosures had numerous ramifications. The animal escapes which occurred put the animals at risk and required intensive staff responses to capture the animals. An intelligent siamang, which had escaped from the islands, was sold to another zoo. Animal groupings were affected by the escape problem with male and female orangutans in separate enclosures and adult and juvenile chimpanzees separated. In the case of the chimpanzees, it was felt the separation would have detrimental effects on the socialization of the juvenile chimpanzees. In order to modify the exhibits to prevent escape, modifications to the enclosures were required and the animals were not displayed while the remodeling occurred. Promotion of the new exhibits was not optimal due to

the need to take animals out of the exhibits and close the exhibits for modifications. Similarly, incorrect grading during construction resulted in moats that were too deep, water being forced onto an underground wall which, in turn, leaked, loss of planting when the wall had to be resealed, and animals off exhibit (and unavailable to the visitors) while repairs were made.

Not only did events and environmental characteristics affect interrelated parts of the zoo system, the events or characteristics which were beneficial to one group of zoo users could be detrimental to another group. For example, the orangutan and chimpanzee displays provided the public with an exciting view of the animals. At the lower levels they were as close to wild animals as the width of a pane of glass. While this benefited visitors, the staff was faced with the increased burden of maintaining the glass that separated the animals and visitors. Also, some staff members felt that the type of behavior that this glassed viewing elicited in the animals was not beneficial to the animals. On the other hand, the Douc langur/leaf monkey building, for the most part, was considered conducive to animal care and management by staff members. Escape was not an issue, the environment was temperature- and humidity-controlled, and most maintenance, with the exception of the glass cleaning, was not difficult. For the viewing public, however, the exhibits presented great viewing difficulties and were underutilized.

A summary assessment of all the exhibits in the group of third-generation enclosures indicated some variation in the extent to which they were successful from the standpoint of all user groups. The renovated Rain Forest could be considered most successful overall. It was considered highly successful by all user groups and characterized by almost no reported problems. It had been an exhibit which functioned well in the past, and the renovation served to heighten its popularity. The open enclosures for primates (i.e., for siamangs, Bornean orangutans, and Pigmy chimpanzees) also were quite successful, but had been and were hampered by the issue of animal containment. Correction of this essential difficulty, which the staff was continuing to address, was the major factor which made these exhibits less than a total success. Two other concerns for these exhibits (i.e., the pool and moat system functioning and some undesirable animal behavior) also detracted from the optimal functioning of the exhibits. The staff was addressing the issue of animal behavior and modifications in the exhibits' design and animal management were planned to improve the situation. The issue of the complex and hard-to-maintain water system was one which probably will continue to be a difficulty unless major renovations are performed. While it represents a hardship to staff members and should serve as an example of a system to be avoided in the future, it is not a critical defect in the overall functioning of these exhibits. These exhibits have the potential to be highly successful, state-of-the-art primate enclosures.

The flightcage also was an innovative exhibit which was not achieving its full promise. Of greatest concern for the exhibit was the restricted use most visitors made of it. It is possible that a restructuring of visitor pathways could improve visitor use patterns. The wide paths cutting through the exhibit and the lack of turnouts or benches encouraged rapid visits. Again, fine-tuning of the exhibit could improve it to better serve all user groups.

The building for the Douc langurs and leaf monkeys was characterized by the most difficulties for a third-generation exhibit. The scale of the structure, the difficulties with light relationships, and maintenance problems were major factors which were detrimental to the user groups and to the success of the exhibits. The side which enclosed the Douc langurs was most problematic due to the lack of light and the behavior which the Doucs demonstrated in it (i.e., climbing to the top of the exhibit out of visitors' view). While modifications were planned to correct some of the difficulties, some could not presently be resolved in order to generate the naturalistic environment and animal behavior characteristic of third-generation exhibits. Further and more complex efforts will be required to optimize this exhibit.

Comparative Assessment of Second- and Third-Generation Exhibits from the Standpoint of the Three User Groups

The model of zoo functioning also was used as the basis for comparison of the second- and third-generation exhibits. Again,

exhibits were evaluated from the standpoint of each of the user groups and from an integrated viewpoint.

Animal Responses to Second- and Third-Generation Exhibits

Overall, it was felt that the move to the new exhibits had a positive effect on the animals. Staff members felt the Pigmy chimpanzees' and Bornean orangutans' health was improved in the new exhibits. The warmth of grass, wood, and trees was seen as facilitating the primates' health. While the potential for the spread of germs is greater on natural surfaces, it was felt the lessening of environmental stress in the new exhibits overcame this threat. The hard, cold cement in the grottos was seen as draining warmth and energy from the animals in cold weather and making them more susceptible to illness, while the new exhibits provided the warmth of natural surfaces. While hypothesis 11 was supported by opinion, documented evidence of fewer instances of animal illness in third-generation exhibits than in second-generation exhibits was not obtained.

Some staff members felt the animals displayed more naturalistic behavior in the new exhibits than the older exhibits, in support of hypothesis 12. Some of this behavior (e.g., tree-climbing) was stimulated by environmental elements. Some stereotyped behaviors which occurred in the older exhibits were not present in the new enclosures (e.g., slapping, drumming, and sliding on the cement),

but different equally troublesome behaviors were observed in the new exhibits (i.e., the chimpanzees' head-banging, rocking, and coprophagy; the orangutans sitting in the dirt and pressing their lips against the glass). While animal behavior was seen as more naturalistic in the new exhibits than in the old, it was still seen as open to improvement.

Animals in the new exhibits were not found to be significantly more active than the same species in the old exhibits. Hypothesis 5, therefore, was not supported by data collected on the behavior of the Pigmy chimpanzees and Bornean orangutans.

