ZOO EXHIBIT DESIGN:  
THE INFLUENCE OF ANIMAL VISIBILITY ON VISITOR EXPERIENCE

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(ABSTRACT)

Naturalistic exhibits have become popular among zoo designers as well as zoo visitors. However, one problem associated with naturalistic exhibits is that many times visitors cannot see the animals.

The primary purpose of this study was to examine the effect of this lack of visibility on visitor experience. Other goals of this study were 1) to theorize the relationship between visitor experience and exhibit design, 2) to present the implications of this study on current practices in zoo exhibit design, and 3) to provide a series of design recommendations which will enhance current design practices.

The results of this study suggest that there is a significant relationship between animal visibility and visitor experience. Most importantly, the results indicate that animal visibility can significantly influence how visitors use the interpretive materials associated with the exhibits. These results are important because a primary zoo objective is visitor education through sign readership.

The most valuable contributions made by this study are 1) the theory proposed in this thesis which provides designers a stronger theoretical foundation from which to begin the design of zoo exhibits, 2) the findings provide additional empirical data in identifying qualities of exhibits which stimulate visitors to read, and 3) the findings provide researchers additional evidence concerning what factors of an exhibit are most significant in influencing visitor attitudes.
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Introduction

PROBLEM STATEMENT

Naturalistic exhibits have become very popular among zoo professionals (Shettel-Neuber, 1988), zoo designers (Coe, 1982; Coe, 1983), and the zoo-going public (Shettel-Neuber, 1988). These exhibits are generally designed to simulate the native habitat of the species on exhibit. The benefits of such exhibits are numerous. Animals often display more natural behavior in exhibits that have been “enriched” with natural elements (Bryant and Kinzley, 1994). Furthermore, there is an increased potential for visitors to learn more about the true behavior of the animal and the environment in which it lives (Patterson and Bitgood, 1987; Schneider, 1982; Bryant and Kinzley, 1994). However, while there are several beneficial aspects of naturalistic exhibits, there may also be some negative implications resulting from the design of naturalistic exhibits. One potential problem with many naturalistic exhibits is that quite often the visitors are not able to see the animals (Coe, 1992; Vecchio, 1994; Andersen, 1991).

RESEARCH QUESTIONS

The following research questions address some of the potential implications resulting from exhibits in which visitors are not able to view the animals or have a limited view of the animals:

1) Is visitor behavior, such as sign readership and interaction among groups of visitors, affected by how visible the animals are to zoo visitors?

2) Is the visitor learning experience affected by how visible the animals are to zoo visitors?

3) Are visitor attitudes toward the species and its natural habitat affected by how visible the animals are to zoo visitors?

4) Is visitor satisfaction significantly affected by how visible the animals are to zoo visitors?

5) How will variables other than animal visibility (such as visitor age, gender, group type and size, direction of travel, the number of previous visits to the exhibit, and the length of visit at the zoo before seeing the exhibit) influence visitor behavior, visitor learning, visitor attitudes, and visitor satisfaction?

HYPOTHESES

Some authors have made the analogy that a zoo exhibit is like theater; the exhibit or enclosure design is the scenery or the stage, and the animals are the actors (Andersen, 1991; Polakowski, 1987). Although visitors may go to the zoo to relax and enjoy the scenery (Kellert, 1979), most visitors expect to see the “actors” perform and are disappointed and disinterested in the exhibit when the animals are out of view (Wolf and Tymitz, 1979; Churchman, 1985; Cheek and Brennan, 1976). Therefore, while the design of
the exhibit may be very important, it is the view of the animals which actually attracts visitor attention and interest. Other literature further supports the concept that animals attract and hold peoples’ attention (Bitgood, Patterson, and Benefield, 1988; Polakowski, 1987). There are also studies which indicate that viewing live animals in educational programs, and seeing them in a naturalistic representation of their habitat, has the potential to increase positive visitor perceptions of, and attitudes toward, the species being viewed (Yerke and Burns, 1991; Yerke and Burns, 1993; Rhoads and Goldsworthy, 1979).

However, in order for visitors to fully benefit from exhibits, both affectively and cognitively, they must also read the interpretive signs associated with the exhibit (Pearth, 1984). Unfortunately, it is still under debate whether or not a sufficient number of visitors actually read the signs (Borun and Miller, 1980). There are studies which have indicated that only a small portion of visitors read signs (Bitgood and Benefield, 1987). On the other hand, there are also studies which have provided encouraging evidence that visitors do read signs (Churchman, 1985. March: Wolf and Tymitz, 1979) and that sign readership can be increased even more, if signs are well-designed and well-located (Arndt, Screven, Benusa, and Bishop, 1993; Bitgood, Nichols, Pierce, and Patterson, 1986). Of primary importance, though, is visitor interest: “Visitors read labels when they are interested in the exhibit or are curious about the objects or animals, or have a desire to learn more [about] the subject” (Moses, 1994, p. 127). This sentiment has been expressed by others as well. Washburne and Wagar (1972) have indicated that “Interest is perhaps the most important ingredient for successful interpretation, because any presentation that fails to stimulate interest will not hold attention or enhance enjoyment and learning” (p.249).

Visitor interest is captivated by exhibits in which the animals are within view and lost at exhibits where no animals are within view. Additionally, visitor interest is essential for sign readership to occur. It would seem logical, then, to expect that sign readership, and therefore knowledge, would increase when animals are within view of zoo visitors. However, it appears that there is very little literature addressing this potential for animal visibility to influence sign readership. This thesis is an attempt to provide the needed data concerning how naturalistic exhibits, and more specifically the visibility of the animals exhibited in them, affect zoo visitors.

HYPOTHESIS #1: The visibility of the animals on exhibit will influence visitor behavior:
- The more visible the animals, the greater the number of visitors who will stop to read signs.
- The more visible the animals, the longer the periods of time visitors will stop to read.
- The more visible the animals, the more the visitors will interact with each other.

HYPOTHESIS #2: The visibility of the animals on exhibit will influence the visitor learning experience.
- The more visible the animals, the more the visitors will learn from the interpretive signs.
- The more visible the animals, the more visitors will feel they have learned from their visit.
- The more visible the animals, the more importance visitors will place on what they feel they have learned from the exhibit.

Introduction
While the main concern of this thesis is to determine how animal visibility influences sign readership and visitor learning, another objective is to determine if visitor concern toward the species is influenced by animal visibility. As mentioned earlier, the context in which animals are seen influences visitor perceptions and attitudes toward that species (Rhoads and Goldsworthy, 1979), and seeing live animals in educational programs also has the potential to influence visitor attitudes towards those species seen (Yerke and Burns, 1991; Yerke and Burns, 1993). However, few studies seem to have examined how the visibility of the animals in the zoo affects zoo visitors.

HYPOTHESIS #3: The visibility of the animals on exhibit will influence visitor attitudes toward the species.

- The more visible the animals, the more positive will be visitor attitudes toward the species.
- The more visible the animals, the more positive will be visitor perceptions of their future behaviors in protecting the animals or learning more about the animals.

A final objective of this study was to gain an idea of what other variables may be responsible for influencing the relationship between visibility of animals and visitor behavior, learning, and attitudes. By gathering information such as visitor age, gender, crowd conditions, satisfaction with the exhibit, and so on, the researcher could claim with more certainty that it was animal visibility, and not other factors, which influenced visitor behavior, learning, and attitudes.

HYPOTHESIS #4: Visitor satisfaction will be significantly affected by the visibility of the animals on exhibit.

HYPOTHESIS #5: Variables other than animal visibility (for example, visitor age and gender) may also influence visitor behavior, visitor learning, visitor attitudes, and visitor satisfaction.

GOALS OF THIS STUDY

There are four primary goals of this study: 1) to determine the effect of animal visibility on visitor experience at zoological parks; 2) to theorize the relationship between visitor experience and zoo exhibit design based on the data analysis of this study; 3) to present the implications of the findings of this study, and the resulting theory, on current practices in zoo exhibit design; and 4) to provide a series of design recommendations developed from the findings of this study to enhance current design practices.

IMPLICATIONS OF THIS STUDY

The results of this thesis should prove valuable for several reasons. First of all, the theory proposed in this thesis will add to the limited amount of theory available concerning zoo design and will, therefore, provide designers a stronger theoretical foundation from which to begin the design of zoo exhibits.
Secondly, the results of this study provide additional empirical data in identifying features and designs which will stimulate visitors to read more text on signs and labels. The need for such empirical data is explained by Martin and O’Reilly, “More research effort must be expended to identify ways to promote further reading of graphic text. This is essential if the more cognitive and affective objectives of zoo educators are to be met” (1988, p. 292). Likewise, the results of this study may provide insight into how to enhance what visitors learn from their visit at the zoo. In order for visitors to fully experience the educational aspects of exhibits, it is essential that they read the interpretive elements (Peart, 1984).

Another implication of this thesis is that the results of the study will help researchers develop a deeper understanding about what factors of an exhibit influence visitor attitudes. According to literature, “An exhibit can be designed or improved to increase the effectiveness of attitude learning” (D’Agostino, Ross, and Webb, 1992 p. 92). However, exhibits can only be “improved” if designers understand what factors of an exhibit are most significant in affecting visitor attitudes. The results of this thesis may provide insight into the influence of animal visibility on visitor attitudes, thus adding to the existing research concerning the design of exhibits to shape visitor attitudes.

This thesis may also prove beneficial in that the results may help to increase the amount of money brought into zoos through visitors. According to Joslin (1982, p. 22), “it is fairly well known that a correlation exists between the length of time people stay in zoos and the amount of money they spend.” If visitors are taking more time to read the signs, they are likely to stay longer at each exhibit. The longer the visitor stays per exhibit, the longer the visitor stays at the zoo, thus increasing the amount of money spent per person per visit to the zoo. Additionally, the results of this study may be used to help enhance visitor experience at the zoo, creating happier visitors who are more likely to increase the frequency and number of their trips to the zoo.

CONCLUSION

This first chapter introduced one of the problems of naturalistic exhibits. Often times visitors at naturalistic exhibits cannot see the animals in the exhibit. The next chapter, the Literature Review, will discuss the history and significance of zoological parks. The Methodology will then provide a description of the setting of the current study, the methods of data collection used for the study, and will also explain the procedures used to perform the study. The following chapter, Results and Analysis, will present the results of the study and will then explain those results in terms of the research questions. The final chapter, the Discussion, will relate the results of the current study to previous research on the design of quality exhibits for both zoo visitors and zoo animals. This last chapter will conclude with a set of guidelines for zoo exhibit design which have been developed based on the findings of this thesis and on the findings of related studies. It is crucial that the results of previous relevant studies be incorporated with the results of the

Introduction
current study during the process of developing design guidelines; only after examining all relevant data can the results of the current study be operationalized into design guidelines which will enable this research to be useful in zoo exhibit design.
Literature Review

The literature review is divided into three sections. First, the history of zoological parks is summarized. The second section of the literature review explains the importance of zoological parks. In order to thoroughly understand the value of zoos, there is also discussion concerning the educational value of living animals, the importance of signage, and the benefits of informal educational settings.

While zoo visitors are the primary focus of this paper, the needs of the animals at the zoo are covered as well. The physiological and psychological needs of the animals are incorporated into the final chapter of this thesis in order to more clearly relate the needs of the animals to the results of the current study and to help explain how these needs influenced the development of the design guidelines.

HISTORY OF ZOOLOGICAL PARKS

It is critical that we understand the evolution of zoo and exhibit design so that we can be aware of what changes have occurred and why. By realizing what factors have influenced the evolution of zoo and exhibit design, we are provided an historical framework to help us understand not only where zoos have been and where they stand now, but we are also given insight into where they are headed in the future. Knowledge of what lies ahead can help us plan for the future through the designs of the zoos and exhibits of today. It is also important that zoo designers examine the history of zoo design in order to understand how the attitudes of zoo visitors and zoo designers have evolved over time. Additionally, reviewing the history of zoological parks gives us the chance to become aware of what accomplishments have been made and, perhaps more importantly, what potential pitfalls we may yet face (Wetzel and O'Brien, 1995).

This portion of the thesis will discuss seven major eras of zoo exhibit design: early collections, zoological gardens, zoological parks, sterile exhibitry, and "The Great Zoo Revolution", current exhibit design, and the future of zoos and exhibit design. Each of these eras have had major impacts on the way zoos and zoo exhibits are being designed today and will continue to influence exhibit design into the future. By looking into the past, we can learn from the good as well as the bad; for this reason, it is imperative that designers keep these past design periods in mind when designing and renovating exhibits.
EARLY COLLECTIONS

Zoological facilities are not a novel idea. According to Fisher (1967), once human societies quit their nomadic ways and formed cities, animal collections began. People have been fascinated by animals and have been displaying wild animals in some form of captivity for centuries. It is known that menageries (collections of caged animals) existed long ago in Egypt, Rome, China, and India (Polakowski, 1987; Hancocks, 1971; Fisher, 1967). The royalty of these ancient civilizations, like the royalty of sixteenth, seventeenth, and eighteenth century Europe, used these menageries both for entertainment and to display the wealth of the owner (Polakowski, 1987). These menageries were built "...with the attitude of displaying animals so that they could be admired by their royal owners and the cages were designed more for the convenience of the spectators than of their inhabitants" (Hancocks, 1971, p. 105).

![Figure 2.1 - "The menagerie at the Chateau de Versailles in the 1650's from an engraving by Perelle" (Hancocks, 1971, p.107)](image)

The wealth of the owner was indicated not only by the animals but also by the architecture of the cages. While the interior of the cages was generally bare or simply decorated, the external architecture was often either "...elaborately decorated to resemble the garden or mansion architecture where they were located" or was decorated in an attempt to "...create a mood or an illusion by replicating the architectural style associated with the animal's native country" (Polakowski, 1987, p. 8).

Although there were some instances of animal collections being utilized as places of study, the popular entertainment of the time was to observe "...the atrocities of the circus spectaculars...", particularly of interest to the Romans (Hancocks, 1971). However, according to Hancocks, "After the fall of the Roman Empire zoological collections declined markedly, in number and size, for almost a thousand years" (1971, pp. 117-118).
It was during the Middle Ages that menageries again became popular. This time, however, there were traveling menageries and their purpose was not to display one’s wealth, but were instead intended to be used to make a profit. Toward the 18th century, permanently housed menageries again became more popular because it saved "...the expense and bother of travelling around" (Hancocks, 1971, p. 121).

![Image of a menagerie](image.png)

**FIGURE 2.2** - "'Polo's Royal Menagerie' in the Strand, London, in the nineteenth century" (Fisher, 1967, p. 69)

**ZOOCOLOGICAL GARDENS**

Another important phase in the evolution of today’s zoos can be seen in the trend of new animal collections which were named Zoological ‘Gardens’. This phase is significant in that scientists were just beginning to gain a renewed interest in studying and learning about animals.

It was not until the nineteenth century that scientists again began to recognize animals as "...subjects for serious biological study and not merely curiosities. The goal was to have a large animal collection; often containing only one of a species" (Polakowski, 1987, p. 19). Hancocks (1995) explains that during the 1800s that "...there was growing interest in the unusual plants and animals being discovered by explorers of unknown lands" (p. 174). It was in the 1800s that the first “zoos” began to "...include scientific labels, with coloured pictures of the animals, a distribution map and a short description of their natural habitat" (Hancocks, 1995, p. 174). The scientific world began to see animals as a thing to study; the Zoological Society of London was founded around this time period with new goals, including as its charter, "...the advancement of zoology and animal physiology..." (Hancocks, 1971, p. 124). The general public,
however, was still drawn to view exhibited animals as curiosities and viewing them was merely another form of entertainment.

The first modern zoo, The Zoological Gardens of London, opened to the public in the 1830s. “Animals were typically exhibited one per cage with several cages of similar animals grouped in one ‘house,’ like a monkey house or a feline house” in a manner of taxonomic organization (Polakowski, 1987, p. 19). In other words, the animals were organized according to a scientific method of classification: Those animals that were most closely related were grouped together. As indicated from the use of the term ‘house,’ animals were generally displayed within a building. It was believed that animals brought from warmer climates would not become acclimated, and thus, would need protection from the cooler weather (Polakowski, 1987).

![Image of early 19th century zoo scene](image)

**FIGURE 2.3 - Lithograph by G. Scharf of the Monkey House at the London Zoo in 1835**" (Fisher, 1967, p.69)

Zoos during this era focused primarily on the animals, the architecture of the buildings in which the cages were housed, and the park setting in which the buildings were placed (Hancocks, 1971). The design of the exhibit, itself, in no way reflected the animals’ native habitat nor allowed for normal social interaction for the animal or animals kept in them. Therefore, although there may have been some educational text and graphics for visitors, “There was no attempt at any sort of educational ‘message’ in exhibit design. Consequently, the animals were misinterpreted and misunderstood” (Polakowski, 1987, p. 20). This era is still significant because of the renewed interest among scientists to study animals and because those who
displayed animals began to provide scientific information about the animals, even though the general public did not yet display a great educational interest in the animals on display.

ZOONOLOGICAL PARKS

A new style of zoo exhibit design was introduced in the early 20th century and greatly improved exhibits for zoo visitors and zoo animals alike. Carl Hagenbeck, in 1907, instigated the first wave of change in zoo exhibit design with the opening of the zoo at Hamburg:

With reinforced concrete and the architectural skill of Urs Eggenschwiler, Hagenbeck created artificial rock formations as a backdrop for the animals. The cage bar was eliminated as a physical and visual barrier and replaced by moats, many of which were hidden to contain the animals and permit unobstructed views of the staged display. The use of vegetation, rocks and logs, similar to stage props, helped create long panoramas containing various animals and illusions of animals within a ‘natural habitat’ (Polakowski, 1987, p. 20).

Hagenbeck’s exhibits were one of the first to use landscaping devices to produce “dramatic panoramas” of many different species with a naturalistic backdrop (Hancocks, 1971, p. 129). Hagenbeck’s success was in his ability to recognize “...the importance of the setting, the position of the observer, and the animals’ spatial needs in presenting them for the entertainment and enjoyment of the visitor” (Polakowski, 1987, p. 20). For the first time, the exhibits were being designed to look like a natural habitat, even if they did not truly reflect the animals’ native habitat. Hagenbeck also lessened the visual impact of the buildings by reducing the extent of their use and, therefore, their size. He hid and camouflaged the buildings as much as possible in order to limit their visual impact (Polakowski, 1987).

These new design considerations had much greater spatial requirements compared to the existing zoos of the time. The zoos had to be much larger in order to create the illusion of the natural setting and to provide beautiful views for the visitors. The zoo exhibits also required much more space because Hagenbeck wished to display a number of the same and different species within one exhibit. As a result of this great increase in size, zoological gardens became known as zoological parks (Polakowski, 1987).

Although controversial ideas initially, Hagenbeck’s contribution in design became quite popular and were well received, not only in Hamburg but throughout Europe and the United States as well. “Hagenbeck’s accomplishments inspired similar zoo design by others and changed the appearance of zoos forever” (Polakowski, 1987, p. 20). Hagenbeck’s innovative thinking should serve as a reminder of the importance of innovation and flexibility in continuing to experiment with new design styles.
STERILE EXHIBITRY

The next era in zoo exhibit design serves as a reminder to designers that several different considerations must be incorporated when creating a new exhibit or when renovating an old exhibit. In this instance, the understandable concern for hygienic conditions for zoo animals were overemphasized and psychological and other physiological needs were forgotten.

As successful as Hagenbeck’s style of exhibit design was, there came a time when it was feared that the animals’ health might suffer due to the lack of hygiene of such conditions. Animals kept in the naturalistic exhibits were more prone to diseases and parasites because of the difficulty in thoroughly cleaning such enclosures (Nouvel, J cited in Polakowski, 1987). As a result, animals again began to be exhibited in bare cages which were described by Polakowski as “...frequently functional to the point of looking like a bathroom with an occasional piece of playground equipment” (1987, pp. 20-21). Such an arrangement allowed the exhibits to be cleaned more easily which helped to reduce the amount of parasites and disease coming in contact with the animals on exhibit (Polakowski, 1987; T. Read cited in Vecchio, 1994). However, these exhibits generally provided the animals with neither the space nor the physiological or psychological stimulation they required.
‘THE GREAT ZOO REVOLUTION’

Johnson (1994, p 103) names the period between 1960-1990 as “The Great Zoo Revolution.” This era in zoo exhibit design marks a significant change in the public’s mentality. This change is important to note because the public’s concern for the environment must continue to be encouraged well into the future. This era is also significant because it shows the importance of zoos being able to evolve. This portion of the thesis will address the many factors which instigated and influenced the new era of design, ‘The Great Zoo Revolution,’ including the following factors: increasing public awareness of ecological crises, regained interest in natural exhibits by zoo personnel and designers, concerns expressed by groups such as The Humane Society, and the incorporation of the American Association of Zoological Parks and Aquariums (AAZPA).

During this time frame, people became more aware of what was happening to the environment. “Society at large was bombarded daily with new ‘environmental crises.’ Seemingly insurmountable problems dealing with nuclear waste, overpopulation, air and water pollution, habitat destruction, species extinction, etc., were reported non-stop in the media” (Johnson, 1994, p. 103). The coverage of these events triggered international concern for the natural environment. “As a result of the unparalleled barrage of publicity, attention was focused as never before on the institutions and practices of our society as they related to the natural world. Because of their mission in maintaining and exhibiting wildlife, as well as their enormous popularity, zoos came under close scrutiny. Their conditions criticized (usually with justification), their very reason for being questioned” (Johnson, 1994, p 103).

At the same time, people working at and designing zoos began to visualize a new way of exhibiting animals. It was William G. Conway, Curator of Birds turned director at the Bronx Zoo, who in 1960 initiated changes at the zoo to reflect the public’s concern for the natural environment. “He envisioned exciting new ‘natural’ zoological exhibits as one of the most effective vehicles for satisfying that interest. That insight and the subsequent changes he initiated at the Bronx Zoo, ushered in a revolution in the zoological field that continues to this day” (Johnson, 1994, p. 103).