Visitor Responses to Second- and Third-Generation Exhibits

Consistent differences in visitor behavior at the old and new exhibits were not found. The fact that the new areas had two separate viewing areas and the old ones did not, made comparisons somewhat difficult. For time spent at the exhibits, only one comparison revealed significantly more time spent at the new exhibits (the upper-level viewing at the new exhibits was longer than at the old exhibit for orangutans), two were not significantly different, and the fourth revealed significantly more time spent at the older exhibits (the viewing times for chimpanzees were longer at the older exhibit than at the lower level in the new area). Consistent support for hypothesis 6, therefore, was not obtained. For those visitors who do go to both vantage points in the new areas, these comparisons may differ, but that could not be determined from these data.

Comparisons of the number of visitors present at the grotto exhibits and the upper- and the lower-level viewing in the new exhibits revealed that more visitors went to the new orangutan exhibits than the old one (using combined and adjusted upper- and lower-level totals). Significantly more visitors, however, were observed at the old exhibits for the Pigmy chimpanzees than at the new exhibits. Support for hypothesis 7 was mixed and did not enable a conclusion that more people were present at third-generation exhibits than at second-generation exhibits.

Dramatic differences between visitors abuse at the two areas were not found to support hypothesis 9. Based on observations and staff perceptions, both physical and verbal abuse were very infrequent in the two areas.

Attitudinal differences on the part of visitors toward the new exhibits were found. A sample of visitors expressed greater liking for the new exhibits over the old exhibits for chimpanzees and orangutans, supporting hypothesis 8. Their comparisons of the areas revealed they liked the new areas for features such as their beauty, openness, variety, and closeness to the animals. Combined with this was the visitor perception that the animals were not harder for them to see in the new exhibits, supporting hypothesis 10.

Staff Responses to Second- and Third-Generation Exhibits

In the comparison of old and new exhibits, staff members did feel the new exhibits were more difficult to maintain. In some

cases, these difficulties related directly to the natural vegetation used in the new exhibits. Trees and plants were difficult to keep alive in the primate enclosures. The cleaning of the animal display areas was not seen as particularly difficult in the new areas. Staff members merely raked rather than hosed out the enclosures. The greatest difficulties with maintenance in the new areas were with the wet moat system, the wood, and the glass. While many maintenance challenges were not related to exhibit naturalism, the involved staff members felt that positive benefits to the animals of naturalistic elements well outweighed increased maintenance on their part.

Integrated Assessment of Second- and Third-Generation Exhibits for All User Groups

In sum, there were not consistent clear-cut differences between animal and visitor behavior observed at the second- and third-generation exhibits. Attitudes toward the two types of exhibits, however, differed both for staff members and visitors. It was a shared belief on the part of staff members and visitors that such third-generation exhibits were beneficial to animal and visitor behavior and visitor attitudes. While staff members saw room for improvement in the new exhibits, they felt the enclosures were superior to the older ones for all groups. Visitors enjoyed going to the older exhibits, but when asked to choose, most of them preferred the new exhibits. Visitors also commented that the exhibits

were better for the animals. Clearly, the appearance of the new exhibits was considered superior to the old by both staff and visitors. In sum, while the new exhibits were not considered perfect, they were seen as a great improvement over the second-generation exhibits and a good beginning effort in the development of third-generation exhibits.

Applied and Theoretical Implications of the Study

The results of the POE and comparison of second- and third-generation exhibits have implications for the design and management of zoos, as well as for the study of zoo environments. The implications for designing and running zoos will be discussed first. A discussion of the significance of the findings in relationship to research in zoo environments will follow.

Implications for Zoo Design and Management

The POE of the Whittier areas and comparison of second- and third-generation exhibits raised several major issues which relate to the design and management of third-generation zoo enclosures. First, the design of third-generation exhibits in a city zoo with space restrictions is not an easy task. One goal of these exhibits is to provide an environment for animals which contains features of their environment in the wild. In a restricted space, it is difficult to provide animals with the natural vegetation they need. The wear

and tear to which animals subject the environment is intensified in the restricted space of a zoo enclosure. Trees, plants, and grass often do not survive due to the concentrated pressure placed on them by the animals.

Another aim of the third-generation exhibits is to allow visitors a view of animals against the backdrop of an environment similar to their natural habitat. Efforts to provide views into naturalistic areas without the distraction of other people or structures are difficult in small spaces, and such difficulties as cross-viewing or very limited viewing space can be the result.

By naturalizing zoo exhibits, traditional barriers such as cages and visible dry moats are replaced with softer and/or less viable separations between animals and people. People and animal spaces are less likely to be sharply separated, and usually interlace with one another. This change in the separation of visitors and animals can lead to difficulties in keeping each in its appropriate place. In the Whittier areas, not only did animals climb or jump out into visitor spaces, but visitors climbed into planters and out onto walls surrounding the animals. Separation of visitors and animals can be more challenging in naturalistic exhibits, and merits special attention.

One design element used to create a more dynamic visitor experience in the exhibits which were assessed in this study were double-level viewing areas for visitors. It was found that such

viewing involved an interaction between the visitor, animals, and environment with visitors often able only to use one or the other vantage point. This suggests the need to carefully consider animal and visitor use of such types of viewing (e.g., the amount of visitor access at one level, wheelchair access to exhibits, and the advisability of having more stable exhibits to complement each of the levels).

Third-generation exhibits are characterized by the use of vegetation typical of that found in the animals' home range. Innovative enclosure designs, such as those of the Whittier area, often use materials such as glass and wood to complement the natural vegetation and to help provide dynamic views for the visitor. Both the natural vegetation and the more challenging structural materials require more and different types of maintenance by the zoo staff. Cement grottos which lasted several decades with very little maintenance are being replaced by exhibits with shorter "life expectancies." This increases present exhibit maintenance, as well as altering the scheduling of renovation and long-term maintenance over the course of years.

The newness and complexity of third-generation exhibits suggest the need for the expertise of many people in the design and management of such exhibits. First, the opportunity for staff members to provide input to the design of new exhibits can prove beneficial to the design and help optimize staff attitudes toward the

exhibits and their development, as well as potentially reduce maintenance difficulties. Such involvement on the part of the staff will require a structured rather than casual effort to solicit staff participation, as well as the presentation of proposed designs in a manner which is understandable to staff members not trained in the design professions. Consultants for specific aspects of design may justify increased development costs to help avoid difficulties and optimize designs.

Finally, many factors go into making third-generation exhibits. The goals established for this new generation of exhibits are not achieved by simply providing grass and trees for the enclosed animals. Stimulation of naturalistic animal behavior involves such factors as the animals' past experiences, the combination or grouping of animals, and the type of and availability of fixed and removable objects in the environment. This suggests that an exhibit which facilitates naturalistic behavior cannot merely be built, but must be achieved through a combination of design and ongoing management. While new exhibits have characteristics and goals which distinguish them as representing a new generation of exhibits, they are at an early stage of development. Experimentation, assessment, and continuing refinement will be required to meet the goals of these new exhibits.

Implications for the Study of Zoos

While the design and management of zoo exhibits which optimize the visitor, staff, and animal experiences is challenging,

the assessment of such exhibits also provides a challenge to the researcher. The present study raised several issues relevant to research in zoos.

The model of zoo functioning proved useful in performing a POE and in comparing and contrasting two environments. The specification of the zoo's physical environment as a major component of the system was particularly helpful in identifying issues relevant to the physical environment's facilitation of zoo system functioning and to the redesign of zoos as a response to pressures from the external environment. The use of such a model of zoo functioning in studies such as the present one can lead to additional development of it as a research tool. For example, the issue of animal containment was found to be an important one and should be added to the model (see Figure 22). Such a framework for the evaluation of zoo environments can provide a useful mechanism for structuring research. Further, similar open system models may be developed for use in assessing other complex environmental systems and provide a framework within which to perform post-occupancy evaluations.

While certain aspects of the model of zoo functioning are meaningful areas of evaluation, methods for measuring them may not be currently available. For example, the measurement of visitor affect and gross motor behaviors through observational methods proved unsatisfactory in the present study. The complexity of dynamic environmental situations is not conducive to measurement

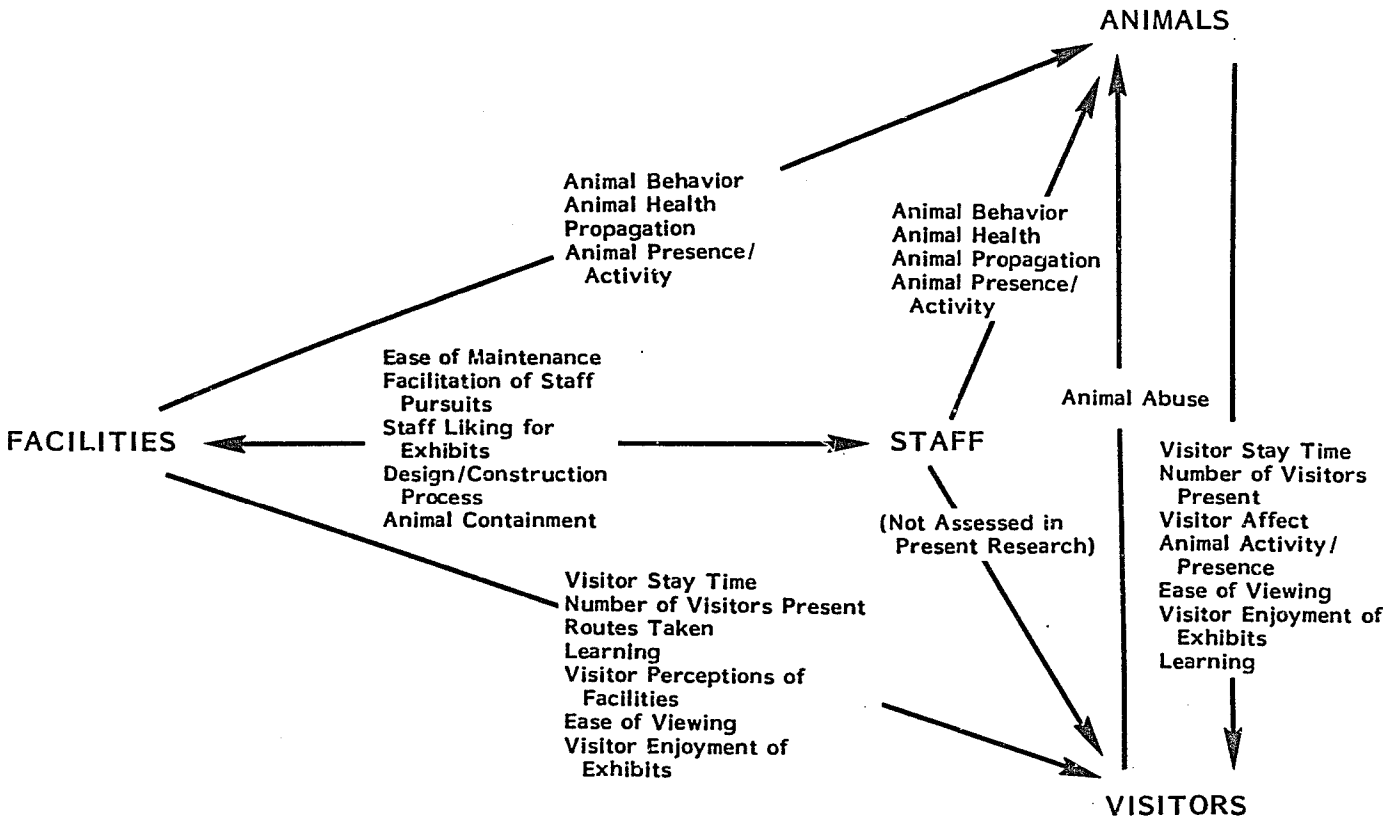


Figure 22. Modified model of key areas for investigation of interrelationships within the zoo system.