A number of other activities occurred during this time period which instigated further changes in zoo management and design. The Endangered Species Act was passed in 1973 and resulted in the creation of captive breeding programs to limit the number of species, particularly endangered species, being collected by zoos to stock their facilities. Additionally, zoos were being accused of cruelty to animals by the Humane Society which “…urged them to clean up their act” (Polakowski, 1987, p. 21).

Another event which moved the “Revolution” ahead was the incorporation of the AAZPA (the American Association of Zoological Parks and Aquariums), now known as the AZA (American Zoo and Aquarium

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Association), in 1972. According to Boyd (1994-1995, p. 8), “One goal of the newly incorporated AAZPA was to strive for higher levels of professionalism among facilities...” Membership to the AAZPA began to require greater commitment from those operating zoo facilities. “Accreditation of institutions was enacted on a voluntary basis in 1972, but was made mandatory for new members in 1980; in 1985 for existing members. Today all institution members must be accredited by the AAZPA. In addition, members pledge to follow the Code of Professional Ethics that was adopted in 1976” (Boyd, 1994-1995, p. 8).

The accreditation process of the AAZPA began to change as well, “The quality of a zoo is no longer measured by the number of species it contains but rather by the quality of its exhibits, its educational programs, its propagation results, and its research and conservation activities” (Polakowski, 1987, p. 22).

Zoos also began making major changes in several areas of zoological management and design. First of all, the goals of zoos began to expand. In addition to providing a place of recreation and entertainment for zoo visitors, zoos began to acknowledge their importance as an educational facility. As a result of the new goals and ‘philosophies’ of zoological parks, “The new evolution stressed two points most vigorously; First, that appropriate habitat simulation was a fundamental and desirable means for properly maintaining and exhibiting wild animals in captivity, and secondly, that suitable interpretive information was an integral and critical component of a successful public zoological exhibit” (Johnson, 1994, p. 104).

Hancocks (1995, p. 175) explains that “The criticisms from 20 and 30 years ago have been largely dispelled by a combination of such things as new standards in veterinary care, introduction of enrichment programs, development of a professional ethics code, and raising of accreditation standards, very successful breeding results, and in the public eye most especially by construction of exhibits that create visions of natural habitat.” However, there are still many problems which need to be addressed (Hancocks, 1995).

This era was significant in that zoos showed their flexibility and ability to evolve to meet the needs and expectations of its visitors while at the same time educating the visitors and creating a stimulating environment in which zoo animals may live. Zoos will need to maintain this flexibility now and in the future in order to continue to improve upon how they meet the needs of the visitors as well as the animals on exhibit.
CURRENT EXHIBIT DESIGN

Designers must be familiar with existing design styles in order to learn from the problems and successes of today’s exhibits. One common thread throughout many of the current styles of exhibit design is that it is often hard for the visitors to see the animals (Coe, 1992; Vecchio, 1994; Andersen, 1991). This portion of the thesis introduces the reader to the most popular exhibit styles currently used or used in the recent past. The following list includes definitions of the most recent exhibit types presented by Vecchio (1994), Hancocks (1971) and Nagao cited in Polakowski (1987).

Naturalistic Exhibits

Vecchio (1994, p. 354) explains naturalistic exhibits as “…tend[ing] to be spacious, have soil or sand substrates, live plants, snags, boulders and rock faces (real or artificial)” . While some naturalistic exhibits may be designed to closely simulate the animals’ native habitat, other naturalistic exhibits place the animal in a natural-looking environment which do not accurately reflect the native habitat.

Behavioral Exhibits

Behavioral exhibits present animals in an environment which encourages the animal to display its characteristic behaviors (Hancocks, 1971) including swimming, burrowing, climbing, and flying (Hancocks, 1971; Nagao cited in Polakowski, 1987).

Habitat Exhibits

“Habitat exhibits are organized around a theme in which animals and plants are selected and displayed together based upon their natural association” (Nagao cited in Polakowski, 1987, p. 22). For example, according to Hancocks (1971, p. 130), “…layout is planned for areas to be broken up into exhibits of grassland, aquatic, polar, forest animals and so on.” Unlike zoogeographic exhibits, discussed next, the animals are not necessarily displayed according to continent.

Zoogeographic Exhibits

Exhibits following a zoogeographic theme display animals in an arrangement which groups them “…according to their continent of origin” (Hancocks, 1971, p. 129). These exhibits may display the animals within the same exhibit or in a series of exhibits which are organized to reflect their common origin (Vecchio, 1994, p. 354).

Landscape Immersion Exhibits

Landscape immersion exhibits are described by designer Jon Coe as “…the newest ingredient in the mix (which) has more to do with the visitors rather than the animals. Through careful design and landscaping the viewing areas, the paths leading to the viewing areas and the exhibit space around them, the visitors are

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encouraged to feel that they are in the animal’s habitat, spying or sneaking a glimpse of the animals as if the animals were coming upon them in the wild” (J. Coe cited in Vecchio, 1994, p. 354). Polakowski (1987, p. 22) further describes landscape immersion exhibits as exhibits in which “…visitors share the same landscape, but not the same area, with the animal. In such an exhibit, both the visitors and the animals are visually surrounded in one landscape that simulates the animal’s natural habitat with no perceivable barriers”.

Wildlife Reserves and Safari Parks
Polakowski (1987, p. 22) describes wildlife reserves and safari parks as being facilities that “…have been developed in which many animals can occupy separate areas on a piece of land so large that they have to be seen from a car, monorail, or other type of transportation.”

Before discussing the exhibit included in this study and before looking at the future of zoos and zoo exhibit design, it was important to first look at the existing styles of exhibit design because designers must be aware of what currently exists in order to make improvements or to incorporate the best aspects of different styles of exhibiting animals.

THE FUTURE OF ZOOS AND EXHIBIT DESIGN
Forecasting the future direction of zoos and aquariums is difficult, filled with risk, and generally hard to define. Taking a comprehensive look across the fast-paced world of exhibit design, evolving conservation and breeding management programs, and the ever-changing needs of visitors is a momentous task; one that demands the acquisition and assimilation of data and the distillation of valid points suggestive of the future of zoos and aquariums (Wetzel and O’Brien, 1995, p. 567).

Designers will not only need to look into the trends of the past but also have to develop an awareness of what is going on in the world today in order to create exhibits and zoos which will attract, excite and educate visitors of today and the future. This portion discusses several factors which will need to be taken into consideration when designing and renovating zoos and zoo exhibits, including such factors as: continued development and the resulting destruction of habitat and species, the need for flexibility, competition with other public attractions, new technology, and the need for good business planning and funding methods.
The Future of Zoos

One factor that zoos will need to face is that as development continues and the native habitats of many species are destroyed, there will be an even greater need for zoos to educate the public about what is going on in the world. “Zoos will be required to promote an increasing public awareness not only about the valuable work being done in zoos, but also about the role the public can take in the preservation of our vanishing natural environment” (Polakowski, 1987, p. 23). The significance of zoos’ goals of educating the public will be even greater in the future. As Wetzel and O’Brien mention, “The value of educational messages and conservation practices will only escalate” (1995, p. 567). Polakowski foresees the educational role of zoos as having great impact on the design of zoos in the future: “Education appears to be emerging as a driving force that will shape some of the zoos of tomorrow” (1993, p. 188). Studies such as that currently being undertaken in this thesis will help to ensure that this goal of education is being met and will be met in the future.

The Future of Exhibit Design

However, zoos must keep finding new ways to make the educational experience fun. Zoos are having increasing amounts of competition from other types of public attractions, including theme parks and megamalls (Wetzel and O’Brien, 1995). In order to meet the educational goal of zoos and still attract visitors, education has to be fun and exciting. As stated by Wetzel and O’Brien (1995, p. 568), “‘Entertainment’ should not be a dirty word any more than ‘education’ should be considered boring.”

Taking advantage of the advances in computer technology can help zoos to better meet visitor expectations, according to Wetzel. The value of computer technology will be considerable because such advances will continue to heighten visitor expectations of their experiences at the zoo. As Wetzel and O’Brien explain, “Memories of the full-motion video segment that illustrates dynamic gorilla behaviors on their CD-Roms may increase the public’s disappointment when they find the ‘real’ gorilla sleeping in the zoo” (1995, p. 568) or when they are not able to see the real gorilla at all because it is hidden in the vegetation of the exhibit. This is not to say that technology will replace the living animals; According to Wetzel (1995, p. 568), “There will be continued increase in the value of experiencing the ‘real thing.’” Viewing television or CD-Roms cannot replace the interaction with living species, something zoos and aquariums can provide in abundance: live animals living in contextual settings.” Therefore, while technology cannot replace the experience of seeing living things, it will prove useful in enhancing the experience.
As we reflect upon the future, a number of things remain clear. Within our culture, the socioeconomic climate is changing. Zoos and aquariums must determine how to best navigate these changes. In the process, these institutions will be transformed themselves, offering new opportunities for both exhibited species and visitors. Continued advances toward holistic design and experiential exhibits will better integrate live animals, habitats, special effects, media, architecture, technology, and new communication systems. This “breaking down the barriers” will yield the next generation of zoos and aquariums (Wetzel, 1995, p. 569).

Additionally, the design of the animal exhibits must continue to advance. Landscape immersion, one of the currently popular trends in zoo design, must be pushed one step further into what Wetzel describes as “experiential” environments (1995, p.569). Also referred to as “holistic design”, the goal of the design concept is to provide “...experiential experiences [which] will parallel a true adventure into nature...” (Wetzel, 1995, p.569). The method of achieving this goal in furthering exhibit design is to incorporate all of the senses, from sight, sound, and smell, to texture (Wetzel, 1995).

The future of zoos will be shaped by the growing need for educating the public about the increasing threats to our environment and by the expectations of the public. Zoos will have to continue to develop innovative ways of providing education and recreation as complementary and integrated elements.

SIGNIFICANCE OF ZOOS

The disproportionate size of city as opposed to rural populations presents peculiar educational obligations to zoos. Generations are growing up without any natural contact with wild creatures; unstable public opinions concerning wildlife and wild environments blow hither and yon unguided by fact or experience. Except at the zoo, the opportunities to know or even become interested in wild creatures are largely vicarious ones for many city dwellers. Nevertheless, the interests and opinions of these people will shape land-use policy and ultimately, the future of wild creatures and wild places (Conway, 1982, p. 4).

In discussing the importance of zoological parks, one needs to realize that zoos have a number of user-groups and each one of these groups may each have different sets of goals and different ideas of what they consider to be the importance of zoological parks.

This section will first briefly mention the user groups and their goals and will then address the educational value of zoos, including the following controversial topics: the educational value of living animals, the importance of signage at zoos, the benefits of informal educational settings, and the potential for creating exhibits which influence visitor attitude. By presenting literature which addresses these topics, the reader can see that research has been performed which strengthen the argument for the educational potential of.
zoological facilities. This information was presented for another reason: Each of these topics was derived from a series of assumptions on which this study was based. The studies included in this literature review were used to support and justify these assumptions and the study as a whole. The literature was also used to further define the potential significance of the current study. It may be of some benefit to restate the five research hypotheses at this time:

HYPOTHESIS #1: The visibility of the animals on exhibit will influence visitor behavior:
- The more visible the animals, the greater the number of visitors who will stop to read signs.
- The more visible the animals, the longer the periods of time visitors will stop to read.
- The more visible the animals, the more the visitors will interact with each other.

HYPOTHESIS #2: The visibility of the animals on exhibit will influence the visitor learning experience.
- The more visible the animals, the more the visitors will learn from the interpretive signs.
- The more visible the animals, the more visitors will feel they have learned from their visit.
- The more visible the animals, the more importance visitors will place on what they feel they have learned from the exhibit.

HYPOTHESIS #3: The visibility of the animals on exhibit will influence visitor attitudes toward the species.
- The more visible the animals, the more positive will be visitor attitudes toward the species.
- The more visible the animals, the more positive will be visitor perceptions of their future behaviors in protecting the animals or learning more about the animals.

HYPOTHESIS #4: Visitor satisfaction will be significantly affected by the visibility of the animals on exhibit.

HYPOTHESIS #5: Variables other than animal visibility (e.g., visitor age and gender) may also influence visitor behavior, visitor learning, visitor attitudes, and visitor satisfaction.

USER GROUPS

In discussing the importance of zoos, it is necessary to point out that there are a number of user groups to consider in the design of a zoo and its exhibits. Shettel-Neuber describes the zoo environment as a complex interactive system. This system is composed of zoo visitors, staff, and animals (Shettel-Neuber, 1988, p. 454). Each user group brings its own individual type of goals and needs. In designing a zoological park or its exhibits, it is important to take into consideration the multiple user-groups and their goals and needs, all of which, as Shettel-Neuber explains, "...interact to affect the zoo system" (1988, p. 454).

Polakowski (1987, p. 4) has also acknowledged that there are multiple user groups with "conflicting needs." According to Polakowski, zoo design often addresses the needs of only one of these user groups, either the animals, the visitors, or management, thus creating a facility that falls short of providing for the needs of all users. In order for a zoo to be considered a successful creation, each of these user groups must have its own goals and needs incorporated, as much as possible, into the design of the facility. Although
the primary focus of this study is the zoo visitor, the physical and psychological needs of the zoo residents (the animals on exhibit) will also be incorporated into the final set of design guidelines developed based on the results of this and previous studies. The literature addressing quality exhibits for zoo animals is briefly discussed in the final chapter. However, this study does not include research concerning zoo staff, but it is still important for designers to remember that in order to successfully design a zoo and its exhibits, it is important to consider all the users.

MULTIPLE GOALS

Before designing a zoo, it is important to understand what goals the facility needs to meet for its users. Only by having a clear understanding of these goals can it be hoped to meet them and provide a facility in which zoo visitors enjoy visiting and zoo staff enjoy working. The following discussion will briefly describe the goals of zoological parks and zoo visitors. The remainder of this chapter will then explain how various elements of zoos help both groups achieve these goals.

Goals Of Zoological Parks

As mentioned earlier, the user groups of zoos are numerous. The staff of the zoo, for example, is composed of a great variety of different backgrounds and job descriptions, each of which tries to meet its own set of goals: The education department tries to make the visitor’s experience at the zoo as educational as possible while the curatorial staff is primarily concerned with the health and well-being of the animals at the facility. However, based on the topic of the thesis, we will only identify the overall goals of the zoological park as a whole, because it is these general goals which pertain to the current study. “Generally, four central goals or purposes emerge as the core of modern zoological park philosophy: 1) recreation, 2) education, 3) conservation, and 4) research. Different zoo facilities treat these concepts with varied emphasis, but each goal is ever present in the minds of modern zoo designers and administrators” (Polakowski, 1987, p. 26).

Goals Of Zoo Visitors

By understanding why people go to zoos and what are their expectations, designers can better meet those needs and goals and perhaps have a better chance of satisfying the needs and goals of the zoo as well. Zoo visitors have multiple goals when they make a trip to the zoo. According to Kellert (1979, p. 89), visitors attend zoos for a variety of reasons: educational value, recreational or entertainment value, social activity (with family and friends), “personal fascination with wild animals,” and to enjoy the natural scenery.

There is, however, continuing controversy concerning whether or not visitors attend zoos with education as a primary goal. While the results of some studies indicate that recreation is the primary goal of visitors
(Polakowski, 1987, p. 26; Joslin, 1982), there are also many studies which indicate that education is another primary goal of zoo visitors (Kellert, 1979; Serrell, 1977; Birney, 1988). In a visitor study by Serrell (1977, p. 50), visitors were given the choice of five words to describe what a visit to the aquarium should be: 60% of the visitors at an aquarium under study believed that a trip to the aquarium should be “educational” and 58% thought the experience should be “informative,” compared to 45% which expected the visit to provide “entertainment.” According to Birney (1988, p. 432), even children visit zoos “...in a state of ‘preparedness’ for a learning experience they value.”

Because of the topic of this thesis, the focus of this discussion will be on the educational aspect of zoological facilities. The rest of this section will discuss the educational value of zoos and of living animals, the importance of labels at zoos, the benefits of informal educational settings (such as zoos), and the potential of creating exhibits which influence visitor attitude.

EDUCATIONAL VALUE OF ZOOS

Visitors arrive at zoological parks with education as one of their primary goals. But, are visitors capable of learning in such an environment? According to Serrell, 1982, “Recent studies [using unobtrusive observation, interviews or questionnaires, and by ‘testing’ visitors for knowledge] have shown that visitors are capable of and willing to learn during their ‘social outing’ even though their exposure to the teaching materials may be very brief” (p. 15). However, it seems that very few studies have actually been performed which focus on finding out exactly what visitors learn from zoos, or from zoo exhibits. Numerous authors commented upon the lack of studies and the resulting lack of empirical evidence supporting claims of educational value of zoos and museums (Martin and O’Reilly, 1988, March; Birney, 1988, July; Churchman, 1985, March; Churchman, 1985, August; Wolf and Tymitz, 1981). Churchman describes some of the areas in which additional research is needed, including, “...why visitors learned from, enjoyed and appreciated exhibits...” (1987, p.16). Churchman further comments that many of the claims made of the educational benefits of naturalistic exhibits have not been sufficiently tested for these assertions to be made (1987).

Martin and O’Reilly were editors for the July, 1988, edition of Environment and Behavior which was devoted to the subject of zoological parks and environment-behavior research. Martin and O’Reilly discussed the reasons behind this lack of empirical data involving visitors at zoological parks and related facilities:

As with other types of applied research, there are numerous problems associated with the conduct of research on human behavior within a zoo setting. Those areas of concern usually involve the descriptive nature of studies, the site-specific nature of studies, methodological inconsistency, and the lack of theory guiding the research (p.388).
Wolf and Tymitz conducted one of the few studies which attempted to determine if visitors learned from their visit to the zoo (1979). First, the researchers provided their description of what was involved in their definition of the term “education” for the purposes of their study:

We interpret the meaning and application of education broadly. From our perspective, education includes observation, perception, satisfying curiosity, making sense out of one’s observation or experiences, incidental learning and, of course, direct efforts to collect or offer information (p.17).

Based on their study at the National Zoological Park, Wolf and Tymitz reported that “…every visitor who was observed viewing an animal and subsequently interviewed was able to give information about what he/she observed” (p.17). Additionally, the observations of the study made it clear that the zoo visitors were a very curious population, asking countless questions during their visit, thus indicating a strong desire to learn.

EDUCATIONAL VALUE OF LIVE ANIMALS

One basic assumption of this study is that providing visitors the opportunity to view live animals in the flesh is of some educational benefit. The following portion of the literature review is presented in support of this assumption.

Conway (1982, p. 4) discusses the great popularity of zoos. According to Conway, “The annual attendance at zoos in North America regularly exceeds the combined attendance at all national football and baseball games.” It is this popularity which creates the great potential for providing both an exciting yet educational experience at the zoo (Polakowski, 1987; Conway, 1982).

The primary element from which zoos derive both their popularity and their unique educational experience, is the presence of live animals on exhibit. According to Kellert (1979, p. 93), “Zoos still represent one of America’s most important sources of contact between people and wildlife.” At zoos, this contact has a particularly strong impact on visitors because “...live animals attract (visitor’s) attention and put them in the mood to learn” (Polakowski, 1987, p. 16). However, there again seems to be few studies, other than that mentioned above performed by Wolf and Tymitz (1979), that have actually been completed either to support or refute the claim that seeing live animals provides visitors with a learning experience.

There have been a few studies which examined how viewing live animals may affect people’s attitudes towards those species (Rhoads and Goldsworthy, 1979), but this subject is discussed later in the Literature Review. There have also been studies which examined the educational benefit of using live animals in educational programs or shows, which have provided evidence that such shows do result in cognitive changes in visitors (Yerke and Burns, 1991), but have also provided evidence that such programs do not
always appear to significantly increase audience knowledge (Yerke and Burns, 1993). However, it seems difficult to draw significant conclusions concerning the effect of viewing live animals in a naturalistic exhibit based on studies looking at the use of live animals in educational programs. Another study was performed by Price, Ashmore, and McGivern (1994) to, in part, assess the potential of two types of exhibit design on visitor knowledge. The two exhibits involved in the study were both primate exhibits displaying cotton-top tamarin monkeys. In one exhibit, the monkeys were seen in traditional cages, while in the second exhibit, the monkeys were described as "free-ranging" and lived in a wooded area. Although the study did not attempt to determine actual differences in knowledge gain between the visitors who viewed the two exhibits, the results of the study indicated that those who had seen the free-ranging monkeys felt they had learned significantly more compared to those who saw the caged monkeys.

Although there seems to be little actual study, or empirical data, the value of using living animals as an educational tool in exhibits is discussed in the literature. Several authors refer to the importance of providing visitors with the exciting opportunity to view living animals at the zoo. "While television may help prime the visitor, the unique experience of seeing the living creature at the zoo or aquarium can lead visitors to a better understanding and greater appreciation for all life" (Serrell, 1977, p. 13). Birney agrees with the importance of viewing animals at the zoo; "Museum and zoo visitors know that they will see authentic objects or live animals and seem to derive pleasure from relating with ‘the real thing.’ Bonding with something real appears to have intrinsic value and is an experience that can be shared" (1988, December, pp. 292-293). This experience provides visitors "...the opportunity to actually see how (living animals) move, find food and adapt to life in various habitats" (Schneider, 1982, p. 128). Conway further describes the educational value of live animals:

"[Zoos] bring to life a whole segment of the world that otherwise most people could not experience. While schools and zoos both compartmentalize knowledge to teach, zoo animals inevitably emphasize synthesis, bringing together for the visitors scattered ideas of anatomy and chemistry, geography and physiology, environmental dependencies and interrelationships. Even at the simplest level, direct contact with live animals can stimulate the imagination, sharpen observation and enrich the thinking of zoo visitors" (Conway, 1982, p. 4).