of such aspects with many research tools and approaches that are developed to date, and successful measurement of those aspects will require further consideration and development.

One of the goals of third-generation exhibits is an increase in naturalistic behavior on the part of the animals. In the present study such an increase was not clearly demonstrated. More sophisticated methods of assessing animal behavior may more clearly identify these differences. Staff perceptions of animal behavior, however, may indicate such distinctions will not always be clear-cut. While changes in behavior have been documented in the past when animals were moved to more naturalistic enclosures, differences in behavior may not be as dramatic when the move is from a second-generation exhibit to a third-generation exhibit as it is when the move is from a first-generation cage to a third-generation enclosure. Also, the changes in behavior may require the passage of time to overcome the effects of past experiences, or may not be seen until future generations of animals are allowed to grow up in the new areas. When presented with new, naturalistic enclosures, animals have been known to refuse to enter them because the old cement enclosures were secure to them. Changes in animal responses to environments may take time.

Another goal of third-generation exhibits is to provide visitors with a greater understanding of and respect for the animals. For the average amount of time visitors spend at exhibits, they may

not be able to perceive changes in animal behavior during one or two exposures. Recorded cases of improved animal behavior in third-generation exhibits involved trained animal observers, and the general public may not be able to make as fine a discrimination as those observers. For the visitor to perceive changes in the type of behavior animals display, repeated experiences and effective educational support probably will be needed.

With a greater public awareness of animal behavior in third-generation exhibits may come changes in visitors' behavior at those exhibits. Behavioral differences at second- and third-generation exhibits on the part of visitors, however, may not be as critical to achieving the goals of third-generation exhibits as attitudinal differences. Differences in the impact of these two generations of exhibits may be more refined than such things as different rates of animal abuse. The present study revealed that abuse rates were low at both types of enclosures. Similarly, the assumption that visitors who spend more time at exhibits will learn more and gain more respect for the animals may not be supported. The important differences may be qualitative rather than quantitative with the experience at the exhibit more important than the length of time spent at that exhibit. Attitudinal differences toward second- and third-generation exhibits on the part of visitors, as well as staff in the present study, were encouraging in that there was an expressed preference for the third-generation exhibits and feeling

that they were better for the animals. Differences in visitor attitudes toward animals in the two types of exhibits (e.g., increased respect for animals in third-generation exhibits) may be stimulated without accompanying differences in certain visitor behaviors. Further clarification of different visitor responses to the exhibits and their measurement is indicated.

Implications for Future Research

While the present research suggested many possibilities for future studies, a few deserve special mention. The interactive effect of animal behavior and visitor behavior promises to be an interesting area for investigation. Crowds have been shown to stimulate animal activity and visitors are attracted to active animals. First, the concurrent mapping of visitor and animal behavior would provide detailed information for understanding this relationship. The emphasis in the current study was on visitor behavior, with a general description of animal activity, but in the future, detailed information about visitors and animals could be obtained by simultaneous measurement by more than one person or instrument (e.g., video recorder). Second, the effect of animal activity on an individual's visit to a series of exhibits and its relative impact compared to other factors, such as fatigue and crowding, would be of interest.

Due to the fact that the zoo staff has been the subject of little research in the past, there are many opportunities to examine

the staff members as integral parts of the zoo system. The present study relied on semistructured interviews to gather information, but the development of structured instruments to assess staff concerns warrants attention.

Continuing assessment of zoo environments and their functioning can provide useful information for the design and management of zoos. Contemporary zoo designers have as their goals the creation of environments which will improve the zoo experience for animals, staff, and visitors. By considering the impact zoo environments have on these user groups, an understanding of environmental factors which contribute to the desired outcomes may be obtained. With extensive resources put into the development of a new generation of zoo environments and a growing reliance on zoos as the last home for many animals whose habitats have disappeared, such research can be a valuable asset in optimizing such an important contemporary environment.

APPENDIX A

PHOTOGRAPHS OF SECOND- AND THIRD-GENERATION EXHIBITS CONSIDERED IN THE PRESENT RESEARCH

Bornean orangutan exhibit at the Great Ape Grottos.

Visitor viewing area at Bornean orangutan exhibit.

Pigmy chimpanzee exhibit at the Great Ape Grottos.

Adult Pigmy chimpanzee in Great Ape Grottos.

Whittier Southeast Asian exhibits (left).

Siamang island (below).

Staircase entrance by siamang overlook (to left).

Overview of Flightcage (left) and Rain Forest (right).

Concave-casqued hornbill in Flightcage (left).

Exterior of Flightcage (below).

Interior of Rain Forest (above).

Bridge between siamang islands (left).

Upper viewing decks for Pigmy chimpanzees.

View into orangutan enclosure from upper viewing deck.

Bornean orangutan on climbing structure (left).

View into orangutan enclosure from lower level (below).