Therefore, according to the literature, just viewing the animals on exhibit is a learning experience for zoo visitors, in and of itself; Even if visitors do not read signs, visitors will benefit from their experiences of viewing animals at the zoo. As a result, the assumption was made that visitors learn may from their encounters and experiences with live animals. Based on this assumption, the author attempted to determine if the visibility levels of these animals also influenced visitor reading behavior and appreciation of the species on exhibit.
IMPORTANCE OF SIGNAGE

Another assumption made by this study is that signage is an important element of zoo exhibits. This is still a highly debated argument. The compilation of the following literature supports the belief that signs are a valuable feature of exhibits.

While it is very important to provide visitors the opportunity to view live animals in their naturalistic exhibits, simply viewing the animals is not enough. According to Mosca (1982), zoos are able to raise the interest of visitors with living animals and then take advantage of this heightened interest with graphics and signage. “The synthesis of living animals and information enables these institutions to progress toward accomplishing one of their major goals, that of contributing to a more informed public which, in turn, leads to a more responsible society.” However, the importance of signs at zoos is still debated (Borun and Miller, 1980). Although there are studies which indicate that signage is ineffective and labels are left unused by most zoo visitors (Bitgood and Benefield, 1987), there are as many studies which indicate that visitors do read signs and which support the use of signs and labels at zoos and similar informal learning environments (Churchman, 1985, March; Wolf and Tymitz, 1981; Wolf and Tymitz, 1979). There were also several studies which indicated that interactive signs increase visitor readership even more (Birney, 1988, July; Arndt, Screven, Benusa, and Bishop, 1992; Derwin and Piper, 1988). Many other studies have been completed on how to increase readership through the design of the physical, written, and graphic components of signs (Arndt, et al., 1993; Derwin and Piper, 1988; Moses, 1994; Bitgood, 1987; Bitgood, Nichols, Pierce, Conroy, and Patterson, 1986; Bitgood, Finlay, and Woehr, 1986).

Many authors argue that signs and labels at zoos are essential for communication between exhibits and the great variety of visitors who view them (Zaremba and Toedter, 1993; Bitgood, Grant, Pierce, and Patterson, 1986). Blakely (1981, p.1) also mentions that during the process of developing an “exhibit philosophy” for the Sedgwick County Zoo, “...it became apparent that the signs, labels, and graphics were integral to, and inseparable from the exhibit as a whole. The animal, the enclosure and its furnishings, and all associated written and art work become, in total, ‘the exhibit.’” It is also argued, in the defense of signage, that “...printed materials are essential in order to communicate information and concepts to a diverse audience” (Borun and Miller, 1980, p. 64). Screven (1979, p. 154) also agrees with the need for signage; “...language is essential in organizing information, guiding how it is processed and providing the means of transfer outside the exhibit environment. Like it or not, if you wish to communicate ideas or concepts and facilitate their application, you probably are stuck using words in some form or another.”

Several authors also remarked, in the support of signage, that it is the signs which complete the full educational experience provided by zoos (Hirschi and Screven, 1988; Arndt, Screven, Benusa, and Bishop, 1993; Bitgood, Finlay, and Woehr, 1986). Bitgood, Finlay, and Woehr (1986) contend that if one of the
primary goals of zoological parks and their visitors is education, then exhibit labels are required to satisfy this educational goal. Hirsch and Screven also defend the use of labels: “Label reading is an important aspect of whatever educational benefit visitors receive from attending a museum. If, therefore, such visitors fail to read a particular exhibit label, they are not experiencing the full impact of the exhibit. In fact, in many cases, it is only through the information contained in the labels that visitors can have any true understanding of the exhibits they are observing” (1988, p.50).

An extensive study of the literature provided few studies which focused on what, or if, visitors actually learn from signs. One of the reasons why so few studies have been completed in this area is due to the fact that it is very difficult to distinguish what information visitors learn from exhibits from their prior knowledge (Wolf and Tymitz, 1979). Peart (1984) discusses one such study, conducted at a museum in British Columbia, Canada, which attempted “...to determine what kind of exhibit had the greatest effect on museum-visitor behavior in terms of knowledge gain...” (p.220). The types of exhibits Peart examined ranged from “abstract”, one-dimensional exhibits without any objects, to “concrete”, three-dimensional exhibits with objects. Peart presented the following results of the study:

Knowledge gain does occur when certain exhibit types are viewed, especially concrete exhibits. Exhibits that utilize objects in a three-dimensional format and provide clear, concise labels are more effective for communicating messages and accomplishing goals than abstract exhibits consisting of flat work and no or few objects (pp. 234-235).

Labels are critical. A good label increases knowledge gain, attracting power, and holding power, while its absence significantly reduces knowledge gain. Once a visitor has been attracted to an exhibit, it is the label, for the most part, that determines the exhibit’s effectiveness (p.235).

The study conducted by Wolf and Tymitz at the National Zoological Park (1979) also found some interesting results. Although the study did not examine what visitors learned from signs, the results of visitor observations did reveal that “Labels stimulated observation and enabled visitors of all ages to become teachers” (p.52). Visitors of all ages were observed reading signs or relaying the information on the signs to other group members. Additionally, results of interviews with zoo visitors indicated that, “Though visitors favored human interaction [with zoo keepers or roving guides], they also desired up-to-date information placed near to the enclosures of the animals“ (p.52). Therefore, it seems that visitors want, and perhaps expect, to have the opportunity to read informative signs and labels at zoo exhibits.

Even if future studies suggest that visitors do not learn from signs, or remember the details presented on signs, proponents of signage will likely argue the value of sign readership. According to Schneider (1982, p. 128), “What is important is that the sensations and general impressions spark their desire to know more, and to care.” It is by seeing the animals and reading about them on the labels which encourage
visitors to want to learn more about the animals; the end result of visitors reading the signs is that visitors will understand and care more.

The fact remains, if zoo visitors don’t read these signs, for whatever reason, they cannot benefit from the information available to them (Bitgood, Finlay, and Woehr, 1986). Therefore, “...more research effort must be expended to identify ways to promote further reading of graphic text. This is essential if the more cognitive and affective objectives of zoo educators are to be met” (Martin and O’Reilly, 1988, p.292). The current study attempts to do just this by determining whether or not the view of the animals on exhibit influences readership.

**BENEFITS OF INFORMAL EDUCATION**

This study was based on yet another assumption, that visitors are capable of learning in an informal setting such as a zoo. The following portion of the literature review supports the argument that visitors do learn from their experiences at zoological parks.

Several authors describe the value of informal learning experiences. (Serrell, 1982; Galper, 1987; Moses, 1994; Borun and Miller, 1980; Wolf and Tymitz, 1981; Thomson and Diem, 1994). Serrell describes the informal learning experience as a positive feature of zoos and as a feature that visitors take advantage of and appreciate (1982). One of the beneficial aspects of the informal educational atmosphere of zoos and museums is that visitors are able to focus on those signs and exhibits which interest them most in whatever order or number of times they choose and at their own pace (Moses, 1994; Borun and Miller, 1980; Wolf and Tymitz, 1981; Thomson and Diem, 1994). In other words, visitors are a “...voluntary audience who set the parameters of their individual involvement...they make conscious decisions to visit (or not visit) certain exhibits based on their interest, curiosity, desire to learn, and time they have available” (Moses, 1994, pp. 127-128). “Thus, each visitor designs his or her own learning experience through choice and commitment” (Thomson and Diem, 1994, p.1). Additionally, previous experiments have indicated that the “optimal learning experience” is the informal, as opposed to the formal, learning experience (Birney, 1988, p. 313).

Because visitors will direct their informal educational experience around things which interest them, the present study attempts to determine if visitors are more interested in learning about the species if they can see the animal on exhibit. According to Mosca (1994, p. 127), “...our visitors read labels when they are interested in the exhibit, are curious about the objects or animals, or have a desire to learn more (about) the subject.”
EXHIBITS THAT CHANGE ATTITUDES

One hypothesis for the current study is that zoo visitors will show a greater amount of concern and respect for the species if the animals in the exhibit are within view of the visitors. This infers that exhibits, and their associated signage, are capable of changing visitor attitudes. Research has been completed which indicates that this is possible.

When discussing the influence of exhibits on visitor attitude, it is first necessary to differentiate what is meant by ‘attitude’ compared to what is meant by the term ‘belief’. D’Agostino, Ross, and Webb (1992, p. 93) define ‘attitude’ as a “...general positive or negative feeling toward some entity such as a person, place, object, issue or behavior. The statement, ‘I like museums’ is said to be a positive attitude toward museums” (D’Agostino, et al., 1992, p. 93). Beliefs, on the other hand, are defined by D’Agostino, Ross, and Webb as “...the information, either factual or subjective, that a person possesses pertaining to the entity. For instance, ‘Museums are very credible,’ or ‘Museums are keepers of knowledge’ are belief statements related to museums” (p. 93). While the terms “attitude” and “belief” have distinct meanings, an individual’s beliefs shape what that individual’s attitude will be (Ajzen and Fishbein cited in D’Agostino, et al., 1992).

D’Agostino, Ross, and Webb (1992), conducted a study involving the use of questionnaires to measure visitor attitudes toward urban wildlife after visiting an exhibit about urban wildlife. Visitors were asked, either before or after viewing the exhibit, to respond to a questionnaire using semantic differential scales. The results of the study provide some evidence that exhibits are capable of influencing visitor attitudes, although only the attitudes toward one of three species tested indicated a change. Visitor attitudes toward bears/lions were significantly more positive among individuals who had seen the exhibit while visitor attitudes toward docile mammals and birds were not significantly altered. The researchers provided one possible explanation for the lack of change in attitude toward the docile mammals and birds: “The control group’s attitudes were already very positive so there was less room for change” (p. 98).

Another study, performed by Taylor (1993), examined short term and long term attitude changes resulting from visiting a botanical garden. Two groups of visitors were included in the study: visitors who had not yet entered the garden and visitors who were exiting the garden. These visitors were asked to complete questionnaires for the study. An additional questionnaire was sent to people one to six months after their visit to assess the long term effects of the visit on people’s behaviors of the study. The results indicated that all of the subjects visiting the botanical gardens had high levels of positive attitudes, regardless of whether or not they had yet seen the exhibit under study. “This generally high positive attitude gave little room for change to be detected from a brief visit to a display of this nature” (p. 169). The long term behavioral impacts of the exhibit, according to Taylor, were significant. However, she also acknowledges.

Literature Review}
that only a fraction of the follow-up questionnaires, 46 out of 119, were ever returned. Additionally, only 24% of those who responded had made changes in the way they gardened as a result of seeing the exhibit. According to Taylor, this 24% is still important because it is among a group of people who already showed "strong positive attitudes" towards the environment (p.170).

Other studies have examined how the use of live animals in educational programs may alter people's attitudes toward those animals. In a study conducted by Reames and Rajecki (1985), preschool children's attitudes were measured before and then after seeing live animals as a part of an educational outreach program. A specialist discussed factual information about the animals and the children were given the opportunity to touch the animals. The results of the study indicated that the children had more positive attitudes toward the animals after their exposure to the living animals. Additionally, two separate studies performed by Yerke and Burns (1991 and 1993) produced results indicating that presentations using live animals are capable of altering visitor attitudes as well as behavior.

Studies have also indicated that the design of animal exhibits, themselves, influence visitor attitudes or perceptions about the animals seen in them. Finlay, James, and Maple (1988, July) conducted a study in which subjects viewed one of three sets of slides, either of animals in the wild, in naturalistic zoo settings, or in caged settings. A control group of individuals who did not view any slides was also used in the study. Eleven semantic differential scales were included in the study and used such adjective pairs as Active-Passive, Energetic-Lazy, Ugly-Beautiful, and so on. The results of the study indicated that "The environment in which an animal is seen does influence the perception of that animal..." (p.519). All but one animal was rated less favorably in the caged setting than in the naturalistic zoo, in the wild setting, or by the control group. The study also found that even in the naturalistic exhibits, the view of the barrier, be it moat, wall, or fence, tended to result in ratings equivalent to those for animals seen in the caged, or traditional, zoo setting. The results of a very similar study conducted by Rhoads and Goldsworthy (1979) showed that visitors consistently rated animals in the natural environment more positively than they rated animals seen in a semi-natural zoo and visitors also rated animals seen in a semi-natural zoo more positively than they rated animals in a caged setting.

Because studies have shown that exhibits are capable of influencing visitor attitudes, it is important to examine what exhibit attributes may influence visitor attitudes. By understanding what factors of an exhibit are most significant in influencing visitor attitudes, designers will be better able to create more effective exhibits. Therefore, it would be of interest to determine if the visibility of the animals on exhibit is one of those factors which is significant in influencing visitor attitudes.
CONCLUSION

The literature review has focused on two subjects: 1) the history of zoological parks and 2) the importance of zoological parks. The history was presented in order to help the reader identify the factors which have influenced the design of zoos and zoo exhibits. The importance of zoological parks was discussed to ensure the reader that the major assumptions of the current study, although controversial, had support from previous studies and other literature.

Based on the information uncovered during the literature review, it can be argued that zoos provide a strong educational service to the zoo-going public. From the research, we can see that the display of live animals not only attracts visitors, but also encourages them to learn about what they see. This literature review has also demonstrated that signs are considered by many researchers to be very important elements of an exhibit. Research has also shown the educational value of the zoo because of (and not in spite of) its informal setting. And finally, this chapter has shown that research does support the notion that exhibits are capable of influencing visitor attitudes.

Although studies have been performed which examine how exhibit design influences visitor behavior, none of these studies pursued the possibility that the visibility of the animal may also influence sign readership, visitor knowledge, or visitor attitude. This thesis attempts to fill in these voids in the literature. The next chapter, Methodology, discusses how this study has attempted to investigate these issues.
Methodology

INTRODUCTION

This chapter is divided into five sections which describe 1) the study site, 2) the study population, 3) the study design, 4) the data collection procedures, and 5) the statistical tests. The first section is divided into two parts and describes the exhibit and the signs used in the study. This section explains the criteria used to select this site for the study and also identifies the variables which may influence the study results. This section also describes the interpretive elements located at the zoo, particularly the signs found at the exhibit and their contents.

The second section, which describes the visitor population, is divided into three parts. First, there is a description of the type of visitors included in the study. Second, there is a discussion about how groups and group members were selected for observation. Third, the visitor characteristics and behaviors measured for the study will be explained.

The third section of this chapter provides a description of the changes made to the design of the study based on the results of a pretest. Also discussed in this section is the rational behind the use of a control group in the study.

The fourth section of the Methodology focuses on the procedures used for recording the observations and for administering the questionnaire. This section also describes the layout used in organizing the questionnaire form.

The final section of the Methodology discusses the statistical models used to analyze the data. The probability value used to determine statistical significance is also discussed in this section.
STUDY SITE

This section is divided into two parts. First, the focus is on the particular exhibit selected for the study, the Red Wolf Exhibit. A discussion of the criteria used in selecting the exhibit is provided. This section discusses why the criteria were important and also identifies the major variables associated with the exhibit that could potentially influence the results of the study. The second portion of this section describes the signs located at the exhibit, including the types of information provided on the signs and the different sign variables. A description of the setting is provided so the reader may become familiar with the context of the study site and understand relationships between the features of the site, the methods, and the results of data collection.

THE EXHIBIT

This portion of Chapter 3 describes the Red Wolf Exhibit at the North Carolina Zoological Park used in this study. In addition to providing a general description of the Red Wolf Exhibit, the following discussion will explain what criteria were used in selecting the Red Wolf Exhibit for this study and important variables associated with the exhibit.

The study was carried out at the 1200 acre (Litwak, 1991) North Carolina Zoological Park located in Asheboro, North Carolina. The Red Wolf Exhibit, a habitat-based exhibit, is located in the newer portion of the facility and was opened in the spring of 1995. This naturalistic exhibit is hidden from other exhibits by the surrounding native woodlands, even during the early spring, the time during which this study was conducted. Data collection occurred over a period of eight days, during four consecutive weekends extending from mid-April through mid-May, 1996.

Exhibit Criteria

A number of exhibit requirements were developed to aid in the selection of an exhibit which would have the appropriate characteristics needed to effectively perform this study. Early identification of these characteristics would be helpful in reducing complications during both data collection and data analysis. The list of exhibit criteria is presented here in order to assist future researchers in their efforts.

Visibility of the Animals on Exhibit

It was important that the exhibit provide opportunities for different degrees of visibility because, as stated previously, one of the purposes of this study is to determine if the visibility of the animals on exhibit influences visitor behavior, learning, or attitude. The Red Wolf Exhibit satisfies this criteria because the visitor’s view of the animals varies depending on the location of the animals within the exhibit. The
layout and elements within the exhibit allow the wolves 1) to remain within clear view of the visitors (refer to Figure 3.1, this page), 2) to become partially hidden from zoo visitors (refer to Figure 3.2, this page), or 3) to hide completely from zoo visitors.

**FIGURE 3.1 - Full view of a red wolf in the study exhibit as seen by visitors viewing the enclosure from the front of the viewing area.**

**FIGURE 3.2 - Partial view of a red wolf (center of photograph) in the study exhibit as seen by visitors viewing the enclosure from the front of the viewing area.**
Exhibit Size and Viewing Distance

The animals on exhibit must not be able to get too far away from the visitors in the selected exhibit. There seems to be a decrease in visitor satisfaction as animals on exhibit are located farther and farther away from the visitor (Conway, 1982; Bitgood, Patterson, and Benefield, 1988). The animals in the Red Wolf Exhibit can get no farther away from zoo visitors than approximately seventy-five feet. Although there is a moat separating the animals from zoo visitors, the animals may be located as close as the banks of the moat, approximately eight feet. The exhibit used in this study has little variance in the distances between the visitor and animal because of the shape of the exhibit. The implication of this low variability is that the effect of animal proximity should be minimal throughout the study and, therefore, should have little effect on study results.

Number of Animals and Viewing Opportunities

The exhibit selected for study needed to have more than one animal on exhibit. It was anticipated that it may be difficult to obtain the minimum number of “Full-Views” because of the possibility that the animals may spend most of their time only in “Partial-View” or “Out-of-View” of the visitors. The more animals kept in the exhibit, the easier it would be to obtain an adequate number of results for the Full-View visibility category. The Red Wolf Exhibit meets this criteria because it has two wolves on exhibit.

Amount Of Text On Signs

Sign needed to have enough text present on the signs to determine whether or not visitors would read more of the signs if the animals were within view. In addition, the four signs at the exhibit needed to have appropriate and similar amounts of text so that differences in readership between the signs would not be a result of differing amounts of text on the signs. Also, prior to the selection of the exhibit, the researcher was given permission to add more information, if necessary, through the approval of the education department at the North Carolina Zoological Park. It was necessary to add additional text to two of the signs so that all four signs had similar amounts of text. Refer to Appendix A for the information contained on each sign.

Location and Number of Signs

There needed to be more than one sign at the viewing area of the exhibit selected for the study. First of all, two signs were needed to help determine if visitors read more if they have seen the animals on exhibit. Two signs at the exhibit would provide visitors the opportunity to read more, if they chose. Secondly, in case of heavy crowding at the exhibit, there would be a greater chance that at least one of the signs would still be unoccupied. It seemed likely that a second visitor (or group) would be less inclined to approach a sign already being used by another visitor or group. Additionally, the exhibit had to have signs located after the exhibit viewing area as well as having the two signs at the viewing area. Signs located at and after
the exhibit were important in determining whether visitors would spend more time reading if the animals were in view. The Red Wolf Exhibit, with its two signs at the viewing area and two others located elsewhere around the exhibit viewing area, meets this criteria. Refer to the plan of the viewing area (Figure 3.3, this page).

![Diagram of the viewing area of the Red Wolf Exhibit]

**FIGURE 3.3** - Map of the viewing area of the Red Wolf Exhibit showing location of signs included in the exhibit

**Ability to Determine Sign Readership**

When observing visitors, the observer had to be certain that visitors being timed for reading were actually reading the signs and not looking into the study exhibit or into an adjacent exhibit. Therefore, signs at the selected exhibit had to be positioned so that when a visitor's head was turned toward any one of the signs, they were not able to look into any part of the exhibit. The two signs located at the Red Wolf Exhibit both have a rock backdrop which blocks the viewing area from the signs (refer to Figure 3.5 on page 34 and Figure 3.6 on page 35; To identify photographs of signs with the corresponding sign location, refer to Figure 3.3, this page). The other two signs are located on the main entry path in a position where the visitor cannot see the animals in the exhibit because of the distance from the exhibit, the vegetation, the topography, and the layout of the exhibit (refer to Figure 3.4 on page 34, Figure 3.7 on page 35, and Figures 3.9 and 3.10 on page 37).
FIGURE 3.4 - Vegetated backdrop behind Sign #1 (refer to Figure 3.3 on page 33, for a map indicating the location of this sign)

FIGURE 3.5 - Rock backdrop behind Sign #2 (refer to Figure 3.3 on page 33, for a map indicating the location of this sign)
Number of Observation Points

A single point of observation was needed so that the observer did not have to follow visitors throughout the study area. By being able to remain in one spot, the researcher would have less difficulty in observing and recording observations. If visitors had to be followed during observations, it seemed more likely that visitors would notice the observer. It was important that visitors not be aware of the observer's actions because visitors' behavior may be influenced if they realize they are being observed (Bitgood, et al., 1988). At the Red Wolf Exhibit, the observer was able to remain seated at one of the benches located in the back of the viewing area. Similarly, the volunteers administering the questionnaires had to be able to spread apart to prevent visitors from becoming aware of the observations. The layout of the viewing area at the red
wolf exhibit, and the number of benches surrounding the exhibit, allowed for those involved in the study to separate. The volunteer awaiting the identification of the next visitor under observation was seated on second bench located next to the observer. The other volunteer was either occupied outside of the viewing area awaiting completion of the questionnaire of the previous visitor under observation, or was waiting her turn on the a bench located farther down the main path (refer to Figure 3.8, this page).

![Diagram](image)

**FIGURE 3.8 - Map of viewing area of the Red Wolf Exhibit showing the location of the observer and volunteers during data collection**

**Visual Competition With Other Exhibits**

In order to record the effect of the view of the Red Wolf Exhibit on the behavior of the visitors, it was important that the visitors not be able to see adjacent exhibits at the same time. Bitgood, Patterson, and Benefield (1988) discussed the influence of visual competition between exhibits. They describe visual competition as "...the situation in which two or more exhibits can be readily viewed as the visitor approaches" (p. 485). The result of visual competition is the reduced percentage of visitors who stop to view the exhibits (Bitgood, et al., 1986; Bitgood, et al., 1988). There is a lack of visual competition at the Red Wolf Exhibit. No other exhibit can be seen when approaching, visiting, or leaving the Red Wolf Exhibit.
Exhibit Variables

Literature from previous studies discussed numerous exhibit variables, which were potentially capable of influencing visitor behavior (Shettel-Neuber, 1988; Bitgood, et al., 1988, July; Zaremba and Toedter, 1993; Derwin and Piper, 1988). It was necessary to identify these variables prior to data collection in order for them to be properly recorded and measured. By measuring and testing these variables, it can more accurately be determined what effects the variables actually may have on the results of the study. There are five exhibit variables which are examined in this study: visibility of the red wolves, number of red wolves within view, activity levels of the red wolves, weather conditions, and crowd conditions.

Visibility Level

The level of animal visibility may change between each visitor under observation and it was hypothesized that these varying levels of visibility may affect visitor behavior, learning, and attitudes. Visitors were asked on the questionnaire to record their view of the red wolves (refer to Appendix E). A previous study by Shettel-Neuber (1988) also used questionnaires to determine the ease with which visitors could see the
animals on exhibit. Visitors who chose not to complete a questionnaire were verbally asked to describe their view of the red wolves. Responses were then recorded onto a survey table (refer to Appendix I). The variable was measured as follows: 1) Clear view of an animal on exhibit (refer to Figure 3.1 on page 31), 2) Partial view of an animal on exhibit (refer to Figure 3.2 on page 31), and 3) No view of an animal on exhibit. For the purposes of this study, the highest level of visibility indicated by the visitor was recorded for data analysis. The amount of time visitors saw the animal was not recorded. Simply the fact that the visitor saw the animal was the important variable in this study.

**Number of Animals in View**

During each person’s visit to the exhibit, there could be either 1) no red wolves within view, 2) one red wolf within view, or 3) both red wolves within view. This variable was recorded because of its potential effect on visitor behavior, learning, and attitudes. Seeing both animals instead of just one may increase visitor levels of curiosity and may, therefore, also increase sign readership and learning as well as attitudes. Visitors were asked on the questionnaire to record the number of the red wolves seen in the exhibit. In the case where first one and then both wolves were within view during the period of one person’s visit, the highest number of animals within view was recorded.

![Figure 3.11 - View of both red wolves in the study exhibit as seen by visitors viewing the enclosure from the front of the viewing area.](image)

**Activity Level**

During each person’s visit to the red wolf exhibit, the animals could potentially be seen engaged in a number of activities. Animal activity was measured and recorded because of its known influence on visitor behavior (Conway, 1982; Shettel-Neuber, 1988; Bitgood, et al., 1988; Hediger, 1964; Arndt, et al., 1993). Visitors were asked on the questionnaire to record the activity level of the red wolves seen in the exhibit. The variable was measured as follows: 1) Lying down, 2) Sitting, 3) Walking, and 4)
Running/Playing. In the case where the animals engaged in varying levels of activity during the period of one person’s visit, the highest level of activity displayed by an animal was recorded. For example, if the wolves slept during the length of a visitor’s time at the exhibit and then got up and ran out of view, the “Playing/Running” category would be recorded.

**FIGURE 3.12 - View of both red wolves running in the study exhibit as seen by visitors viewing the enclosure from the front of the viewing area**

**Weather Conditions**

For this study, weather conditions were recorded because it was possible that poor conditions might influence sign readership. A visitor may be much less inclined to read a sign, regardless of the visibility of the animal, if the weather is unpleasant. Several other studies also recorded weather conditions (Zaremba and Toedter, 1993; Bitgood et al., 1988; Derwin and Piper, 1988) or have mentioned the potential influence of weather on results (Arndt, et al., 1993). Visitor observations of these conditions should be recognized because each visitor has his/her own perception of what constitutes comfortable or uncomfortable weather. Visitors were asked to record their perception of the weather on a 1-5 scale rating from “very uncomfortable” to “very comfortable”.

**Crowd Conditions**

The number of visitors in the viewing area of the Red Wolf Exhibit was recorded. Crowd conditions at the exhibit were recorded because the number of people at the viewing area may influence sign readership (Zaremba and Toedter, 1993; Bitgood, et al., 1988). For example, if the viewing area is too crowded, visitors may hurry to get ahead of the crowd, possibly resulting in less time spent reading signs. Visitors at the Red Wolf Exhibit were asked to record their perception of the crowd conditions on a 1-5 scale ranging from “extremely crowded” to “not at all crowded”.

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Selection of the appropriate exhibit required a great deal of consideration. Exhibit criteria had to be developed prior to exhibit selection to reduce complications during data collection as well as during data analysis. Additionally, exhibit variables had to be identified prior to data collection in order for these variables to be properly recorded and measured. The value of noting these variables was primarily to allow for data analysis to be performed to aid in determining the degree to which they may have influenced the results of the study. Now that the exhibit criteria and variables have been discussed, the interpretive sign variables will be described. Variables associated with zoo visitors will then be presented in the following section.

THE SIGNS

This portion of the thesis describes the location and the information presented on the four red wolf interpretive signs included in the study. The description concludes with a discussion of the variables associated with the four signs. To understand the relationship between time spent reading the interpretive signs and the visibility of the animals on exhibit, it was necessary to examine sign-related characteristics that might influence the results of the study.

The two types of interpretive signs located around the Red Wolf Exhibit are the “advance organizers” and the “trailside interpretation” signs (Litwak, 1991, p. 432). Litwak describes these two types of interpretive elements: The advance organizers are the first level of interpretive elements: “The team agreed that every major access pathway to animal or exhibit viewing would have an advanced organizer in order to provide an overview introduction of the basic characteristics of the authentic habitat storylines agreed upon in the masterplan” (Litwak, 1991, pp. 432-433).

Trailside interpretation is considered the second level of interpretive elements: “The overall storylines were broken down into a series of logical bite-sized elements and located on the exhibit plan at convenient stopping points” (Litwak, 1991, p. 433).

At the Red Wolf Exhibit, three of the four signs are classified as trailside interpretation signs while the fourth sign is classified as an advance organizer. The advance organizer (Sign #4) is located such that this introductory sign is the first sign seen by visitors coming from the Africa entrance, while the visitors coming from the North America entrance see this sign last (refer to Figure 3.3 on page 33).

The location of each sign in relation to the exhibit may be seen in Figure 3.3 on page 33. Two signs are located at the primary viewing area of the exhibit (Sign #2 and Sign #3) and two signs are located along
the main path before visitors reach the secondary path (the loop) which leads to the red wolf exhibit (Sign #1 and Sign #4).

The information found on the signs includes the species' common and scientific names and physical description as well as basic information concerning the following subjects: red wolf behavior, group dynamics, original territory, causes of near extinction, and preventative measures taken against the threat of extinction. Refer to Appendix A for the information presented on the signs.

**Sign Variables**

There are a number of factors related to the four signs at the exhibit which could potentially influence the amount of time visitors will spend reading them. Each of these variables will be described and the measures used to record them will be discussed. The variables are: viewing sequence, shade conditions, and presence of others.

**Viewing Sequence**

Unless they changed their direction of travel after viewing the exhibit, people who visited the Red Wolf Exhibit walked past four signs. Viewing sequence was recorded in order to help determine if the view of the animal on exhibit influences readership at signs located at or after the exhibit (refer to Figure 3.3 on page 33). For each visitor under observation, the observer recorded the viewing sequence for each sign to identify each of the signs as being in one of the following locations: 1) Located before the viewing area 2) Located at the viewing area, or 3) Located after the viewing area. Visitors who changed direction of travel after viewing the exhibit were not included in the study.

**Shade Conditions**

Because the signs around the Red Wolf Exhibit are located in different parts of the viewing area, one sign may be in the shade while the others are still in the sun. These microclimate conditions may change for each sign throughout the day. This variable was recorded in order to determine if shade conditions affected sign readership. The observer recorded the presence or lack of shade for each sign during the period of time in which each visitor under observation visited the Red Wolf Exhibit.

**Presence of Others**

As the visitor under observation passed each sign, there may or may not have been another visitor or group already at the sign, either reading it or just standing in front of it. The presence of others was recorded in order to determine the influence this variable may have had on sign readership. Visitors may be less likely to stop at signs already occupied by a person from another group. The observer recorded the presence of visitors from other groups at each sign at the time the visitor under observation passed the sign.

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VISITORS

This section is divided into three parts. First, the focus is on identifying the visitor population used in the study. The second portion of this section describes the sampling methods used in this study. The final portion of this section describes the variables related to the visitors, such as visitor age and gender, which could influence the results of this study.

THE VISITOR POPULATION

Study Population:
The study population was comprised of visitors to the North Carolina Zoological Park, in Asheboro, North Carolina. This study was conducted under a variety of conditions in order to represent the types of conditions which many visitors are exposed to throughout the year. As a result, it is hoped that the study population was not significantly different from people visiting other zoos.

Number of Participants
For statistical purposes, approximately fifty visitors were needed for each of the visibility categories: Full-View, Partial-View, and No-View. This number of visitors per category was needed to provide a sufficient power to determine variables and conditions of statistical significance. Substantially fewer than fifty visitors would make it difficult for the researcher to identify conditions of statistical significance that actually did exist. Therefore, although the number of visitors per category did not necessarily need to be equal, no category could have significantly less than fifty subjects.

THE SAMPLING METHOD

This portion of the thesis first describes the methods used in the selection of groups included in the study and then explains the methods used to select specific group members for observation.

Group Selection:
A random selection of groups was used as the first step to select study participants. The group selection process implemented in this study is similar to that used by Bitgood, Patterson, and Benefield (1988).

It took approximately thirty minutes for the researchers to arrive at the exhibit and get situated. By the time the researchers were prepared to start, the first few visitors were generally just beginning to arrive at the exhibit. The first visitor group to enter the area, after the researchers were ready to begin, was the group from which a visitor was selected for observation. After the visitor group under observation left the exhibit area, the next visitor group estimated to be closest to a sign located on the main path was selected.
**Group-Member Selection:**

Similar to the study conducted by Bitgood, Patterson, and Benefield (1988), only one member per group was selected for observation. Selecting only one person per group simplified observation and allowed for greater accuracy in recording observations because the observer was less likely to become overwhelmed.

Visitors were chosen for observation according to a system of random selection. The reason for the random selection is due to the possibility that the person’s physical position within the group may influence the results. For example, the first person to the exhibit may be more excited or interested in the exhibit and may, therefore, read more of the sign; On the other hand, he or she may be the least interested and is simply trying to silently encourage fellow group members to quickly continue on past the exhibit.

The following method of random selection was used in this study: Numbers were randomly selected for each day of the observation by rolling dice. No number greater than six was used. These numbers were written in the order of their selection onto a piece of paper (for example: 3,1,4,2,6,5...). In this example, the first number in the sequence (#3) would determine that from the first group, the third person to enter the observation area would be selected for observation. The second group would be assigned the next number in sequence; in this example, the next number in sequence (#1) would determine that of the second group, the first person to enter the observation area would be observed. The third group would then be assigned the next number in sequence (#4). If there are only two members in the group, then the next number in line on the pre-printed list of numbers will be selected. In this example, the next number is (#2) so the second person to enter the exhibit would be selected.

**VISITOR VARIABLES**

There are a number of visitor characteristics which could potentially influence the amount of time visitors spend reading signs. By measuring and testing these variables, it can more accurately be determined what effects these variables had on the results of the study. In this portion of the thesis, each of these variables will be described and the measures used to record these variables will be discussed. Visitor variables include: time of arrival at the zoo, number of prior visits to the Red Wolf Exhibit, number of signs noticed, prior knowledge about red wolves, age, gender, group type and size, and direction of travel.

**Time of arrival at the zoo**

Visitors were asked about what time they arrived at the zoo. This information was analyzed to determine whether or not sign readership decreased the longer a visitor was at the zoo. The information concerning visitor time of arrival at the zoo was subtracted from the visitor’s time of arrival at the red wolf exhibit to determine how long the visitor had been at the zoo before seeing the red wolf exhibit. There were four
categories used to classify this variable: less than one hour, one to less than two hours, two to less than three hours, and three or more hours.

*Number of prior visits to the Red Wolf Exhibit*

Visitors were asked how many times they had already visited the Red Wolf Exhibit. This question was asked because of the possibility that visitors who had already seen the exhibit may have also already read the signs. The more times the exhibit has been visited, the greater the possibility that sign readership will decrease (Chambers cited in Zaremba and Toedter, 1993). Responses were placed into four categories: 1) no prior visits, 2) one prior visit, 3) two prior visits, or 4) three or more prior visits.

*Number of signs noticed*

Visitors were asked to comment on the number of signs they saw at the exhibit. This question was asked because sign readership would be reduced if visitors did not see all of the signs located around the exhibit. It was important to know if signs were not read simply because the visitor did not know they were there.

*Prior knowledge about red wolves*

Visitors were asked to comment on their degree of knowledge about red wolves they had prior to arriving at the exhibit. The purpose of this question was to determine if the visitor already had any special knowledge about the species (Serrell, 1989). If the visitor already knew a lot about the animals, this prior knowledge may reduce readership. Visitors were asked to respond on a 1-5 scale, ranging from “no prior knowledge” to “great deal of knowledge”.

*Age*

The age groups of visitors ranged from the very young to the very old and it was possible that certain age groups may be more or less likely to read signs regardless of the view of the animals on exhibit. Visitors were asked to indicate their age by circling the appropriate response on a 1-5 scale. The following categories were used (developed based on the categories used in the 1990 Census of Population: General Population Characteristics) to record visitor age groups: 15-19, 20-29, 30-39, 40-49, 50-59, 60-64, and 65 and older.

*Gender*

Visitors were asked to indicate their gender in the questionnaire because of the possibility that one gender may be more or less inclined to read the signs.

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Group type and size

Groups were composed of a variety of combinations and numbers of people. The social group type has been recorded in a number of studies (Derwin and Piper, 1988, p. 440; Zaremba and Toedter, 1993; Bitgood, et al., 1988, p. 478; Serrell, 1989). Different social groups may have different reading patterns. Family groups, for example, may have greater concern for the educational aspect of a visit to the zoo and may, therefore, read more of the signs. Additionally, the size of the group may have an influence on visitor behavior (Serrell, 1989). For example, members of large visitor groups may be less likely to stop to read signs for fear of slowing down the rest of the members of the group. Groups were classified into one of the following five categories on the observation form: Alone, Couple, Peer Group, Family Group, or Mixed Group. Individuals categorized as “Alone” were visitors who approached, viewed, and left the exhibit by him/herself. Groups composed of two people of the opposite gender were categorized as a “Couple”. Groups composed of two people of the same age and gender and groups of three or more people estimated to be of similar age were recorded as a “Peer Group”. Any group accompanied by one or more children was classified as a “Family Group”. Finally, groups of adults from different age groups were recorded as a “Mixed Group”. The size of the group was also recorded on the observation form. Groups were recorded as having one, two, three, four, or five or more members.

Direction of travel

There were two directions from which visitors could arrive at the exhibit. The direction of travel may be a significant variable because the experiences of visitors arriving from one direction may influence visitor behavior. For example, visitors coming from the North America entrance experience the signs at the red wolf exhibit in a different order than visitors coming from the Africa entrance. Additionally, the direction of travel could affect visitor fatigue because visitors traveling from the Africa entrance have had the opportunity to visit more exhibits and have potentially had a longer path system to traverse before reaching the red wolf exhibit. Finally, visitors will have had the opportunity to experience different types and amounts of learning from the exhibits they have visited, depending on their direction of travel. Because of the influence that the direction of travel may have on visitors’ experience and, therefore, on visitor behavior, learning, and attitudes, the direction traveled by the visitor was recorded by the observer onto the observation form.
STUDY DESIGN

This portion of the thesis first describes the method of the pretesting used to help aid the researcher in designing the study. Then, the control group, and its purpose in the study, is discussed.

PRETEST

Before initiating the actual study, a pretest was needed to ensure that 1) different observers following the same procedures, and observing the same phenomena, obtained similar results, 2) the observation forms were effectively designed for efficient use during observation, and 3) the visitors understood the wording and questions included on the questionnaire.

The pretrial was performed on a Saturday early in the month of April, 1996, at the Red Wolf Exhibit. the same exhibit in which the actual study was to take place. During the pretrial, the procedures were followed as proposed. Problems which surfaced during the day were noted so that appropriate changes could be made to reduce the number of complications in the actual study. The following discussion explains what changes were made and why.

Originally, a table format was to be used on the observation form to record the sign variables. Because of the confusion caused by trying to locate the appropriate row and column during the course of observation, it was decided that a diagram would be easier to use when recording information in the field (refer to Appendix C for the observation form).

Additionally, the number of comments needing to be written down were reduced by using a simple arrow to indicate the visitors’ direction of travel, instead of recording the sequence, for each sign, in which the signs were passed.

Thirdly, instead of recording the number of people at a sign as the visitor under observation walked passed, it was decided to be sufficient to simply circle “yes” or “no” to indicate whether or not other visitors were present. Recording the numbers of others present was deemed unnecessary information.

Also, it had been proposed that the observer would record the visibility of the animals on exhibit. However, it was not always possible for the observer to accurately determine the visibility of the animals as viewed by the visitor. Therefore, it was decided that visitors’ recorded responses on the questionnaire would be used to measure animal visibility.
Finally, it was decided that a very brief and informal survey would be used for visitors who did not wish to fill out a questionnaire. This survey was simply to find out what kind of view the visitor under observation had of the red wolves (refer to Appendix B for a description of how questionnaires and surveys were administered and refer to Appendix E for the survey table).

CONTROL GROUP

A control group was used as a benchmark to further determine how visitors were influenced by their experience at the red wolf exhibit and to ascertain what overall effect visiting the exhibit had on people. It seemed possible that visitors to the exhibit may, in fact, be negatively affected by a lack of view of the animals on exhibit. For instance, visitor disappointment with a lack of view of the animals may be detrimental to visitor attitudes. Therefore, a control group of visitors who had not yet seen the exhibit was needed. In order to fully answer the research question concerning whether or not animal visibility affected visitor learning and attitude, it was necessary to compare attitudes of visitors who had not seen the exhibit with those who had seen the exhibit but who had either no view, a partial view, or a full view. Attitudes of visitors who had not seen the exhibit were compared to those who had seen the exhibit but who had either no view, a partial view, or a full view. In order to compare visitor responses, visitors entering the zoo were given a questionnaire similar to the one given to visitors who had visited the Red Wolf Exhibit.

The questionnaire given to the control group was a revision of the version of the questionnaire given to visitors who had viewed the red wolf exhibit (refer to Appendix G for the questionnaire given to the control group and refer to Appendix E for the questionnaire handed to visitors after leaving the Red Wolf Exhibit). Many questions were eliminated from the questionnaire for the control group because they referred to the view of the exhibit and the signs located around the exhibit. The questions that were retained on the control questionnaire referred to prior number of visits to the red wolf exhibit, prior knowledge of red wolves, visitor attitudes toward red wolves and their habitat, visitor likelihood of engaging in certain behaviors in the future, and visitor knowledge about red wolves.

Visitors included in the Control Group were selected as they passed through the entrance gates. The first group to pass through the gates was approached and all visitors estimated to be older than fifteen were given a questionnaire. After this group had completed questionnaires, the next group coming through the gates was approached. This procedure was followed until fifty-seven questionnaires were completed. The data was collected for the control group over a period of 6 hours on a Saturday in late May.
PROCEDURE

Many previous studies have discussed the value of using unobtrusive observations of zoo visitors and visitor questionnaires (Miles, Alt, Gosling, Lewis, and Tout, 1982; Serrell, 1982; Henerson, Lyons Morris, and Fitz-Gibbon, 1978; Sommer and Sommer, 1991). Serrell discussed the need to continually evaluate a program and explained that “The only really effective measure of an effective program is through feedback from visitors - by their behavior, comments and response to questions” (1982, p. 15). Serrell further explains: “The impact of various exhibit and education techniques can be assessed through unobtrusive observation, interviews, or questionnaires, and by testing visitors for knowledge” (1982, p.15). The following discussion explains more precisely why observations and questionnaires were chosen as the two methods of data collection for this study.

Visitor observation was selected because it was the most efficient way to most accurately record visitor behaviors. Only by observing visitors could the researcher record which signs were read and how long visitors spent reading them. Visitor questionnaires were used for this study to obtain information which could not be recorded from observations. Questionnaires were chosen, instead of interviews, in order to gather more accurate responses concerning visitor attitudes and potential behavioral changes. People are more likely to respond honestly on a written questionnaire than when asked in a face-to-face interview. Although visitors may not always answer honestly on a questionnaire, people generally feel more anonymous when completing a questionnaire because there is no interviewer to make judgments about their responses (Henerson, Lyons-Morris, Fitz-Gibbon, 1978). Therefore, observations and visitor questionnaires were selected because they were the most appropriate methods of data collection for this study.

The following section of this chapter describes the procedures used in implementing the study. This section is divided into three parts: General Procedures, Observations, and Visitor Questionnaires. After first describing the general procedures undertaken in the study, the procedures used in making observations will be explained along with a description of the observation. The final portion of this section describes the questionnaire form, its organization and the items of which it is composed.

This section is important for two reasons. First it provides the reader with an understanding of the procedures used in data collection in order to avoid unwanted influences due to inconsistent procedures. Familiarity with the procedures will allow the reader to better understand relationships between the methods of data collection and the results. Secondly, a description of the methodology will allow the study to be duplicated or used to help others develop similar studies in the future.
GENERAL PROCEDURES

The researcher and two volunteers were involved in the process of data collection and were present at the study site. Data collection was easier if more than one person was available to administer visitor questionnaires. The researcher observed and recorded visitor behavior while the volunteers administered visitor questionnaires. By having two volunteers responsible for visitor questionnaires, observations could be made continuously. While volunteer #1 approached the first visitor to fill-out the questionnaire, the researcher was able to begin observations on the next visitor to be observed. Volunteer #2 was then available to approach the second visitor when the observation was complete. In this way, volunteer #1 and #2 alternated approaching visitors to complete questionnaires. Also, having two volunteers allowed the observations to continue if one volunteer needed to take a break.