Visitor observing orangutan at lower level.

Exterior of Douc langur/Francois' leaf monkey building.

Douc langur (right) and Francois' leaf monkey (left) exhibits.

Siamang on climbing structure.

APPENDIX B

SUMMARY INFORMATION REGARDING RESEARCH SUBJECTS

Behavior Mapping

Sex and Role of People Observed During Behavior Mapping

Site	Visitors			Staff		Experimenter		
	Male	Female	Child	Male	Female	Male	Female	Missing
GAG Orang								
N	139	161	60	0	0	0	0	363
%	19%	22%	8%	0%	0%	0%	0%	50%
GAG Pigmies								
N	131	138	43	5	0	6	0	901
%	11%	11%	4%	4%	0%	.5%	0%	74%
Flightcage - South								
N	108	109	46	5	7	0	0	72
%	31%	31%	13%	1%	2%	0%	0%	21%
Flightcage - North								
N	78	80	42	1	0	0	0	19
%	36%	36%	19%	.5%	0%	0%	0%	9%
WSEA Lower Orang								
N	107	123	64	2	0	0	0	237
%	18%	21%	11%	.3%	0%	0%	0%	49%
WSEA Lower Pigmy								
N	106	125	79	0	0	0	0	137
%	24%	28%	18%	0%	0%	0%	0%	31%

Sex and Role of People Observed During Behavior Mapping (continued)

Site	Visitors			Staff		Experimenter		
	Male	Female	Child	Male	Female	Male	Female	Missing
WSEA Leaf Monkey								
N	87	80	55	3	1	0	0	59
%	31%	28%	19%	1%	.4%	0%	0%	21%
WSEA Douc Langur								
N	61	78	35	3	1	0	0	27
%	30%	38%	17%	2%	.5%	0%	0%	13%
WSEA Upper Pigmy								
N	193	86	56	0	0	0	0	563
%	21%	10%	6%	0%	0%	0%	0%	63%
WSEA Upper Orang								
N	134	128	49	3	0	0	0	270
%	23%	22%	8%	.5%	0%	0%	0%	46%
WSEA Bridge								
N	189	189	82	1	1	0	0	265
%	26%	26%	11%	.1%	.1%	0%	0%	37%

Timing

Sex of Subject

Sex	Frequency	Percentage
Male	232	46.8
Female	251	50.6
Missing	13	2.6
	496	100.0

Estimated Age of Subject

Estimated age in years	Frequency	Percentage
1-10	33	6.7
11-20	42	8.5
21-30	155	31.3
31-40	98	19.8
41-50	49	9.9
51-60	76	15.3
61-70	16	3.6
Missing	25	5.0
	496	100.0

Tracking

Sex of Subject

Sex	Frequency	Percentage	Children Present		
			Children (N)	Frequency	Percentage
Male	16	94.0	0	17	68.0
Female	9	36.0	1	2	8.0
	25	100.0	2	5	20.0
			3	1	4.0
				25	100.0

Estimated Age of Subject

Estimated age in years	Frequency	Percentage
1-10	0	0.0
11-20	3	12.0
21-30	7	28.0
31-40	5	20.0
41-50	1	4.0
51-60	2	8.0
61-70	4	16.0
Missing	3	12.0
	25	100.0

Tracking (continued)

Size of Group

Group size	Frequency	Percentage
1	4	16.0
2	7	28.0
3	5	20.0
4	5	20.0
5	1	4.0
6 or more	1	4.0
Missing	2	8.0
	25	100.0

Strollers/Wheelchairs Present

	Frequency	Percentage
Strollers	3	12.0
Wheelchairs	1	4.0
None	21	84.0
	25	100.0

APPENDIX C

BEHAVIOR MAPPING FORM

Day: M T W T F S S Time: _____ Weather: _____

Date: _____ Location: _____

	Visitors	Staff	
Male			Wheelchairs
Female			Strollers
Children			Maint. carts
			On benches

Standing	Squatting	Jumping
Sitting	Riding/Carried	
Walking	Running	

Photographing	Talking-animals	Gesturing-animals
Reading	Talking-others	Touching-exh./anim.
Eating/Drinking	Child tending	Laughing
Crying	Yelling	Smiling

Animal activity:

Day: M T W T F S S Time: _____ Weather: _____

Date: _____ Location: _____

	Visitors	Staff	
Male			Wheelchairs
Female			Strollers
Children			Maint. carts
			On benches

Standing	Squatting	Jumping
Sitting	Riding/Carried	
Walking	Running	

Photographing	Talking-animals	Gesturing-animals
Reading	Talking-others	Touching-exh./anim.
Eating/Drinking	Child tending	Laughing
Crying	Yelling	Smiling

Animal activity:

APPENDIX D

VISITOR QUESTIONNAIRE

Date:_____ Sex of Respondent: M F

Day of Week: M T W T F S S Group Size:_____

Time:_____ Weather:_____

Comments:_____

How many times have you been to the San Diego Zoo in the past 12 months?_____

Where do you live?_____

Did you visit Bird and Primate Mesa today? Y N

(If "No") Have you visited Bird and Primate Mesa in the past 12 months? Y N

Did you go to the new Heart of the Zoo exhibits in the past 12 months? Y N

(If "No") Have you gone to the new Heart of the Zoo exhibits in the past 12 months? Y N

Do you remember what part of the world the new Heart of the Zoo exhibits represent?