To ensure that the procedure did not vary between volunteers, a standard procedure was developed for the study. Prior to data collection, volunteers met with the researcher to obtain both written and verbal instructions concerning the standard procedure to be used in the study (Please refer to Appendix B for a sample of the written instructions provided for volunteers who participated in the study). Volunteers were reminded, prior to the start of each day of data collection, the importance of following the procedure. Volunteers also practiced the procedure prior to arrival at the North Carolina Zoological Park and for the first hour each Saturday upon arrival at the Red Wolf Exhibit.

The purpose of providing volunteers with a detailed description and clear explanation of the procedures to be followed was to ensure that their approach was consistent throughout the study. By keeping the procedures consistent, there was less chance that the volunteers would influence the responses made by the visitors completing the questionnaire forms.

OBSERVATIONS

Visitor observations were selected as a means of data collection because they were the most efficient and accurate means of recording visitor behaviors. Only by observing visitors could the researcher record which signs were read and how long visitors spent reading them. While visitors could have been asked to record how many and which signs they read, the definition of “read” may vary between visitors. For example, some visitors might believe they “read” a sign even if it was really more of a glance at the title of the sign. Additionally, visitors could not be expected to recall the length of time they spent reading each sign. In other words, “Observation is the most direct method of securing information about a visitor’s behavior” (Miles et al., 1982, p.159).
This portion of the Methodology first explains the purpose of the observations and how this method of data collection will help to answer the questions defined by the study. After briefly restating the goals of the visitor observations, the discussion will continue with a description of the procedures and techniques used for observation.

There are two primary purposes for visitor observations: 1) to record the actual time visitors spend looking at the signs and 2) to record various visitor and setting variables, in addition to animal visibility, which may have influenced visitor behavior, learning, and attitudes.

**Procedures For Observation**

The procedures for the observations undertaken in the current study will be described in detail so that others who wish to continue the study will have specific guidelines to follow. These procedures are also explained so that others may be able to identify what changes may be necessary to improve future studies. Another reason for explaining the procedures is so that the reader can judge the validity and reliability of the observations.

This portion of the thesis will describe the boundaries of the observation area, measures of visitor reading time, measures of visitor gestures, measures of additional visitor behaviors, and the pretest of the study. These procedures remained consistent throughout the data collection period. Observations for this study took place on Saturdays and Sundays during the months of April and May, 1996. Data were collected between 10:30 a.m. through 4:00 p.m. each day of the study.

**Observation Area**

Visitors were observed from the time that they approached the first red wolf sign on the main path (Sign #1 or #4) until they left the viewing area and passed the last red wolf sign on the main path (Sign #1 or #4). Observations were recorded on preprinted observation forms (refer to Appendix C for an observation form and Appendix D for a coded observation form) and visitors were approached with the questionnaire after they passed the last red wolf sign on the main path (refer to Figure 3.3 on page 33).

**Visitor Reading Time**

A stopwatch was used to record the amount of time the visitor spent looking at each of the four signs included in the study. The stopwatch was only activated during time periods in which the visitor stopped walking and turned his/her head toward the sign (Bitgood, et al., 1988; Zaremba and Toedter, 1993; Arndt, et al., 1993). The observer recorded the total time the visitor under observation spent looking at
each sign. This information was recorded in a manner that would later allow the researcher to distinguish the amount of time a visitor spent looking at each sign.

**FIGURE 3.13** - Visitor reading Sign #1 (refer to Figure 3.3 on page 33, for a map indicating the location of this sign)

**FIGURE 3.14** - Visitors reading Sign #3 (refer to Figure 3.3 on page 33, for a map indicating the location of this sign)
Visitor Gestures

The observer recorded the number of times the visitor under observation physically pointed out any aspect of the animal or its exhibit to any other visitor. The purpose of this observation was to determine if visitors showed a greater number of these behaviors when the animals were in view as a possible indication that visitors are more interested and involved. Screven explains that a crude measure of visitor interaction with an exhibit is to record such visitor behavior as pointing. "Such interaction reflects involvement -- a prerequisite to learning -- and is a useful indication that the conditions for learning are present" (1979, pp. 152-153). Therefore, the number of times visitors pointed to the exhibit, while the visitor under observation was near the railing in the viewing area, was recorded.

![Image of visitors pointing at a red wolf exhibit]

FIGURE 3.15 - Visitors pointing to a red wolf seen in the exhibit

Additional Observations

Space was provided for the observer to make additional observations about the behavior of the visitor. These behaviors were recorded in case there was a pattern of similar behaviors which had not been expected. By having a record of these observations, they could then be used to determine what relationships may exist between different visitor behaviors.

The Observation Form

There are five types of information which were recorded on the form: visitor, exhibit, and sign variable information; visitor behavior information; and basic record-keeping information. The components of the observation form will not be described in detail here because the information has already been presented.
earlier in the Methodology. Instead, this section will primarily serve as a concise reminder of what type of information was recorded on the observation form.

First of all, the visitor variable information recorded on the observation form included gender, group size and type, and direction of travel. Secondly, the sign variable information recorded on the observation form included viewing sequence, shade conditions, and presence of others. Next, the visitor behavior information recorded on the observation form included reading time at each sign, visitor gestures (pointing), and additional observations. Lastly, basic record-keeping information recorded on the observation form included the observation number, volunteer initials, and time of observation.

Preprinted observation forms were used to record the information. The list of what to measure, and how to measure it, had to be determined before conducting the actual experiment. "The first step in building up an observational schedule is to identify the limited range of behavior relevant to the evaluation project; it is not enough to observe, you have to observe something. Obviously these behaviors must relate to the problems to be solved" (Miles, et al., 1982, p. 159).

VISITOR QUESTIONNAIRES

An explanation for the reason of using questionnaires is described below, followed by a description of the organization and content of the questionnaire. Readers who are interested in the procedures used by volunteers to approach visitors and administer the questionnaire may refer to the written instructions provided to the volunteers in Appendix B.

The visitor questionnaire was developed as a means of gathering data which could not be collected from observations. Data collected from the visitor questionnaires included: whether or not any animals were in view, the number of animals within view, the activity levels of the animals, visitor satisfaction regarding the exhibit and the signs, visitor attitudes regarding the species, visitor perceptions of crowd conditions and weather conditions, potential visitor behaviors after leaving the zoo, visitor time of arrival at the zoo, number of previous visits to the exhibit, visitor age and gender. There was also a section in the questionnaire which "quizzed" visitors on the information presented on the signs included in the study.

The reasons for collecting all of this information were to allow the researcher 1) to determine the effect of animal visibility on sign readership, 2) to determine effect of animal visibility on visitor learning, 3) to determine the effect of animal visibility on visitor attitudes toward the species and the effect of animal visibility on intended behaviors recorded by visitors, 4) to determine the effect of animal visibility on visitor satisfaction with the exhibit, and 5) to determine if the following variables influenced the data results: visitor's length of time at the zoo prior to arriving at the Red Wolf Exhibit, number of previous
visits to the Red Wolf Exhibit by the visitor, crowd and weather conditions, number of signs noticed, level of knowledge prior to visit, age, and gender as well as visitor perception of crowd and weather conditions, and the signs. This information can most easily be obtained by directly asking the person who has been observed. Visitor questionnaires were an essential method of data collection which helped to gather data concerning visitor views of the animals, visitor attitudes, and intended behaviors of visitors, all of which would otherwise have been very difficult to determine.

There are a number of reasons why visitor questionnaires have been chosen over visitor interviews as a means of obtaining information. First of all, people were asked to respond to questions verbally are less likely to respond honestly and are more likely to provide what they consider is the "right" response. The responses people give are likely to be influenced by the interviewer's facial expressions and body language. Another advantage of using questionnaires was that they could be given to several visitors from the same group at the same time. Finally, responses from questionnaires are generally easier to analyze because there is much greater uniformity in how the questions are asked and answered (Henerson, et al., 1978).

Henerson, Lyons Morris, and Fitz-Gibbon also list other advantages to using questionnaires: "They permit a person a considerable amount of time to think about his answers before responding. They can be given to many people simultaneously. They provide greater uniformity across measurement situations than do interviews. Each person responds to exactly the same questions. In general, the data they provide can be more easily analyzed and interpreted than the data received from oral responses" (1978, p. 29). Another reason why questionnaires were used as a means of collecting data is that such self-reports are an acceptable means to obtain information about people's attitudes (Henerson, et al., 1978).

Henerson, Lyons Morris, and Fitz-Gibbon (1978) recommend that the objectives for the procedure be identified first before designing a questionnaire. It is important that the researcher understand exactly what information is to be obtained from the questionnaire. The primary goals of the questionnaire form used in the current study were 1) to determine the implications of animal visibility on visitor attitudes for the species and its environment, 2) To determine implications of animal visibility on visitor learning, 3) to determine the implications of animal visibility on intended behavior recorded by visitors, and 4) to determine if various visitor or setting variables may have influenced visitor behavior, learning, or attitude.

**The Questionnaire Form**

The questionnaire had to meet three goals: the form had to be carefully designed to ensure that 1) unnecessary questions were not asked, 2) questions were properly worded, and 3) questions were asked on the questionnaire form which would help answer the research questions. The following discussion will serve as a means of clarifying for the reader that the final questionnaire form met these three goals (Please
refer to Appendix E for a sample of the questionnaire form and Appendix F for the coding used on the questionnaire.

**Organization**

The questionnaire was structured so that related questions were located together on the form. For example, questions asking about visitor opinions of the exhibit (questions #6-8) were presented together and questions asking about visitor opinions of signs (questions #11-15) were located together as a distinct section of the questionnaire.

The purpose of dividing the questionnaire into sections was to create a structured format that was easy to follow. The structure of the individual questions was also to make the questionnaire as simple as possible to avoid confusion for visitors reading the form. While a small portion of the questions require short, fill-in-the-blank responses, and one open-ended statement, the majority of the questions are close-ended with ordered answer choices. This structure greatly simplifies data analysis and is also less demanding for participants (Dillman, 1978).

The questionnaire is divided into the following nine categories: 1) Communication with visitor, 2) Volunteer data entry, 3) General visitor information, 4) Visitor attitudes toward the exhibit, 5) Visitor attitudes toward the signs, 6) Visitor attitudes toward the species and its environment, and 7) Intended visitor behavior after leaving the zoo, 8) Visitor knowledge of interpreted information, and 9) Additional visitor comments.

The questionnaire was subdivided at another level, as well: Questions were initially simple, became increasingly more complex, and then concluded with simple questions. Several authors recommend that questionnaires start with easy questions requiring factual data that can be easily answered by the respondents (Miles, et al., 1982; Sommer and Sommer, 1991; Whittall, 1994). Whittall also recommends that the last few questions on the questionnaire, again, be simple questions involving factual data. Thus, it is at the beginning of the questionnaire that visitors are asked their time of arrival, view of the animals, and at the end of the questionnaire that visitors are asked to note their age and gender.

The following discussion provides the rationale for each of the nine categories which compose the questionnaire.
Categories
Each of the nine categories found in the questionnaire were designed with a distinct purpose. This discussion will explain the rationale of each category so the reader is able to understand exactly what purpose was intended to be served by each of these categories.

1. Communication With Visitor: It was essential that the questionnaire be able to communicate to the visitor in several ways. First of all, the questions had to be clearly written and easily understood. In order to achieve this goal, several authors were referenced for guidance concerning proper question format, sentence and wording recommendations, and organizational format (Miles, et al., 1982; Dillman, 1978; Sommer and Sommer, 1991).

Second, while the purpose of the questionnaire had to be clearly understood, information could not be provided that might influence visitor responses. In order to help explain the purpose of the questionnaire, a title was developed to provide a very general description of the study (Serrell, 1989) and an introductory statement was included to provide additional general information describing the study (Henerson, et al., 1978; Sommer and Sommer, 1991).

Third, it was important that visitors understood the method of recording their response. Therefore, brief directions were given for each set of questions on the questionnaire (Henerson, et al., 1978). For example, when rating scales were used as a means of recording visitor response, visitors were directed to circle the response on the scale which most closely reflected their answer.

Finally, it was deemed important to the researcher that visitors feel appreciated for having taken the time to assist the researcher. To ensure that visitors realized the researcher’s gratitude for their assistance, visitors were thanked verbally by the volunteer (Dillman, 1978) and were also thanked on the questionnaire in both the introductory and closing statements (Sommer and Sommer, 1991).

2. Volunteer Data Entry: On each questionnaire form was a shaded box in which visitors were instructed not to write. In this shaded area, volunteers recorded the appropriate visitor group number, the visitor under observation’s time of arrival at the exhibit, and whether or not the questionnaire was completed by the visitor under observation or one of the other group members.

3. General Visitor Information: Certain information about the visitor was needed in order to understand the relationship between the amount of time spent reading the signs and other factors associated with individuals and their backgrounds. For example, visitors who had only been at the zoo for one hour may spend more time reading signs than people who had been at the zoo for more than three hours.
The following general visitor information was obtained from the questionnaire: Length of time of visit at the zoo prior to visiting the Red Wolf Exhibit, number of previous visits to the Red Wolf Exhibit, view of the red wolves, number of red wolves seen, activity level of the red wolves, attitudes toward crowd and weather conditions, number of signs noticed, level of knowledge prior to visit, age, and gender.

4. Visitor Satisfaction With The Exhibit: Visitors were asked questions regarding their satisfaction with their view of the red wolves, the distance from which the red wolves could be viewed, and the overall appearance of the Red Wolf Exhibit. The reason for asking these visitor satisfaction questions is that different visitors may have the same view but may react differently with varying levels of satisfaction. For example, some visitors may be very satisfied with a partial view of the animal while others may be very dissatisfied. Additionally, the level of satisfaction may influence sign readership. If the visitor is dissatisfied, it may be that he/she will not take the time to read the signs. Similarly, satisfaction with the viewing distance from the animals on exhibit and the appearance of the exhibit may also affect readership. Therefore, visitors were asked to respond on a 1-5 Likert scale regarding their degree of satisfaction with each of these exhibit characteristics.

5. Visitor Satisfaction With The Signs: Visitors were also asked to express their satisfaction with the signs at the Red Wolf Exhibit. The purpose of this portion of the questionnaire was to determine if there was a relationship between sign readership and satisfaction with the signs. Visitors who find the signs unattractive, uninformative, difficult to understand, or an unimportant part of the exhibit may spend less time reading signs. Visitors were asked to rate, on a 1-5 scale, each of the following: attractiveness, informative value, difficulty in understanding, quantity, and value of signs (for example, did the visitor consider the signs an important part of the exhibit).

6. Visitor Attitudes Toward The Species: Visitors were asked to express their attitudes toward the species and its environment. The purpose of asking visitors to react to these statements was to determine if there was a relationship between animal visibility and visitor attitudes, or between sign readership and visitor attitudes. The reason for asking so many questions related to visitor attitudes was to ensure that adequate data would be collected to increase the reliability and validity of the measure of visitor attitudes (Henerson, et al., 1978; C. Osgood, C. Suci, and P. Tannenbaum cited in D’Agostino, et al., 1992). Therefore, in order to better determine visitor attitudes, visitors were asked to respond, using a 1-5 scale, their level of agreement or disagreement to the following statements: The natural habitat of red wolves should be protected from development, red wolves should be reintroduced into the wild areas of North Carolina, red wolves are a threat to humans, and red wolves should be reduced in number in the wild.
7. **Intended Visitor Behavior:** Visitors were asked to indicate, on a 1-5 scale, the likelihood of engaging in three specific behaviors after leaving the zoo: 1) supporting a decision to use a portion of their tax dollars to buy habitat to be reserved for red wolves (D’Agostino, et al., 1992), 2) researching red wolves at the library, and 3) watching a television program about red wolves. The purpose of asking visitors these questions was to determine if animal visibility influenced visitor responses to behavioral questions.

8. **Visitor Knowledge:** Visitors were asked to respond to six “quiz” questions concerning the information presented on the signs. The questions included three formats: True/False, multiple-choice, and fill-in-the-blank. The purpose of quizzing visitors was to determine 1) if visitors really read the signs and 2) if the amount of information visitors learn, or can recall, is influenced by the visibility of the animals in the exhibit.

Visitors were also asked how much they felt they learned from their visit to the red wolf exhibit and how they felt about what they learned. These questions were asked to determine what effect animal visibility may have on perceived knowledge gain and perceived importance of what was learned. Another purpose of asking these questions was to determine if perceived knowledge gain and perceived importance of what was learned could influence visitor satisfaction with the exhibit. Therefore, visitors were asked to rate their learning experience on two Likert-type scales ranging from “learned little” to “learned a lot” and from “not important [part of the exhibit]” to “very important [part of the exhibit].”

9. **Additional Comments:** Visitors were invited to make additional comments on the questionnaire form. This statement was included because these comments may have introduced unknown aspects of the visit which could have affected the visitors’ experience.

**A BACK-UP METHOD FOR THE QUESTIONNAIRE**

As useful as the visitor questionnaires proved, there were instances in which visitors did not wish to fill out the questionnaire. When the visitor under observation did not wish to fill out a questionnaire, the visitor was asked about the view of the animals so that the data collected from the observations could still be used. The volunteers then recorded this information onto a survey table so that the researcher would still have a record of animal visibility (refer to Appendix I for a sample of the survey table).
STATISTICAL TESTS

The following four statistical tests were used to analyze data: the Two-Sample Z-Test Applied to Proportions, the Two-Sample T-Test for Means, the One-Way Analysis of Variance (ANOVA), and Chi-Square Analysis.

The Two-Sample Z-Test Applied to Proportions was used to compare the percentage of visitors who read signs among two different groups of visitors. For example, data was collected for three groups of visitors, 1) those who saw no-view, 2) those who saw a partial-view, and 3) those who saw a full-view of a red wolf; each Two-Sample Z-Test calculated during the analysis of data could only be used to compare two of these groups at a time.

The Two-Sample T-Test for Means was used to compare differences between the mean reading times for two groups of visitors. Like the Two-Sample Z-Test for Proportions, this test could not compare all three visibility groups at one time; instead, only two visibility groups could be compared per calculation. For example, this test was used to compare the differences in average reading times between visitors who saw no red wolves and those who saw a partial view of a red wolf. Two additional calculations had to be made to determine the relationship between average reading times and all three visitor groups.

The One-Way Analysis of Variance (ANOVA) was used to identify significant differences among mean questionnaire responses for more than two groups of visitors: for example, between visitors who had no view, visitors who had a partial view, and visitors who had a full view of a red wolf.

Finally, Chi-Square Analysis was used to determine if there was a dependence between two variables. For example, the test was used to determine whether or not there was a difference in the number of visitors who read signs as a result of such variables as the presence, or lack of, shade or other people at signs, length of time at the zoo, number of previous visits to the exhibit, age, and gender.

For all statistical analyses, p=.10. any test results with p=.10 or p<.10, was considered to indicate a significant relationship.1

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1 The testing methods and the p-value used in analyzing data were the methods of analysis recommended by Dr. Hinkelmann and Ph.D. student, Kiho Kim, in association with the Statistical Consulting Center at Virginia Polytechnic Institute and State University.
CONCLUSION

Throughout this chapter, the methods and procedures used to collect data have been described. The criteria used to determine exhibit selection were valuable in lessening the complexity of the study by limiting the number of characteristics associated with the exhibit that may have complicated observations. Similarly, the variables associated with both the exhibit and the signs were identified, recorded, measured, and analyzed to better understand how they may affect visitor behavior, learning, and attitudes. Analysis of these variables helped to determine what other factors, other than animal visibility, may have had an effect of visitor behavior, learning, and attitudes. In order to increase the validity of the study, this information was collected using primarily two methods: visitor observations and visitor questionnaires. Brief and informal visitor surveys were also used with those visitors who did not wish to complete a questionnaire. By providing a detailed description of the procedures used in conducting this study, and the methods used to collect data, it is hoped that others researching visitor behavior at zoological parks will be able to use this thesis as a reference of what, and perhaps what not, to do in future studies.
Results & Analysis

In this chapter, the results of the statistical testing is presented. First, the general results of data collection are described, followed by the results of data analysis in terms of the five research questions presented in the introductory chapter. Based on the results presented in this chapter and the implications of the results discussed in Chapter 5, recommendations will be developed for the design of zoo exhibits in the future.

RESULTS

GENERAL RESULTS OF DATA COLLECTION

Observations took place on eight days over a period of four weekends during the months of April and May, 1996. A total of 348 observations were successfully completed during this time. Among the 348 visitors who were observed as they experienced the red wolf exhibit, 135 (38.8%) were not able to see a red wolf. 137 (39.4%) saw a partial view of a red wolf, and 76 (21.8%) got a full view of a red wolf.¹

Of the 348 observations made, a total of 94 people (27.0%) were observed stopping to read signs.² Out of the 94 visitors who stopped to read, 66 people (70.2%) read only one sign, 23 people (24.5%) read two signs, 4 people (4.3%) read three signs, and one person read all four signs (1.1%). Therefore, out of the 1392 opportunities there were for the 348 visitors to read one of the four signs, signs were read a total of 128 times (9.2% out of 1392).

Of the 348 observations made, a total of 184 visitors under observation agreed to fill out a questionnaire. Therefore, only half (52.9%) of the 348 visitors observed actually completed a questionnaire. However, among those who did not wish to complete a written questionnaire, 164 out of 166 visitors (98.8%) were willing to respond to an informal survey which provided the researcher a brief description of the visitors’ degree of visibility of the red wolves and a description of what the red wolves were doing.

There are several reasons why so few visitors under observation completed a questionnaire. First of all, a large number of visitors were family groups with young children. There were many times when the group did not stop to fill out a questionnaire because of the children in the group. For example, not only would

¹ Please refer to Chapter 3, page 37, Visibility Level, to review the methods used to record visitors’ view of the red wolves.
children urge the other members to “hurry up”, but children also employed numerous other tactics to encourage the other members to keep moving, including crying, arguing, or running ahead of the rest of the group. Additionally, crowd conditions seemed to have an impact on visitors’ willingness to fill out the survey. During times of heavy crowding around the exhibit, people were less likely to complete a questionnaire. However, it seems the primary reason why so few visitors under observation completed a questionnaire was that many times one of the other group members volunteered, or was volunteered by his/her companions, to complete the form for the rest of the group.

In addition to the visitors who completed questionnaires after viewing the red wolf exhibit, a control group, consisting of another 57 visitors, completed questionnaires upon entering the zoo. The purpose of the control group was to establish benchmarks how the visit to the exhibit influenced visitor responses.²

RESULTS OF RESEARCH QUESTIONS

In the following discussion, each of the five research questions will be discussed. Each question will be followed by a description of the observation and survey results relevant to that question.

RESEARCH QUESTION #1: How does the visibility of the animals on exhibit influence visitor behavior?

This research question is examined by three different measures: 1) the number of visitors who stopped to read signs, 2) the average amount of time visitors spent reading signs, and 3) the amount of visitor interaction with the exhibit, indicated through visitor gestures. The following discussion presents the findings for each of these three measures.

Do more visitors stop to read the signs at zoo exhibits if the animals on exhibit are visible?

First of all, there was a significant relationship between sign readership and sign location in relation to the exhibit viewing area (Table 4.1 on page 63). Regardless of the view of the red wolves, significantly more visitors read signs located at the viewing area compared to the number who read the signs either before or after the viewing area. Of all the people observed reading signs located around the exhibit, 60.9% read a sign located at the viewing area compared to 18.8% who read signs located before and 20.3% who read signs located after the viewing area. Therefore, it seems that, regardless of animal visibility, visitors are more likely to read signs located at the viewing area of the exhibit. Because these percentages are based on nearly 350 observations, including over 90 occurrences in which a visitor under observation read a sign.

² Please refer to Chapter 3, page 50, Visitor Reading Time, to review the methods used to determine sign readership.
³ Please refer to Chapter 3, page 47, to review the discussion concerning the control group.
these differences are statistically, as well as practically, significant. These findings provide some guidance concerning where to locate signs and what type of information to put on signs located in different areas around a particular exhibit. For instance, based on the results of this study it would seem that signs should be located at exhibit viewing areas, or closely following the viewing areas, where they are more likely to be read by visitors. Additionally, information which is to be communicated to visitors should be organized according to a hierarchy of importance, in which case information categorized as being of primary importance should be placed on the signs located at the viewing area of the exhibit.

<table>
<thead>
<tr>
<th>TABLE 4.1</th>
<th>SIGN LOCATION &amp; VISITOR SIGN READERSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGN READERSHIP BEHAVIOR</td>
<td>LOCATION OF SIGNS IN RELATION TO EXHIBIT VIEWING AREA</td>
</tr>
<tr>
<td>Number of Signs Read (out of the 128 signs read) According to Location</td>
<td>BEFORE</td>
</tr>
<tr>
<td>24</td>
<td>78</td>
</tr>
<tr>
<td>Percentage of Signs Read According to Location out of the 128 Signs Read</td>
<td>24 / 128</td>
</tr>
<tr>
<td>= (18.8%)</td>
<td>= (60.9%)</td>
</tr>
<tr>
<td>Percentage of Signs Read According to Location out of the 1392 Opportunities to Read (348 people x 4 signs = 1392)</td>
<td>24 / 1392</td>
</tr>
<tr>
<td>= (1.7%)</td>
<td>= (5.3%)</td>
</tr>
<tr>
<td>% of Visitors who Read According to Location out of the 348 Visitors Under Observation</td>
<td>24 / 348</td>
</tr>
<tr>
<td>= (6.9%)</td>
<td>= (22.4%)</td>
</tr>
<tr>
<td>Average Time Spent at Signs According to Location</td>
<td>14.2 seconds</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of all 348 visitors under observation

**Statistical method of analysis used to determine significance: Two Sample Z-test Applied to Proportions and One-Way Analysis of Variance (ANOVA)

***Shaded areas indicate significant differences between categories at p=.10

****Parentheses are used to separate numbers that are significantly different from each other

Although, overall, sign readership was low, a significantly greater percentage of visitors stopped to read signs after seeing a full view of a red wolf (32.9%) compared to visitors who did not see any red wolves (20.7%). Additionally, when examining the influence of animal visibility on reading for just the signs located at the viewing area, as opposed to the signs located after the viewing area, there was a significant relationship between the percentage of visitors who stopped to read and the level of animal visibility (Table 4.2 on page 64). A greater percentage of visitors stopped to read a sign located at the viewing area when a red wolf was in full view (27.6%) compared to when a red wolf was not in view (19.3%).

Results & Analysis 63
The results were similar for readership of signs located after the viewing area. Although fewer people, overall, read signs located after the viewing area, animal visibility had a similar effect on the number of visitors who read signs (Table 4.2, this page). A significantly greater percentage of visitors stopped to read a sign located after the viewing area when a red wolf had been in full view (14.5%) compared to when a red wolf was in partial view (6.6%) or not in view (3.0%). Therefore, the effect of having a full view of the animals on exhibit does seem to influence visitor reading behavior even after they have left the immediate vicinity of the viewing area.

Not only was there a relationship between animal visibility and the number of visitors who read signs, but there was also a relationship between animal visibility and the number of visitors who stopped at two locations to read (Table 4.3 on page 66). Significantly more people who had a full view of the wolf stopped to read both at and after the viewing area for the exhibit. Of the visitors who saw a full view of a red wolf, 9.2% read signs both at and after the viewing area compared to the 1.5% of visitors who read both...
signs after not having a view of a red wolf. These results, again, indicated that the effect of animal visibility could extend to signs located beyond the viewing area of the animals on exhibit.

Because some visitors read signs at more than one location, the percentage of visitors who read signs (discussed earlier) is different than the percentage of signs read (Table 4.2 on page 64). When looking at the total number of opportunities there were for visitors to read signs (each visitor had the opportunity to read four signs) sign readership was low. However, signs were read significantly more often when visitors had a full view of a red wolf (10.5%) compared to the number of times signs were read when visitors had no view (5.6%) of a red wolf. These results continue to suggest that there is a relationship between animal visibility and sign readership.

Furthermore, the results of the study indicate that there may be a relationship between the number of animals within view and sign readership (Table 4.4 on page 67). Significantly more signs were read by visitors who had seen more than one red wolf (10.6%) compared to the number of signs read by visitors who saw no red wolves (6.1%). However, while the percentage of people who read signs was greater for those who saw one wolf (8.8%), compared to those who saw no wolves (6.1%), this difference was not significant. Similarly, while there was a difference between the number of visitors who read when one red wolf was in view (8.8%) and when two red wolves were in view (10.6%), the difference was not significant. These results suggest that those who see a greater number of animals may read more signs. Further testing with a larger population would be needed to confirm this. Additionally, a pattern was found indicating that a greater percentage of visitors stopped to read signs, both at and after the viewing area, when two animals were within view compared to when only one was within view. However, the relationship was not shown to be significant based on the data collected for this study. Again, a larger study sample would need to be examined to determine if the relationship is real.

Finally, very few visitors read both of the signs located at the viewing area of the red wolf exhibit. However, among those observed reading at the viewing area, there was a significant relationship between wolf visibility and the number of people who read both signs. Of the eight visitors who did read both signs, seven read the signs when they had a full view of a red wolf (87.5%) and only one visitor (12.5%) read both signs who did not see a red wolf.

In summary, these findings indicate that 1) regardless of view, visitors are more likely to read signs at the viewing area of an exhibit rather than before or after, and 2) a larger number of visitors read, and read more than one sign, when they have a full view of the animals on exhibit. Additionally, although no significant relationship could be determined, there is evidence which suggests that a larger number of visitors may read signs when more than one animal is within view.

Results & Analysis
TABLE 4.3
ANIMAL VISIBILITY & THE PERCENTAGE OF VISITORS WHO READ SIGNS

<table>
<thead>
<tr>
<th>SIGN READERSHIP BEHAVIOR</th>
<th>LEVEL OF VISIBILITY OF THE RED WOLVES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO VIEW</td>
</tr>
<tr>
<td># of Visitors Observed According to Visibility</td>
<td>135</td>
</tr>
<tr>
<td># of Visitors Who Read According to Visibility</td>
<td>28</td>
</tr>
<tr>
<td>% Of Visitors Who Read According To Visibility</td>
<td>(20.7%)</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Both At and After the Viewing Area</td>
<td>2</td>
</tr>
<tr>
<td>% of Visitors Who Read Signs Both At and After the Viewing Area</td>
<td>(1.5%)</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of all 348 visitors under observation who responded to either a written questionnaire or the verbal survey.
**Statistical method of analysis used: Two Sample Z-test Applied to Proportions
***Shaded areas indicate significant differences between categories at p=.10
****Parentheses are used to separate numbers that are significantly different from each other

Do visitors spend more time reading signs at zoo exhibits if the animals on exhibit are visible?
While the amount of time spent reading a sign ranged from zero to 41 seconds, the average amount of time spent reading signs, regardless of the view, was fairly short (13.9 seconds). However, there was a relationship between both animal visibility and the number of animals within view, and the amount of time people tended to spend reading signs (Table 4.5 on page 68). The greater the visibility of the animals on exhibit, the more time visitors spent reading signs. When making comparisons among the average reading times of just those visitors who read signs, visitors who had a full view of a red wolf spent significantly more time reading (21.0 seconds) compared to visitors who saw a partial view (14.5 seconds) or no view (12.6 seconds) of a red wolf. Therefore, among visitors who read, those who saw a full view of a red wolf read an average of approximately 6.5 seconds longer compared to those who got a partial view and 8.5 seconds longer than those who did not see a red wolf.
### TABLE 4.4
NUMBER OF ANIMALS WITHIN VIEW & SIGN READERSHIP BEHAVIOR

<table>
<thead>
<tr>
<th>SIGN READERSHIP BEHAVIOR</th>
<th>NUMBER OF RED WOLVES WITHIN VIEW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO WOLVES</td>
</tr>
<tr>
<td># of Visitors Observed According to # of Animals</td>
<td>49</td>
</tr>
<tr>
<td># of Visitors Who Read According to # of Animals</td>
<td>12</td>
</tr>
<tr>
<td>% Of Visitors Who Read According to # of Animals</td>
<td>24.5%</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Both At and After the Exhibit Viewing Area</td>
<td>0</td>
</tr>
<tr>
<td># Of Signs Read Divided by the Total Number of Signs Passed</td>
<td>12</td>
</tr>
<tr>
<td>% Of Signs Read According to # of Animals</td>
<td>6.1%</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Located At the Viewing Area</td>
<td>12</td>
</tr>
<tr>
<td>% of Visitors Who Read Signs Located At the Viewing Area</td>
<td>24.5%</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Located After the Viewing Area</td>
<td>0</td>
</tr>
<tr>
<td>% of Visitors Who Read Signs Located After the Viewing Area</td>
<td>0</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 184 visitors under observation who responded to a written questionnaire.

**Statistical method of analysis: Two Sample Z-Test Applied to Proportions

***Shaded areas indicate significant differences between categories at p=.10

****Parentheses are used to separate numbers that are significantly different from each other

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Similar results are found when looking at the relationship between animal visibility and average reading times at just the signs located at the viewing area (Table 4.5 on page 68). Visitors who had a full view of an animal spent significantly more time reading signs (17.7 seconds) compared to visitors who saw a partial view (13.2 seconds) or no view (11.5 seconds). These results suggest that a full view of an animal on exhibit significantly increases the amount of time visitors spend reading.

However, while there was a significant relationship between the level of animal visibility and the average amount of time signs were read at the viewing area, animal visibility did not have the same effect on the amount of time signs were read after the viewing area (Table 4.5 on page 68). There was no significant

Results & Analysis
increase in the amount of time signs were read when visitors had a full view (13.5 seconds) compared to when visitors had a partial view (10.7 seconds) or no view (13.8 seconds) of the animals on exhibit. Therefore, after seeing a full view of an animal, visitor interest may be raised enough that more visitors stop to read a sign located after the viewing area, but visitor interest is apparently not heightened enough to significantly increase the amount of time visitors spend reading signs located after the viewing area.

| TABLE 4.5 |
| ANIMAL VISIBILITY & MEAN READING TIMES |

<table>
<thead>
<tr>
<th>SIGN READERSHIP BEHAVIOR</th>
<th>LEVEL OF VISIBILITY OF THE RED WOLF EXHIBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO VIEW</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading per Visitor (Among Visitors who Read)</td>
<td>(12.6)</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading Per Sign (Among Visitors Who Read)</td>
<td>(11.8)</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading By Visitors Who Read Signs Located At the Exhibit Viewing Area</td>
<td>(11.5)</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading By Visitors Who Read Signs Located After the Exhibit Viewing Area</td>
<td>(13.8)</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 128 visitors under observation who read a sign and who either responded to a questionnaire or to the verbal survey.

**Statistical method of analysis used: One-Way Analysis of Variance (ANOVA)

***Shaded areas indicate significant differences between categories at p=.10

****Parentheses are used to separate numbers that are significantly different from each other

Furthermore, while not found to be a statistically significant difference, there may be a relationship between average reading time of signs located at the viewing area and the activity of the animals within view (Table 4.6 on page 69). Visitors who only saw a red wolf laying down spent less time reading, on average, (12.7 seconds) compared to visitors who saw the animals sitting (19.2 seconds) or who saw the animals walking, running, or playing (17.0 seconds). These results may lack statistical significance because of the sample size (Table 4.7 on page 70). For instance, average reading times for the “laying down” category were calculated from only the 23 instances in which signs were read while a red wolf was laying down. Similarly, average reading times for the “sitting” category were calculated from the 7 instances in which signs were read while a red wolf was sitting. Finally, average reading times for the “walk-play” category were calculated from the 34 instances in which signs were read while a red wolf was seen walking, running, or playing. Because of these low numbers, particularly for the “sitting” category, additional studies with larger sample sizes are needed for further analysis. Analyzing a larger group of visitors may produce results.
which indicate that there is a real relationship between animal activity and sign readership of signs located at the viewing area. However, the results of this study still seem to suggest that there may be a relationship between animal activity levels and sign readership.

**TABLE 4.6**
**ANIMAL ACTIVITY LEVELS & MEAN READING TIMES**

<table>
<thead>
<tr>
<th>SIGN READERSHIP BEHAVIOR</th>
<th>ACTIVITY LEVEL OF RED WOLVES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO VIEW</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading per Visitor</td>
<td></td>
</tr>
<tr>
<td>(Among Visitors who Read)</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td>11.8</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading Per Sign</td>
<td></td>
</tr>
<tr>
<td>(Among Visitors Who Read)</td>
<td>11.7</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading By Visitors</td>
<td></td>
</tr>
<tr>
<td>Who Read Signs Located at the Exhibit Viewing Area</td>
<td>11.8</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading By Visitors</td>
<td></td>
</tr>
<tr>
<td>Who Read Signs Located After the Exhibit Viewing Area</td>
<td>11.8</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 84 visitors under observation who read a sign and who indicated the activity level of the red wolves on either a written questionnaire or a verbal survey.*

**Statistical method of analysis used to determine significance: One-Way Analysis of Variance (ANOVA)**

***Shaded areas indicate significant differences between categories at p=.10***

****Parentheses are used to separate numbers that are significantly different from each other****

Furthermore, visitors who saw two red wolves spent more time reading signs located after the viewing area (Table 4.8 on page 71). Visitors who saw two red wolves spent an average 17.7 seconds reading signs located after the exhibit while visitors who saw one red wolf spent 11.0 seconds reading signs located after the exhibit. Still, because of the small sample size (Table 4.7 on page 70), these results lack statistical significance. However, these results further substantiate the need for future study to determine what relationship may exist between animal activity levels and sign readership.

In summary, these findings suggest that visitors spend more time reading signs located at the viewing area when they have a full view of at least one animal. There are also indications, although less conclusive, that visitors will spend more time reading if the animals are seen sitting, walking, running, or playing rather...
than lying down and that visitors will spend more time reading signs located after the viewing area when more than one animal is within view.

<table>
<thead>
<tr>
<th>TABLE 4.7</th>
<th>ANIMAL ACTIVITY LEVELS &amp; VISITOR SIGN READERSHIP BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGN READERSHIP BEHAVIOR</td>
<td>ACTIVITY LEVEL OF RED WOLVES</td>
</tr>
<tr>
<td># of Visitors Observed According to Activity</td>
<td>NO VIEW</td>
</tr>
<tr>
<td></td>
<td>133</td>
</tr>
<tr>
<td># of Visitors Who Read According to Activity</td>
<td>28</td>
</tr>
<tr>
<td>% Of Visitors Who Read According to Activity</td>
<td>21.1%</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Both At and After the Exhibit Viewing Area</td>
<td>2</td>
</tr>
<tr>
<td># Of Signs Read Divided by the Total Number of Signs Passed</td>
<td>30</td>
</tr>
<tr>
<td>% Of Signs Read According to # of Animals</td>
<td>133 people x 4 signs</td>
</tr>
<tr>
<td></td>
<td>5.6%</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Located At the Viewing Area</td>
<td>26</td>
</tr>
<tr>
<td>% of Visitors Who Read Signs Located At the Viewing Area</td>
<td>19.5%</td>
</tr>
<tr>
<td># of Visitors Who Read Signs Located After the Viewing Area</td>
<td>4</td>
</tr>
<tr>
<td>% of Visitors Who Read Signs Located After the Viewing Area</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 327 visitors under observation who indicated the activity level of the red wolves on either a written questionnaire or a verbal survey. Statistical method of analysis used to determine significance: Two Sample Z-Test Applied to Proportions. Shaded areas indicate significant differences between categories at p=.10. Parentheses are used to separate numbers that are significantly different from each other.

When comparing average reading times among visitors who had different degrees of visibility of the animals, the greatest increase in average time was little more than eight seconds. Although this increase may seem small, it still has substantial practical value. For instance, text presented on interpretive signs has become increasingly succinct, to the point in which very important information (such as the endangered status of an animal or the need for additional land to successfully reintroduce an animal) can be communicated to the average visitor in less than eight seconds. Furthermore, the cumulative effect of this
**TABLE 4.8**  
NUMBER OF ANIMALS WITHIN VIEW & MEAN READING TIMES  

<table>
<thead>
<tr>
<th>SIGN READERSHIP BEHAVIOR</th>
<th>NUMBER OF RED WOLVES WITHIN VIEW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO WOLVES</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading per Visitor (Among Visitors Who Read)</td>
<td>13.8</td>
</tr>
<tr>
<td>Average # Seconds Spent Reading Per Sign (Among Visitors Who Read)</td>
<td>13.8</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading By Visitors Who Read Signs Located At the Exhibit Viewing Area</td>
<td>13.8</td>
</tr>
<tr>
<td>Average # of Seconds Spent Reading By Visitors Who Read Signs Located After the Exhibit Viewing Area</td>
<td>(0)</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 54 visitors under observation who read a sign and responded to a questionnaire.  
**Statistical method of analysis used: One-Way Analysis of Variance (ANOVA).  
***Shaded areas indicate significant differences between categories at p=.10.  
****Parentheses are used to separate numbers that are significantly different from each other.

“small” increase in sign readership has the potential to be quite substantial. If visitor reading time is similarly affected at other zoo exhibits and visitor reading time is increased by eight seconds per exhibit in which visitors have a view of the animals on exhibit, then the amount of information read by visitors may be considerably increased.

**Does visitor interaction between visitors, as indicated through visitor gestures, increase if the animals on exhibit are visible?**

The number of times visitors pointed while they were located at the exhibit viewing area was recorded. The purpose of these observations was to determine if visitors showed a greater number of these behaviors when the animals were in view as a possible indication of their level of involvement: “Such interaction reflects involvement—a prerequisite to learning—and is a useful indication that the conditions for learning are present” (Screven, 1979, pp. 152-153). The results of this study indicate that visitor gesturing, namely pointing, was related to the visibility of the animal (Table 4.9 on page 73). Significantly more visitors pointed at the exhibit when the animal was either within full view (37.0%o) or partial view (36%o) compared to when the animals were not in view at all (8.16%o). Neither the activity levels of the animals nor the number of animals within view had a significant relationship with the number of visitors pointing at the exhibit. Of the visitors who had a view of a red wolf, a similar percentage of visitors pointed at the exhibit regardless of whether the animal was laying down (37.8%), sitting down (28.0%), or more active (38.5%).

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While it may seem that the percentage of visitors observed pointing to seated animals is much lower than compared to the other two categories, there were relatively few visitors observed in this category. As a result, testing did not indicate that the difference was statistically significant. Similarly, there was no significant difference in the number of visitors pointing at the exhibit when there was one red wolf in view (37.5%) compared to when there were two red wolves within view (34.0%). Therefore, while there is a significant relationship between animal visibility and visitor interaction, the activity level and number of animals within view does not seem to have a significant relationship, based on the data collected during this study.

In summary, these findings regarding Research Question #1 suggest that visitor behavior is influenced by the view of the animals on exhibit in the following ways: 1) regardless of view, visitors are more likely to read signs at the viewing area of an exhibit rather than before or after, 2) a larger number of visitors read, and read more than one sign, when they have had a full view of the animals on exhibit, 3) visitors spend more time reading signs located at the viewing area when they have a full view of at least one animal, 4) there is more interaction between visitors, as indicated by visitors’ pointing at the exhibit, when animals are either within partial or full view, and 5) there are also indications, although less conclusive, that a larger number of visitors read when more than one animal is in view and that visitors spend more time reading if the animals are seen sitting, walking, running or playing, rather than lying down and that visitors spend more time reading signs located after the viewing area when more than one animal is within view.