Did you read most of the signs in the Southeast Asia exhibit? Y N

Do you think enough information was presented on signs in this exhibit? Y N

What did you like best about the Southeast Asian exhibit?_____

_____

Was there anything about the Southeast Asian exhibit that you didn't like?_____

How easy was it for you to see the orangutans and pigmy chimps in the Southeast Asian exhibit? (Visitors will be shown photo of exhibit for the purpose of memory prompt and shown a copy of the following scale):

1. very difficult
2. difficult
3. neither difficult nor easy
4. easy
5. very easy

To what extent did you like the Southeast Asian orangutan and pigmy chimp exhibits? (Visitors will be shown copy of the following scale):

1. not at all
2. to a small extent
3. to a moderate extent
4. to a great extent
5. to a very great extent

Did you visit the primates in the grotto area today? Y N
(Visitors will be shown photos of the area for the purpose of memory prompt.)

(If "No") Have you visited the primates in the grotto area in the past 12 months? Y N

What did you like best about the grotto primate exhibits?_____

_____

Was there anything about the grotto primate exhibits that you didn't like?_____

_____

How easy was it for you to see the orangutans and pigmy chimps in the grotto area? (Visitors will be shown a photo of the exhibit for the purpose of memory prompt, and shown a copy of the following scale):

1. very difficult
2. difficult
3. neither difficult nor easy
4. easy
5. very easy

To what extent did you like the orangutan and pigmy chimp exhibits in the grotto area? (Visitors will be shown a copy of the following scale):

1. not at all
2. to a small extent
3. to a moderate extent
4. to a great extent
5. to a very great extent

If you had to choose, would you rather see primates in an area like the Southeast Asian exhibit or the grotto area?_____
Why?_____

Did you go to the new flightcage in the Heart of the Zoo today? Y N
(Show photo.)

(If "No") Have you gone to the new flightcage in the past 12 months? Y N

Did you go to the Rain Forest walk-through flightcage today? Y N
(Show photo.)

(If "No") Have you gone to the Rain Forest walk-through flightcage in the past 12 months? Y N

Did you like one of the bird exhibits (that is the new flightcage or the Rain Forest) better than the other one? Y N
Why?_____

Note: Visitors will be asked if they would be willing to answer a few questions about their visit. If they ask, they will be told that the interview takes approximately 5-7 minutes. Photographs of certain exhibits will be used to make sure they know which exhibits they are being asked to rate. They will be asked to rate the exhibits and not the particular photograph of the exhibit. When they are asked to provide a scale rating, a hard copy of the scaled responses will be shown to them so they can provide a number or word response. The interviewer will read all the questions and mark the respondent's answers on her copy. At the point where the respondent completes the questionnaire or responds that he/she has not seen a particular exhibit that day or previously, the interviewer will thank him/her for his/her participation.

APPENDIX E

ANIMAL ACTIVITY AND NUMBER OF VISITORS PRESENT FOR SECOND- AND THIRD-GENERATION EXHIBITS

Second-Generation Exhibits

Bornean Orangutan

Number of visitors present	Animal Activity: Not present/ not visible	Asleep	Present and moderately active	Very active	Row total
0	1	0	2	2	5 8.8
1-10	1	2	14	5	22 38.6
11-20	1	4	14	4	23 40.4
21-30	0	0	3	1	4 7.0
31-40	0	0	1	1	2 3.5
41-50	0	0	1	0	1 1.8
Column total	3 5.3	6 10.5	35 61.4	13 22.8	57 100.0

Pigmy Chimpanzee

Number of visitors present	Animal Activity: Not present / not visible	Present and moderately active: Asleep	Present and moderately active	Very active	Row total
0	11	0	1	0	12 20.7
1-10	5	0	7	1	13 22.4
11-20	0	0	11	0	11 19.0
21-30	0	0	9	1	10 17.2
31-40	0	0	3	1	4 6.9
41-50	0	0	3	0	3 5.2
51-60	0	0	0	0	0 0.0
61-70	0	0	1	0	1 1.7
71-80	0	0	0	2	2 3.4
81-90	0	0	1	1	2 3.4
Column total	16 27.6	0 0.0	36 62.1	6 10.3	58 100.0

Third-Generation Exhibits

Bornean Orangutan (Lower Level)

Number of visitors present	Animal Activity: Not present/ not visible	Present and moderately active: Asleep	Present and moderately active	Very active	Row total
	10	0	4	1	15 25.0
1-10	2	0	19	1	22 36.7
11-20	1	0	10	6	17 28.3
21-30	0	0	2	0	2 3.3
31-40	0	0	4	0	4 6.7
Column total	13 21.7	0 0.0	39 65.0	8 13.3	60 100.0

Bornean Orangutan (Upper Level)

Number of visitors present	Animal Activity: Not present/ not visible	Asleep	Present and moderately active	Very active	Row total
0	6	0	3	0	9
1-10	8	0	10	4	22
11-20	0	0	7	4	11
21-30	0	0	3	3	6
Column total	14 29.2	0 0	23 47.9	11 22.9	48 100.0

Pirmy Chimpanzee (Lower Level)

Number of visitors present	Animal Activity: Not present/ not visible	Asleep	Present and moderately active	Very active	Row total
0	13	0	2	1	16 29.1
1-10	5	0	17	4	26 47.3
11-20	1	0	5	5	11 20.0
21-30	1	0	0	0	1 1.8
31-40	0	0	0	0	0 0.0
41-50	0	0	0	0	0 0.0
51-60	0	0	0	1	1 1.8
Column total	19 34.5	0 0.0	25 45.5	11 20.0	55 100.0

Pigmy Chimpanzee (Upper Level)