**RESEARCH QUESTION #2:** Do visitors learn more from interpretive signs at zoo exhibits when an animal on exhibit is visible?

This research question is studied by three different measures: 1) by giving visitors a quiz based on the information presented on the signs located around the exhibit, 2) by asking visitors how much they felt they learned from the exhibit, and 3) by asking visitors how important was the information they learned from the exhibit. The following discussion presents the findings for each of these three measures.

**Do visitors learn more from interpretive signs at zoo exhibits when an animal on exhibit is visible?**

The average quiz score of the 315 visitors who filled out questionnaires after viewing the red wolf exhibit was relatively low and, in fact, did not differ from the average quiz score of the 57 visitors from the control group (refer to Appendix F and Appendix H to see how questions were coded and scored for both groups). Both groups scored an average of approximately 5.5 points out of a total possible 12 points. This is particularly important to note because while all 315 visitors in the study group had seen the red wolf exhibit just prior to being asked to complete a questionnaire, only 23 people (less than half) of the 57
TABLE 4.9
VIEW OF ANIMALS AND VISITOR GESTURES

<table>
<thead>
<tr>
<th>VISITOR BEHAVIOR</th>
<th>LEVEL OF VISIBILITY OF THE RED WOLVES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO VIEW</td>
<td>PARTIAL VIEW</td>
<td>FULL VIEW</td>
</tr>
<tr>
<td># of Visitors Observed Per Visibility Level</td>
<td>49</td>
<td>89</td>
<td>46</td>
</tr>
<tr>
<td># of Visitors Who Pointed at the Exhibit</td>
<td>4</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>% of Visitors Who Pointed at the Exhibit</td>
<td>(8.16%)</td>
<td>(36.0%)</td>
<td>37.0%</td>
</tr>
</tbody>
</table>

NUMBER OF RED WOLVES WITHIN VIEW

<table>
<thead>
<tr>
<th></th>
<th>NO WOLVES</th>
<th>ONE WOLF</th>
<th>TWO WOLVES</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Visitors Observed Per Visibility Level</td>
<td>49</td>
<td>88</td>
<td>47</td>
</tr>
<tr>
<td># of Visitors Who Pointed at the Exhibit</td>
<td>4</td>
<td>33</td>
<td>16</td>
</tr>
<tr>
<td>% of Visitors Who Pointed at the Exhibit</td>
<td>(8.16%)</td>
<td>(37.5%)</td>
<td>34.0%</td>
</tr>
</tbody>
</table>

ACTIVITY LEVEL OF RED WOLVES WITHIN VIEW

<table>
<thead>
<tr>
<th></th>
<th>LAYING DOWN</th>
<th>SITTING DOWN</th>
<th>WALKING-PLAYING</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Visitors Observed Per Visibility Level</td>
<td>45</td>
<td>25</td>
<td>65</td>
</tr>
<tr>
<td># of Visitors Who Pointed at the Exhibit</td>
<td>17</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>% of Visitors Who Pointed at the Exhibit</td>
<td>37.8%</td>
<td>28.0%</td>
<td>38.5%</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 184 visitors under observation who responded to a written questionnaire

**Statistical method of analysis used to determine significance: Two Sample Z-Test Applied to Proportions

***Shaded areas indicate significant differences between categories at p= .10

****Parentheses are used to separate numbers that are significantly different from each other

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visitors in the control group had ever seen the red wolf exhibit before. It had been expected that the control group would have a significantly lower quiz score, particularly because so few of the visitors in the control group had seen the red wolf exhibit. However, it turned out that there was only one exception, among the six quiz questions, in which visitors who had viewed the exhibit scored significantly higher than visitors from the control group. The control group had a lower average score for the question asking “What is being done to help red wolves recover from near extinction?” The control group scored an average of 0.68 (out of 2 total possible points) compared to the other group’s average of 1.04. However, it is important to point out that average quiz scores to this question were significantly lower for the control group even when compared to just those people who had visited the exhibit, but were not able to see a red wolf (average score of 1.00). This finding implies that, at least in this instance, visitors learn from the signs, even without a view of the animals. Again, this result was found in only one of six quiz questions, so further study is needed to provide more conclusive evidence concerning the relationship between animal visibility and the visitor learning experience.

The average quiz scores were also low when comparing responses of visitors who had just seen the exhibit, regardless of visibility (Table 4.10 on page 75). Although visitors with a partial or a full view had a higher average quiz score (5.67 and 5.55, respectively) compared to visitors who did not see a red wolf (4.88), this number was not shown to be significantly different. Therefore, while the results of the current study show that there may be a relationship between animal visibility and visitor knowledge of information on interpretive elements, analysis indicated that there is slightly greater than 10% probability that there is no significant relationship.

However, when comparing average visitor quiz scores between visitors who saw either one or two red wolves and those who saw none, visitors who saw either one or two animals scored significantly higher (5.60 and 5.72) compared to visitors who did not (4.88). These results do suggest that, although no statistically significant difference was found between quiz scores and degree of animal visibility, additional studies using larger samples may actually show that there is a significant difference in visitor learning, at least between visitors who have a view of an animal and those who do not.

**Do visitors feel they have learned more from the exhibit when an animal on exhibit is visible?**

Although the average perceived knowledge gain was moderate for all three levels of visibility, there was a significant relationship found between animal visibility and perceived visitor knowledge gain (Table 4.10 on page 75). Visitors who saw a red wolf scored significantly higher compared to those who did not see a red wolf. On a 1-5 scale with 5 indicating that visitors felt they “learned a lot” from the exhibit, visitors with a full view scored 2.69 points and visitors with a partial view scored 2.61 points, both of which were significantly higher averages than the 1.96 score of the visitors who did not see a red wolf. These results

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<table>
<thead>
<tr>
<th>QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerning visitor satisfaction, attitudes, and learning (5= Most positive response)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WOLF VISIBILITY</th>
<th>NUMBER OF WOLVES</th>
<th>ACTIVITY LEVEL</th>
<th>CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>PART</td>
<td>FULL</td>
<td>NONE</td>
</tr>
<tr>
<td>Visitor Satisfaction with View of Red Wolves</td>
<td>(1.71)</td>
<td>(2.80)</td>
<td>(3.86)</td>
</tr>
<tr>
<td>Visitor Satisfaction with Viewing Distance</td>
<td>(2.21)</td>
<td>(2.92)</td>
<td>(3.75)</td>
</tr>
<tr>
<td>Satisfaction with Overall Appearance</td>
<td>(3.23)</td>
<td>(3.65)</td>
<td>(3.95)</td>
</tr>
<tr>
<td>Visitor Perception of How Much was Learned</td>
<td>(1.96)</td>
<td>(2.61)</td>
<td>(2.69)</td>
</tr>
<tr>
<td>Perceived Importance of What was Learned</td>
<td>(2.57)</td>
<td>(3.19)</td>
<td>(3.16)</td>
</tr>
<tr>
<td>Red Wolf Habitat Should be Protected</td>
<td>3.88</td>
<td>4.14</td>
<td>3.91</td>
</tr>
<tr>
<td>Red Wolves Should be Reintroduced into N.C.</td>
<td>3.69</td>
<td>3.84</td>
<td>3.79</td>
</tr>
<tr>
<td>Red Wolves are a Threat to Humans</td>
<td>3.56</td>
<td>3.79</td>
<td>3.68</td>
</tr>
<tr>
<td>Red Wolves Should be Reduced in Number</td>
<td>3.72</td>
<td>4.02</td>
<td>3.70</td>
</tr>
<tr>
<td>Visit Library for Additional Research</td>
<td>(1.85)</td>
<td>(2.20)</td>
<td>(2.21)</td>
</tr>
<tr>
<td>Watch Television Program about Red Wolves</td>
<td>(3.36)</td>
<td>(3.74)</td>
<td>(3.72)</td>
</tr>
<tr>
<td>Quiz Score</td>
<td>4.88</td>
<td>5.67</td>
<td>5.55</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 184 visitors under observation who completed a questionnaire
**Statistical method of analysis used to determine significance: One-Way Analysis of Variance (ANOVA)
***Shaded areas indicate significant differences between categories at p<.10
****Parentheses are used to separate numbers that are significantly different from each other
*****Refer to Appendix F to see how questionnaire responses were coded and how quiz responses were scored
indicate that visitors who have a view of the animals in the exhibit, walk away from the experience with the perception that they have learned more from their visit.

**Do visitors feel that what they have learned is more important when an animal on exhibit is visible?**

Not only was there a significant relationship between animal visibility and perceived knowledge gain, there was also a significant difference between animal visibility and how visitors scored on a question asking visitors about the importance of what they learned (Table 4.10 on page 75). Visitors were asked to respond on a 1-5 scale ranging from 1 = "not important" to 5 = "very important". Visitors who had seen partial or full views of the wolves had significantly higher average responses (3.19 and 3.16, respectively) compared to visitors who had not seen a red wolf (2.57). These findings suggest that visitors who are able to see the animals on exhibit may place more value on what they learned from the exhibit.

In summary, these findings indicate that 1) visitors who have a view of an animal, whether a partial or full view, have a significantly higher quiz score compared to visitors with no view of an animal, 2) visitors who have a view of the animals on exhibit feel they have learned more from the experience, and 3) visitors who have a view of the animals on exhibit place greater value on what they learned from the exhibit. There is also less conclusive evidence suggesting a relationship may exist between the number of animals within view and increased knowledge gained from the signs.

**RESEARCH QUESTION #3:** How are visitor attitudes toward the species and its natural habitat influenced by the visitors’ view (or lack of view) of the animals in the exhibit?

This research question is examined through the use of two different measures: 1) asking visitors questions to determine their attitudes toward the species and 2) asking visitors questions to determine their willingness to use a portion of their tax dollars to buy land to be reserved for red wolves, to visit a library to learn more about red wolves, or watch a television program about red wolves. The following discussion presents the findings for each of these measures.

**How are visitor attitudes toward the species influenced by the visitors’ view (or lack of view) of the animals in the exhibit?**

There were a total of four questions dealing with people’s attitudes toward red wolves and their native habitat. Visitors were asked to record their level of agreement concerning 1) the protection of native red wolf habitat from development, 2) the reintroduction of red wolves into the wild areas of North Carolina, 3) the perceived threat of red wolves to humans, and 4) the need to reduce red wolves in the wild. Each of the four questions had a 1-5 response scale with the responses being coded such that 5 represented the most positive attitude toward red wolves. The responses to these questions, it was hoped, would help the

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researcher understand what attitudes visitors had concerning red wolves and their native habitat. It had been expected that the averages would be higher for visitors who had recently seen the exhibit compared to those in the control group who had not visited the exhibit.

The average scores of the control group and of the visitors who had been observed at the red wolf exhibit were all relatively high, ranging from 3.56 to 4.15 (Table 4.10 on page 75). These averages were also high regardless of animal visibility for those visitors who saw the exhibit. No significant relationships were found between animal visibility and visitor attitude scores. These results suggest that visitors who have a view of the animals on exhibit will not necessarily leave the exhibit with a significantly more positive attitude toward the species and its habitat. However, these results do suggest that visitors arrive at the zoo with positive attitudes already. However, while partial and full views of the animals on exhibit do not seem to appreciably enhance visitor attitudes, other findings from this study indicate a relationship does exist between animal visibility and visitor attitudes. While no significant differences in average attitude scores could be found when looking at individual questions concerning visitor attitudes, the overall average score for all four attitude questions is lowest among visitors who had no view of a red wolf. People who had visited the red wolf exhibit, but had no view of the animals had a significantly lower average score (17.59 out of 20) compared to people who had just arrived at the zoo (19.81) and compared to people who had a partial view (19.53) or full view (19.54). These results suggest that a lack of animal visibility may actually have a negative effect on visitor attitudes.

*How does animal visibility affect visitor perception of their future behaviors?*

There were a total of three questions dealing with visitors' perceived likelihood of engaging in certain behaviors after leaving the zoo. One question referred to the likelihood that the visitor would support of a decision to use a portion of tax dollars to reserve land for red wolves. The other two questions asked visitors how likely it would be that they would seek out more information at the library or to watch a television program about red wolves after their visit. Visitors were asked to respond on a 1-5 scale ranging from 1 = “not likely” to 5 = “very likely” to engage in the behavior. It was hoped that the responses to these questions might help to determine how animal visibility may influence visitor perception of their future behaviors and, therefore, may help determine visitors’ actual intended behaviors (Ajzen and Fishbein cited in D’Agostino, et al., 1992). It was expected that visitors who had a view of a red wolf would also score higher on these predicted behavior questions.

Looking over the average scores for all visibility levels, the averages ranged from moderately low (1.85) to moderately high (3.74) (Table 4.10 on page 75). Data analysis indicated that there was a significant relationship between animal visibility and average visitor responses to two of the three questions. Visitors who had no view of a red wolf had lower average scores on these two questions compared to visitors who
had a view of a red wolf. The first question in which there was a significant relationship with visitor responses concerned visitor likelihood of watching a television program about red wolves. Visitors who had a partial or full view of a red wolf scored significantly higher (3.74 and 3.72) compared to visitors who did not see a red wolf (3.36). Similarly, visitors who saw either a partial or a full view of the animals on exhibit indicated that they would be more likely to visit a library than visitors who did not see a red wolf (2.20 and 2.21 compared to 1.85). A third question asked visitors about their willingness to allow a portion of their taxes to be used to reserve land for red wolves. Average responses to this question did not indicate a significant relationship between animal visibility and visitor willingness. However, other results did suggest a relationship may exist between visibility and visitor intended behaviors. Although no significant relationships were found when looking at individual questions concerning visitor intentions, or in looking at the sum of the three relevant questions, average visitor responses were lowest for people who had visited the red wolf exhibit, but had no view of the animals. People who had visited the exhibit, but had not seen a red wolf had a lower average score, even compared to visitors who had just entered the zoo. More study is needed, with a larger sample size, to determine if a relationship exists between visibility and intended behaviors.

In summary, these findings suggest that: 1) visitors arrive at the zoo with positive attitudes which do not seem to be strongly influenced by animal visibility, 2) visitor attitudes may be negatively affected if visitors are not able to see the animals at the zoo, and 3) visitors are more likely to perceive themselves learning more about red wolves, either by visiting a library or watching a television program, if they have seen either a partial or full view of a red wolf.

**Research Question #4:** Is visitor satisfaction with the exhibit significantly affected by animal visibility?

There was a significant relationship between the number of animals within view of zoo visitors and 1) visitor satisfaction with the view of the animals, 2) the satisfaction of the viewing distance and, 3) the overall appearance of the exhibit.

Visitors were asked to rate their levels of satisfaction with the view of the red wolves, the distance from which the red wolves were viewed, and the overall appearance of the exhibit (Table 4.10, p.75). Responses were recorded on a 1-5 scale with 5 representing "very satisfied". Not surprisingly, visitors who were not able to see the animals on exhibit had the lowest average viewing satisfaction score (1.71) while visitors with partial and full views of the animals had increasingly higher scores (2.80 and 3.86, respectively). Similarly, visitors who were least satisfied with the exhibit's overall appearance were the visitors who did not see any animals (3.23) compared to visitors who had a partial view (3.65) or a full view (3.95).
Visitors who had a view of more than one animal had higher average visitor satisfaction scores (Table 4.10 on page 75). Visitors who saw two of the red wolves rated their satisfaction with the view of the exhibit significantly higher (3.66) compared to those who saw only one animal (2.95). Visitors from both viewing categories rated their satisfaction with the view significantly higher than people who did not see any red wolves (1.71). Similarly, visitors who saw two red wolves also rated higher on satisfaction with viewing distance than visitors who saw one red wolf or who did not see any red wolves (3.51 compared to 3.10 compared to 2.21). Additionally, visitors who had a view of both of the red wolves in the exhibit had significantly greater satisfaction with the overall appearance of the exhibit. While all scores for visitor satisfaction with the overall appearance were relatively high, the more animals in view, the more satisfied were the visitors. Visitors who saw both animals had an average overall satisfaction response of 3.86 compared to visitors who saw only one animal on exhibit whose average response was 3.72 for overall satisfaction. Not surprisingly, both of these responses were higher than the rating of 3.23 by visitors who had no view of a red wolf.

Finally, visitors who saw animals while they were most active (for example, walking, running, or playing) were significantly more satisfied with their view of the red wolves (3.69) compared to those who saw the animals sitting (2.82) or laying down (2.66). Similarly, visitors were significantly more satisfied with their viewing distance if the animals were walking, running, or playing (3.64) than if the animals were either sitting (2.73) or laying down (2.93).

Based on observations at the red wolf exhibit, there seems to be a relationship not only between animal visibility and visitor satisfaction, but also between visitor satisfaction and visitor behavior. One example of how visitor behavior may be influenced by exhibit design stems from visitor reaction to not having a view of the animals in the exhibit. It seemed that when visitors were not satisfied with the view they had, they often tried to increase their chances of getting a view of the animals in the exhibit. Some of the ways they did this were potentially harmful or stressful to zoo animals. Some visitors tried to get wolves attention by making noise, such as: whistling and calling to the wolves, thumping on the hand-railing or glass, and howling. While these behaviors seemed annoying, at worst, they generally had the opposite effect intended by the zoo visitors. The more noise made by visitors, the more the animals went into "hiding." Another, potentially more harmful, method of getting a view of the wolves was to go off the pathway to get closer to the enclosure in which the animals were located. Portions of two visitor groups were observed engaging in this activity. While both groups left the prohibited area when instructed, they likely will continue such behavior when people around them do not discourage them and their behavior could well encourage other visitors to engage in the same behaviors.
Therefore, it seems possible that exhibit designers who try to protect zoo animals from excessive disturbances by people, by providing animals with visually secluded places within the exhibit, may in fact be encouraging more disruptive behavior by zoo visitors. Visitors who are satisfied with their view of the animals may actually result in happier, less stressed animals simply because visitors who are more satisfied with their view of the animals may be less likely to display behaviors which will increase the levels of stress for the animals. Therefore, happier visitors may result in happier animals. Furthermore, happier visitors may also result in more frequent trips being made to the zoo.

In summary, these findings indicate that 1) visitors are least satisfied with their view of the animals and with the overall exhibit appearance when they are not able to see the animals on exhibit, and become increasingly more satisfied when they are able to see a partial or full view of the animals; 2) visitors are significantly more satisfied with their view of the animals, with the viewing distance, and with the overall exhibit appearance when more animals are within view; and 3) higher animal activity levels significantly increase visitor satisfaction with their view of the animals and with the viewing distance from which the animals are viewed.

**RESEARCH QUESTION #5:** What variables other than animal visibility influence visitor behavior, visitor learning, visitor attitudes, and visitor satisfaction?

There were numerous variables which either influenced or were in some way related to visitor behavior, learning, attitudes, and satisfaction. Only those variables which had a significant relationship are presented in this discussion. These variables will be mentioned so that the reader will have an understanding of the interrelationships between these variables and how they may have affected the results presented earlier in the chapter concerning visitor behavior, learning, attitude, and satisfaction. First, those variables related to visitor behavior are described, for example, visitor perceptions of crowd size and the number of times visitors had previously seen the red wolf exhibit. Secondly, variables which showed a significant relationship with the visitors' learning experience are presented, for example, the influence of reading, group type, and visitor age on quiz scores. Also discussed are the relationships between sign readership and visitors' perception of knowledge gain and between sign readership and perceived importance of that knowledge gain. Thirdly, factors associated with visitors' attitudes are described. These factors include the number of previous visits and the number of signs noticed, and how they relate to visitors' reported attitudes and intended behaviors. Other factors which have a relationship with reported visitor attitudes and/or reported intended behaviors include perceived knowledge gain and perceived importance of that knowledge gain. Lastly, visitor satisfaction with the view of the red wolves, with viewing distance, and with the overall appearance of the exhibit are discussed. The variables related to visitor satisfaction include quiz scores, reported attitudes, and intended behaviors.
Visitor Behavior

- The relationship between crowd size and readership

There was a significant relationship between visitors' feelings about the number of people at the exhibit and sign readership (Table 4.11 on page 82). Significantly more visitors who read signs indicated that they felt the exhibit was “not at all crowded” (21.7%) compared to visitors who felt the exhibit was either “slightly crowded” (10.8%) or “moderately crowded” (13.7%). Similarly, significantly fewer visitors read signs if they had indicated that the exhibit was either “very crowded” (8.9%) or “extremely crowded” (9.5%). However, while crowding does reduce the number of people who stop to read, it does not seem to significantly affect the amount of time spent reading by those who do stop at signs. Average reading times were similar for all crowd categories; visitors who rated the exhibit as “very” to “extremely crowded” spent an average 15.3 seconds reading, visitors who said the exhibit was “moderately crowded” read an average 16.3 seconds, and visitors who rated the exhibit as “slightly” or “not at all crowded” read an average 12.1 seconds and 15.6 seconds, respectively. Still, significantly more visitors stopped to read when they considered the exhibit to be “not at all crowded”, which indicates that the number of people at the exhibit significantly affected visitor reading behaviors.

- The relationship between number of previous visits and readership

There was also a significant relationship between the number of times the visitor had previously visited the exhibit and sign readership (Table 4.11 on page 82). Visitors who had never visited the red wolf exhibit or who had only visited the exhibit once before, spent approximately twice as much time reading (15.7 seconds and 16.8 seconds, respectively) compared to visitors who had seen the exhibit three or more times (8.4 seconds). Similarly, a smaller percentage of visitors stopped to read if they had previously been to the exhibit two or more times (12.7%) compared to the number of visitors who stopped to read who had never seen the red wolf exhibit before (15.3%) or who had been to the exhibit only once before (15.6%). However, this difference is not statistically significant. Regardless, the number of previous visits does significantly affect visitor reading time.