Number of visitors present	Animal Activity: Not present / not visible	Asleep	Present and moderately active	Very active	Row total
0	5	0	1	6	6
1-10	4	0	11	1	16
11-20	0	0	7	6	13
21-30	0	0	5	3	8
31-40	0	0	1	3	4
41-50	0	0	0	0	0
51-60	0	0	0	0	0
61-70	0	0	0	1	1
Column total	9 18.8	0 0.0	25 25.1	14 29.2	47 100.0

Francois' Leaf Monkeys

Number of visitors present	Animal Activity: Not present/ not visible	Asleep	Present and moderately active	Very active	Row total
0	4	0	7	0	11 21.2
1-10	4	0	27	5	36 69.2
11-20	0	0	2	1	3 5.8
21-30	0	0	2	0	2 3.8
Column total	8 15.4	0 0.0	38 73.1	6 11.5	52 100.0

Douc Langurs

Number of visitors present	Animal Activity: Not present/ not visible	Asleep	Present and moderately active	Very active	Row total
0	7	0	7	1	15
1-10	14	0	17	4	35
11-20	1	0	2	0	3
Column total	22 41.5	0 0.0	26 49.1	5 9.4	53 100.0

APPENDIX F

SUMMARY OF RESPONSES TO VISITOR QUESTIONNAIRE

Sex of Respondents

Male	45	47.9%
Female	44	46.8%
Missing	5	5.3%
Total	94	100.0%

Size of Group

1	7	7.4%
2	50	53.2%
3	14	14.9%
4	16	17.0%
5	1	1.1%
6 or more	1	1.1%
Missing	5	5.3%
Total	94	100.0%

Weather During Visit

Warm, sunny	92	97.9%
Cold, drizzle	2	2.1%
Total	94	100.0%

Number of Visits to the Zoo in Past 12 Months

1	63	67.0%
2	10	10.6%
3	4	4.3%
4	2	2.1%
5	4	4.3%
6 or more	10	10.6%
Missing	1	1.1%
Total	94	100.0%

Home Residence of Visitor

San Diego County	26	27.7%
California	15	16.0%
Arizona	10	10.6%
Canada	5	5.4%
Florida	4	4.3%
Oregon	3	3.2%
Illinois	2	2.1%
Minnesota	2	2.1%
New Mexico	2	2.1%
New York	2	2.1%
Texas	2	2.1%
Washington	2	2.1%
Wisconsin	2	2.1%
Alabama	1	1.1%
Australia	1	1.1%
Germany	1	1.1%
Iowa	1	1.1%
Kansas	1	1.1%
Lebanon	1	1.1%
Massachusetts	1	1.1%
Mexico	1	1.1%
Michigan	1	1.1%
Mississippi	1	1.1%
Nevada	1	1.1%
New Jersey	1	1.1%
North Carolina	1	1.1%
Ohio	1	1.1%
Rhode Island	1	1.1%
Vermont	1	1.1%
Washington, D.C.	1	1.1%
Total	94	100.0%

Membership Status of Visitor

Member	24	25.5%
Nonmember	56	59.6%
Missing	14	14.9%
Total	94	100.0%

Visited Bird and Primate Mesa Today		
Yes	87	92.6%
No	7	7.4%
Total	94	100.0%

Visited Bird and Primate Mesa in Past 12 Months (If "No" to above)		
Yes	7	7.4%
Missing	87	92.6%
Total	94	100.0%

Visited Whittier Exhibits Today		
Yes	82	87.2%
No	12	12.8%
Total	94	100.0%

Visited Whittier Exhibits in Past 12 Months (If "No" to above)		
Yes	12	12.8%
Missing	82	87.2%
Total	94	100.0%

Part of the World Represented in the Whittier Exhibits		
Don't remember	44	46.8%
Asia	17	18.1%
Africa	15	16.0%
Southeast Asia	10	10.6%
South America	2	2.1%
East Africa	1	1.1%
Sumatra	1	1.1%
Missing	4	4.3%
Total	94	100.0%

Read Most of Signs at Whittier Exhibits		
Yes	45	47.9%
No	43	45.7%
Some	5	5.3%
Missing	1	1.1%
Total	94	100.0%

Enough Information Presented on Signs		
Yes	76	80.9%
No	12	12.8%
Missing	6	6.4%
Total	94	100.0%

Liked Best About Whittier Exhibits		
Beauty/setting/layout	23	20.5%
Monkeys	9	8.0%
Whole area	7	6.3%
Openness	6	5.4%
Birds	5	4.5%
Siamangs	5	4.7%
Animals not caged	4	3.6%
Exotic animals	4	3.6%
Closeness	4	3.6%
Pigmies	4	3.6%
Cats/lions/tigers[a]	3	2.7%
Variety of animals	3	2.7%
Orangutans	3	2.7%
Elephant[a]	3	2.7%
Double viewing	3	2.7%
No response	2	1.8%
Active monkeys	2	1.8%
Glass	2	1.8%
Everything	1	.9%
Being among them	1	.9%
Easy to photograph	1	.9%
Snakes[a]	1	.9%
Easy to see	1	.9%
Architecture	1	.9%
Log play structure	1	.9%
Parrots/peacocks[a]	1	.9%
Relaxed	1	.9%
Gorilla[a]	1	.9%

Liked Best About Whittier Exhibits (cont'd)

Monkeys resembling man	1	.9%
Freedom for animals	1	.9%
Unusual plants	1	.9%
Climbing	1	.9%
Safe	1	.9%
New aviary	1	.9%
Accessible	1	.9%
No cages	1	.9%
Open air	1	.9%
Woodwork	1	.9%
Total	112	100.0%[b]

[a]Not in Whittier area.

[b]Each respondent could provide more than one answer.

Did Not Like About Whittier Exhibits

Nothing	62	75.6%
Cages empty	2	1.8%
Hard to see	2	2.4%
Upper level	1	.9%
Animals encaged	1	.9%
Can't pet animals	1	.9%
Too many to focus attention	1	.9%
Fences too high for strollers	1	.9%
Cost too much	1	.9%
Too many people	1	.9%
Not enough of it	1	.9%
Confusing/hard to orient	1	.9%
Glass view too small and crowded	1	.9%
Have to walk uphill	1	.9%
Glare	1	.9%
Glass angle	1	.9%
Sitting on planter to see	1	.9%
Hard to find in zoo	1	.9%
Crowded	1	.9%
Total	82	100.0%[a]

[a]Each respondent could provide more than one answer.

Ease of Seeing Orangutans and Pigmy Chimpanzees at Whittier Exhibits

Very difficult	1	1.1%
Difficult	6	6.4%
Neither difficult nor easy	10	10.6%
Easy	32	34.0%
Very easy	41	43.6%
Missing	4	4.3%
Total	94	100.0%

Extent of Liking for Whittier Orangutan and Pigmy Chimpanzee Exhibits

Not at all	0	0.0%
To a small extent	2	2.1%
To a moderate extent	16	17.0%
To a great extent	40	42.6%
To a very great extent	34	36.2%
Missing	2	2.1%
Total	94	100.0%

Visited Great Ape Grottos Today

Yes	66	70.2%
No	23	24.5%
Missing	5	5.3%
Total	94	100.0%

Visited Great Ape Grottos in Past 12 Months
(If "No" to above)

Yes	18	19.2%
Missing	76	80.9%
Total	94	100.0%

Liked Best About Grotto Orangutan and Pigmy Chimpanzee Exhibits

No response	21	22.6%
Easy to see	13	14.0%
Animal activity/movement	10	10.8%
Openness	7	7.5%
Watching them play (Pigmies)	4	4.3%
Display/setting	4	4.3%
Space for animals to roam	4	4.3%

Liked Best About Grotto Orangutan and Pigmy Chimpanzee Exhibits (cont'd)

Behavior of animals	3	3.2%
Orangutans	3	3.2%
Natural setting	3	3.2%
Nothing	2	2.2%
Human characteristics	2	2.2%
Levels of viewing	2	2.2%
Animals seem happy	2	2.2%
Easy to find	1	1.1%
Freedom of movement	1	1.1%
Doesn't look artificial	1	1.1%
More animals together	1	1.1%
Remind one of man's origin	1	1.1%
Feeding time	1	1.1%
Lovely environment for animals	1	1.1%
Learning about them	1	1.1%
Get through quickly	1	1.1%
Large	1	1.1%
Plain	1	1.1%
Animals	1	1.1%
Cleanliness	1	1.1%
Total	93	100.0%[a]

[a]Each respondent could provide more than one answer.

Did Not Like About Grotto Orangutan and Pigmy Chimpanzee Exhibits

Nothing	33	35.5%
No response	20	21.5%
Lack of activity/animals asleep	8	8.6%
Hard to see/no good view	4	4.3%
Crowded	4	4.3%
Cement	3	3.2%
Not enough animals	2	2.2%
Lack of trees, grass	2	2.2%
Boring for us and them	1	1.1%
No activities for animals	1	1.1%
Phoenix zoo is nicer	1	1.1%
Not enough orangutans	1	1.1%
Caged-in look	1	1.1%
Crowded, inactive gorillas	1	1.1%
People dropping things from Skyfari	1	1.1%

Did Not Like About Grotto Orangutan and Pigmy Chimpanzee Exhibits (cont'd)

Vomiting gorillas	1	1.1%
Can't get close	1	1.1%
Exhibit closed	1	1.1%
Lack of privacy	1	1.1%
Too far away/inconvenient	1	1.1%
Dull	1	1.1%
Animals look bored	1	1.1%
Empty	1	1.1%
Smell	1	1.1%
Desolate, sparse	1	1.1%
Total	93	100.0%[a]

[a]Each respondent could provide more than one answer.

Ease of Seeing Orangutans and Pigmy Chimpanzees at Grotto Exhibits

Very difficult	1	1.1%
Difficult	6	6.4%
Neither difficult nor easy	8	8.5%
Easy	28	29.8%
Very easy	33	35.1%
Missing	18	19.1%
Total	94	100.0%

Extent of Liking for Grotto Orangutan and Pigmy Chimpanzee Exhibits

Not at all	0	0.0%
To a small extent	3	3.2%
To a moderate extent	29	30.9%
To a great extent	24	25.5%
To a very great extent	19	20.2%
Missing	19	20.2%
Total	94	100.0%

If Had to Choose, Visitor Choice of Exhibit		
Whittier exhibits	50	53.2%
Grotto exhibits	17	18.1%
Both	2	2.1%
No choice	3	3.2%
Missing	22	23.4%
Total	94	100.0%

Visited Flightcage Today		
Yes	45	47.9%
No	36	38.3%
Missing	13	13.8%
Total	94	100.0%

Visited Flightcage in Past 12 Months (If "No" to above)		
Yes	6	6.4%
No	22	23.4%
Missing	66	70.4%
Total	94	100.0%

Visited Rain Forest Today		
Yes	53	56.4%
No	25	26.6%
Missing	16	17.0%
Total	94	100.0%

Visited Rain Forest in Past 12 Months (If "No" to above)		
Yes	4	4.3%
No	16	17.0%
Missing	74	78.7%
Total	94	100.0%

Preference for Flightcage or Rain Forest

Rain Forest	33	35.1%
Both	12	12.8%
No preference	9	9.6%
Flightcage	1	1.1%
Missing	39	41.5%
Total	94	100.0%

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