Visitor Learning

- The relationship between readership and quiz scores

Additionally, among visitors who had been observed at the exhibit, there was a significant difference in average quiz scores between visitors who had read signs and those who had not (Table 4.12 on page 84). Visitors who had read at least one sign scored significantly higher (6.33) than visitors who did not read any signs (5.20) and higher than the Control Group (5.51). Additionally, visitors read for more than 15 seconds had an even higher average quiz score (6.85). Similarly, the more signs visitors read, the higher their average quiz score. Visitors who read two or more signs scored higher (6.68) than visitors who read
### TABLE 4.11
SIGN READERSHIP BEHAVIORS AND VISITOR PERCEPTION OF CROWD SIZE / PREVIOUS VISITS

<table>
<thead>
<tr>
<th>SIGN READERSHIP BEHAVIOR</th>
<th>VISITOR PERCEPTION OF CROWD SIZE</th>
<th>NUMBER OF PREVIOUS VISITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXTREMELY CROWDED</td>
<td>VERY CROWDED</td>
</tr>
<tr>
<td>Total Number of Opportunities for Signs to be Read</td>
<td>21</td>
<td>45</td>
</tr>
<tr>
<td>Number of Times Signs Read</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Percentage of Times Signs Read</td>
<td>(9.52)</td>
<td>8.89</td>
</tr>
<tr>
<td>Average Reading Time (in seconds)</td>
<td>15.3</td>
<td>16.3</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of 184 visitors under observation who completed a written questionnaire. The numbers are based on the three opportunities each visitor had to read: before, at, or after the exhibit viewing area for a total of 552 recorded observations.*

*Statistical method of analysis used to determine significance: Chi-Square and Two Sample Z-test Applied to Proportions*

***Shaded areas indicate significant differences between categories at p=.10***

****Parentheses are used to separate numbers that are significantly different from each other***
one sign (5.95) or who did not read any signs (5.20). These results support the claim of previous studies, that when visitors do read, they learn from the interpretive elements. On the other hand, it is also possible that these results suggest that perhaps people did not learn from the signs, but that the people who read the signs were also the people who already knew more.

- **The relationship between group type and quiz scores**

There was also a significant relationship between group type and average visitor quiz scores (Table 4.13 on page 85). People who visited the exhibit alone had a significantly lower average quiz score (3.00) compared to couples (5.94), family groups (5.22), and peer groups (5.78), while mixed groups had the highest average quiz score (7.86). However, please note the very small sample sizes of people who visited the exhibit alone (N=2), in peer groups (N=9), and in mixed groups (N=7). Still, it seems that different group types walk away from exhibits having learned different amounts from signs.

- **The relationship between visitor age and quiz scores**

There was also a significant relationship between different visitor age groups and average quiz scores (Table 4.13 on page 85). Visitors in the youngest age group (15-19) and in the age group between 30-39, had significantly higher average quiz scores (6.31 and 6.54, respectively) compared to visitors between the ages 20-29 (5.18), 40-49 (5.11), and 50 and older (5.16). Therefore, visitor age does have an effect on visitor quiz scores.

- **The relationship between readership and perceived knowledge gained**

There was also a relationship between visitor perception of the amount learned from the red wolf exhibit and sign readership (Table 4.12 on page 84). There was a significant difference in average perceived knowledge gained scores between visitors who read signs (2.76) and those who did not (2.38). Additionally, visitors who read two or more of the signs located around the exhibit had a higher average for perceived knowledge gained (3.00) compared to visitors who read only one sign (2.51) or visitors who did not read any signs (2.34). These results suggest that visitors who read more feel they have learned more. It is important that visitors feel they have learned from their visit, because education is one of the goals of zoo visitors (Polakowski, 1987; Kellert, 1979; Serrell, 1977, and Birney, 1988).

- **The relationship between readership and perceived importance of knowledge gained**

Additionally, there was a significant relationship between sign readership and visitor perception of the importance of what was learned (Table 4.12 on page 84). Visitors who read signs considered what they learned to be of greater importance (3.30) compared to those who did not read any signs (2.91). These results suggest that visitors who read signs may place greater value on their educational experience.
### Table 4.12
SIGN READERSHIP & VISITOR RESPONSES TO QUESTIONS INCLUDED IN THE QUESTIONNAIRE

<table>
<thead>
<tr>
<th>QUESTIONS Concerning visitor satisfaction, attitudes, and learning (5=Most positive response)</th>
<th>AVERAGE VISITOR RESPONSE TO QUESTIONS INCLUDED ON THE QUESTIONNAIRE AS A FUNCTION OF THE NUMBER OF SIGNS READ AND AMOUNT OF TIME SPENT READING SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NUMBER OF SIGNS READ</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Visitor Satisfaction with the View of the Red Wolves</td>
<td>2.78</td>
</tr>
<tr>
<td>Visitor Satisfaction with the Viewing Distance</td>
<td>(2.88)</td>
</tr>
<tr>
<td>Visitor Satisfaction with the Exhibit's Overall Appearance</td>
<td>3.63</td>
</tr>
<tr>
<td>Visitor Perception of How Much was Learned from the Exhibit</td>
<td>(2.38)</td>
</tr>
<tr>
<td>Perceived Importance of What was Learned from the Exhibit</td>
<td>2.91</td>
</tr>
<tr>
<td>Red Wolf Habitat Should be Protected</td>
<td>3.86</td>
</tr>
<tr>
<td>Red Wolves Should be Reintroduced into NC.</td>
<td>(3.64)</td>
</tr>
<tr>
<td>Red Wolves are a Threat to Humans</td>
<td>(3.50)</td>
</tr>
<tr>
<td>Red Wolves Should be Reduced in Number</td>
<td>3.75</td>
</tr>
<tr>
<td>Use Taxes to Reserve Land for Red Wolves</td>
<td>3.27</td>
</tr>
<tr>
<td>Visit Library for Additional Research</td>
<td>2.17</td>
</tr>
<tr>
<td>Watch Television Program about Red Wolves</td>
<td>3.65</td>
</tr>
<tr>
<td>Quiz Score</td>
<td>(5.20)</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 184 visitors under observation who completed a questionnaire

**Statistical method of analysis used to determine significance: One-Way Analysis of Variance (ANOVA)**

***Shaded areas indicate significant differences between categories at p<.10***

****Parentheses are used to separate numbers that are significantly different from each other

*****Refer to Appendix F to see how questionnaire responses were coded and how quiz responses were scored.
TABLE 4.13
QUIZ SCORES AND GROUP TYPE / VISITOR AGE

<table>
<thead>
<tr>
<th>GROUP TYPES</th>
<th>N</th>
<th>Avg. Quiz Score</th>
<th>VISITOR AGE GROUPS</th>
<th>N</th>
<th>Avg. Quiz Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual (Alone)</td>
<td>2</td>
<td>3.00*</td>
<td>15-19</td>
<td>13</td>
<td>6.31*</td>
</tr>
<tr>
<td>Couples</td>
<td>51</td>
<td>5.94</td>
<td>20-29</td>
<td>57</td>
<td>5.18</td>
</tr>
<tr>
<td>Family Groups</td>
<td>115</td>
<td>5.22</td>
<td>30-39</td>
<td>52</td>
<td>6.54*</td>
</tr>
<tr>
<td>Peer Groups</td>
<td>9</td>
<td>5.78</td>
<td>40-49</td>
<td>28</td>
<td>5.11</td>
</tr>
<tr>
<td>Mixed Groups</td>
<td>7</td>
<td>7.86*</td>
<td>50 and older</td>
<td>25</td>
<td>5.16</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of 184 visitors under observation who completed a written questionnaire.

**Statistical method of analysis used: One-Way Analysis of Variance (ANOVA)

***Shaded areas indicate significant differences between categories at p<.10

****Asterisks are used to separate numbers that are significantly different from others

Visitor Attitudes

- The relationship between previous number of visits and visitor attitudes/intended behaviors

There was a significant relationship between visitor attitudes and number of previous visits (Table 4.14, p. 86). Visitors who had seen the red wolf exhibit at least three times had a significantly higher total average attitude and behavior score (28.05) compared to visitors who had never seen the red wolf exhibit before (23.84) or who had seen the exhibit once before (24.92). However, analysis of the data collected from the control group did not indicate a significant difference between the number of previous visits to the exhibit. People who had never visited the exhibit did not score significantly lower (24.29) compared to visitors who had seen the exhibit once (26.64) or twice before (25.10). Although the analysis of the control group did not indicate a similar significant difference, it is possible that the small sample size did not provide sufficient statistical power to produce similar results; there were only eleven visitors who had seen the exhibit once before and only nine had seen the exhibit, previously, on two or more occasions. Therefore, based on the responses of visitors who completed a questionnaire after seeing the exhibit, it seems that visitor attitude scores are related to the number of prior visits to the exhibit. Because the exhibit had only been open for one year when data was collected for this study, it may be assumed, for the purposes of this study, that people who have seen the exhibit two or more times are fairly “frequent” visitors. If this is true, the results suggest that frequent visitors arrive at the zoo with more positive attitudes.

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4 Please refer to Appendix F to review the questions (19-20 and 22-26). The sum of these questions was used in data analysis.
• The relationship between the number of signs noticed and visitor attitudes/intended behaviors

There was also a significant relationship between visitor attitudes and the number of signs visitors reported noticing (Table 4.14 on page 86). Visitors who indicated seeing only one, or no, signs had significantly lower overall average attitude/intended behavior scores (22.34) compared to visitors who recorded seeing two (24.82) or three signs (24.86). Additionally, visitors who indicated that they saw four or five signs had a significantly higher score (27.21) compared to the others. There are two possible explanations for these results. First, visitor attitude/intended behavior scores may be lower because they did not see the signs to read them. However, it is also possible that visitors who have lower attitude/intended behavior scores may be less interested in reading signs and, therefore, noticed fewer signs because they simply were not looking for them. Therefore, it may not be a difficulty in finding signs which affected visitor recorded attitudes; instead it may be visitor indifference which results in lower attitude/intended behavior scores.

<p>| TABLE 4.14 |
| OVERALL VISITOR ATTITUDES / INTENDED BEHAVIORS AND NUMBER OF PREVIOUS VISITS / NUMBER OF SIGNS NOTICED |
| NUMBER OF PREVIOUS VISITS | NUMBER OF SIGNS NOTICED |</p>
<table>
<thead>
<tr>
<th>STUDY GROUP</th>
<th>N</th>
<th>AVG</th>
<th>CONTROL GROUP</th>
<th>N</th>
<th>AVG</th>
<th>N</th>
<th>AVG</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Visit</td>
<td>137</td>
<td>23.84</td>
<td>No Visits</td>
<td>34</td>
<td>24.29</td>
<td>One</td>
<td>32</td>
</tr>
<tr>
<td>Two Visits</td>
<td>26</td>
<td>24.92</td>
<td>One Visit</td>
<td>11</td>
<td>26.64</td>
<td>Two</td>
<td>66</td>
</tr>
<tr>
<td>Three Or More</td>
<td>20</td>
<td>28.05*</td>
<td>Two Or More</td>
<td>9</td>
<td>25.10</td>
<td>Three</td>
<td>56</td>
</tr>
<tr>
<td>Four - Five</td>
<td>24</td>
<td>27.21*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The information presented in this table reflects data recorded during observations of 184 visitors under observation who completed a questionnaire and responses from the 57 visitors from the control group. Statistical method of analysis used to determine significance: One-Way Analysis of Variance (ANOVA). Shaded areas indicate significant differences between categories at p= .10 Asterisks are used to separate numbers that are significantly different from others.

• The relationship between perceived knowledge gained and visitor attitudes

Additionally, visitors who recorded higher levels of knowledge gained from the exhibit also had increasingly higher average scores on three of the four attitude questions and on all of the predicted behavior questions (Table 4.15 on page 88). Visitor responses to Likert-type scales were coded such that 1 = the least positive response for red wolves and 5 = the most positive response for red wolves (refer to

5 Although there were only four signs included in the study, a fifth sign was added by the zoo half-way through the course of data collection. For this reason, after the fifth sign was added, visitors had the opportunity to indicate if they had seen all five signs located around the exhibit.
Appendix F to see responses for visitors to choose from and how those responses were coded). While the averaged responses to the attitude questions were comparatively high, ranging from 3.53 to 4.64, visitors who responded with higher levels of perceived knowledge gained agreed more strongly with the protection of native wolf habitat (4.33 and 4.64) compared to visitors who recorded that they learned little from their visit (4.08 and 3.79). Similarly, visitors who responded with higher levels of perceived knowledge were more supportive of wolf reintroduction efforts (4.22 and 4.14 compared to 3.65 and 3.95) and more strongly disagreed with the statement that wolves are a threat to humans (4.21 compared to 3.53 and 3.76 and 3.83). These results suggest that visitors who feel they have learned from their experience have more positive attitudes toward the species.

- **The relationship between perceived importance of knowledge gained and visitor attitudes**

Additionally, visitors who recorded higher levels of perceived importance of the educational value of what they learned also had higher average scores for two of the four attitude questions and for all three of the questions used to help identify future behaviors (Table 4.15 on page 88). Visitor responses to Likert-type scales were coded such that 1 = the least positive response for red wolves and 5 = the most positive response for red wolves (refer to Appendix F to see responses for visitors to choose from and how those responses were coded). All averages of the attitude questions were high, ranging from 3.64 to 4.67, regardless of the perceived importance of what was learned from the exhibit. However, visitors who had recorded the highest perceived levels of the importance of the knowledge gained responded more strongly in agreement that wolf habitat should be protected (4.47 and 4.50) compared to visitors who recorded the lower levels of perceived importance of what was learned (3.91 and 4.13). Similarly, visitors who felt the most positive about what they learned from the exhibit, also felt the most strongly that red wolves were not a threat to humans (4.00 and 4.67) compared to visitors who considered what they learned to be unimportant (3.64 and 3.68).

Although not shown to be statistically significant, there also appeared to be a similar trend among visitor responses concerning whether or not the number of red wolves in the wild should be reduced; however, more data would need to be collected to determine if the difference is statistically significant. These findings indicate that visitors who feel they have learned something of value may feel more positively about the animals and their habitats.

- **The relationship between perceived knowledge gained and intended behaviors**

Visitors who feel they have learned a lot from the exhibit also scored significantly higher on visitors' predicted behavior questions (Table 4.15 on page 88). Visitor responses to Likert-type scales were coded such that 1 = very unlikely to engage in a particular behavior and 5 = very likely to engage in a certain behavior (refer to Appendix F to see responses for visitors to choose from and how those responses were coded). Visitors who indicated they had learned more also indicated 1) greater perceived willingness to

*Results & Analysis* 87
### Table 4.15
VISITORS' PERCEPTION OF THEIR LEARNING EXPERIENCE & RESPONSES TO QUESTIONS INCLUDED IN THE QUESTIONNAIRE

<table>
<thead>
<tr>
<th>QUESTIONS Concerning visitor satisfaction, attitudes, and learning (5=Most positive response)</th>
<th>AVERAGE VISITOR RESPONSES TO QUESTIONS INCLUDED ON THE QUESTIONNAIRE AS A FUNCTION OF VISITOR PERCEPTION OF KNOWLEDGE GAIN AND IMPORTANCE OF WHAT WAS LEARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VISITOR PERCEPTION OF THE AMOUNT OF KNOWLEDGE GAINED FROM VISITING THE EXHIBIT</td>
</tr>
<tr>
<td></td>
<td>Using a 1-5 Scaled Response</td>
</tr>
<tr>
<td></td>
<td>1 &amp; 2</td>
</tr>
<tr>
<td>Visitor Satisfaction with View of Red Wolves</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(2.39)</td>
<td>(2.77)</td>
</tr>
<tr>
<td>Visitor Satisfaction with the Viewing Distance</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(2.63)</td>
<td>(2.79)</td>
</tr>
<tr>
<td>Visitor Satisfaction with the Overall Appearance</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(3.38)</td>
<td>(3.33)</td>
</tr>
<tr>
<td>Red Wolf Habitat Should be Protected</td>
<td>(N=33)</td>
</tr>
<tr>
<td>4.08</td>
<td>(3.79)</td>
</tr>
<tr>
<td>Red Wolves Should be Reintroduced into N.C.</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(3.65)</td>
<td>(3.95)</td>
</tr>
<tr>
<td>Red Wolves are a Threat to Humans</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(3.53)</td>
<td>(3.76)</td>
</tr>
<tr>
<td>Red Wolves Should be Reduced in Number</td>
<td>(N=33)</td>
</tr>
<tr>
<td>3.94</td>
<td>4.08</td>
</tr>
<tr>
<td>Use Taxes to Reserve Land for Red Wolves</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(3.06)</td>
<td>(3.51)</td>
</tr>
<tr>
<td>Visit Library for Additional Research</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(2.00)</td>
<td>(2.13)</td>
</tr>
<tr>
<td>Watch Television Program about Red Wolves</td>
<td>(N=33)</td>
</tr>
<tr>
<td>(3.56)</td>
<td>3.56</td>
</tr>
<tr>
<td>Quiz Score</td>
<td>(N=33)</td>
</tr>
<tr>
<td>5.00</td>
<td>5.40</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 184 visitors under observation who completed a questionnaire.

**Statistical method of analysis used to determine significance: One-Way Analysis of Variance (ANOVA).

***Shaded areas indicate significant differences between categories at p= .10.

****Parentheses are used to separate numbers that are significantly different from each other.

*****Refer to Appendix F to see how questionnaire responses were coded and how quiz responses were scored.
help pay to protect native red wolf habitat compared to visitors who thought they learned less from the exhibit (3.51, 3.60, and 3.87 compared to 3.06); 2) greater perceived likelihood of visiting a library for additional research (2.68 compared to 2.00, 2.13, and 2.25); and 3) greater perceived likelihood of watching a television program on red wolves (4.24 compared to 3.56 and 3.78). These results are important because visitor responses may be indicative of what they may do.

- **The relationship between perceived importance of knowledge gained and intended behaviors**
  There was also a significant relationship between perceived importance of knowledge gained from the exhibit and predicted visitor behaviors (Table 4.15 on page 88). Visitors who rated the importance of the educational value higher also had an average score reflecting greater perceived willingness to allow taxes to be used to preserve land for red wolves (4.17) compared to those who rated the importance of what was learned toward the middle of the scale (3.56 and 3.69) and lower end of the scale (2.70). Also, visitors who rated the educational experience as very important also indicated they may be more likely to visit a library for additional research on red wolves (3.08 compared to 2.22, 2.12, and 2.33) or to watch a television program about red wolves (4.42 compared to 3.35, 3.75, and 3.96).

Visitor Satisfaction

- **The relationship between quiz scores and visitor satisfaction with overall appearance**
  Visitor satisfaction with the overall appearance was similarly related to visitor average quiz scores (Table 4.16 on page 90). Visitors who had higher satisfaction with the overall exhibit appearance had significantly higher quiz scores (5.89, 6.72, and 5.92) compared to visitors who gave the exhibit the lowest satisfaction ratings (5.06).

- **The relationship between visitor attitudes and visitor satisfaction with overall appearance**
  Analysis indicated that there was a significant relationship between visitor satisfaction with the overall exhibit appearance and only one of the four attitude questions (Table 4.16 on page 90). While the average attitude scores were all rather high, ranging from 3.57 to 4.62, the only attitude question which seemed to be related to visitor satisfaction was the question concerning whether or not red wolf habitat should be protected. Visitors with the highest satisfaction levels with the exhibit’s overall appearance had a significantly higher average score for this question (4.31 and 4.62) than visitors with the lowest levels of visitor satisfaction with overall appearance (4.12).

- **The relationship between intended behaviors and visitor satisfaction with overall appearance**
  Visitor satisfaction with the overall appearance of the exhibit was related to visitor predicted willingness to allow taxes to be used to reserve land for red wolves (Table 4.16 on page 90). Visitors most satisfied with the overall appearance of the exhibit had a significantly higher average scores, indicating that they would be
### TABLE 4.16
VISITOR SATISFACTION SCORES & RESPONSES TO QUESTIONS INCLUDED IN THE QUESTIONNAIRE

<table>
<thead>
<tr>
<th>QUESTIONS Concerning visitor satisfaction, attitudes, and learning (5=Most positive response)</th>
<th>AVERAGE VISITOR RESPONSES TO QUESTIONS INCLUDED ON THE QUESTIONNAIRE AS A FUNCTION OF VISITOR SATISFACTION WITH VIEW, VIEWING DISTANCE, AND OVERALL APPEARANCE OF EXHIBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VISITOR SATISFACTION WITH VIEW</td>
</tr>
<tr>
<td></td>
<td>Using a 1-5 Scaled Response: 1=Very Dissatisfied to 5=Very Satisfied</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Visitor Perception of How Much was Learned from the Exhibit</td>
<td>(2.00)</td>
</tr>
<tr>
<td>Perceived Importance of What was Learned from the Exhibit</td>
<td>(2.81)</td>
</tr>
<tr>
<td>Red Wolf Habitat Should be Protected</td>
<td>4.10</td>
</tr>
<tr>
<td>Red Wolves Should be Reintroduced into N.C.</td>
<td>4.05</td>
</tr>
<tr>
<td>Red Wolves are a Threat to Humans</td>
<td>3.48</td>
</tr>
<tr>
<td>Red Wolves Should be Reduced in Number</td>
<td>3.76</td>
</tr>
<tr>
<td>Use Taxes to Reserve Land for Red Wolves</td>
<td>(3.18)</td>
</tr>
<tr>
<td>Visit Library for Additional Research</td>
<td>(1.77)</td>
</tr>
<tr>
<td>Watch Television Program about Red Wolves</td>
<td>(3.41)</td>
</tr>
<tr>
<td>Quiz Score</td>
<td>5.55</td>
</tr>
</tbody>
</table>

*The information presented in this table reflects data recorded during observations of the 184 visitors under observation who completed a questionnaire.

**Statistical method of analysis used to determine significance: One-Way Analysis of Variance (ANOVA).

***Shaded areas indicate significant differences between categories at p= .10

****Parentheses are used to separate numbers that are significantly different from each other.

*****Refer to Appendix F to see how questionnaire responses were coded and how quiz responses were scored.
more willing for taxes to be used for this purpose (3.59 and 3.98) compared to visitors who were the least satisfied with the overall appearance (3.26 and 3.28). Similarly, visitors that were the most satisfied with the overall appearance also responded with a significantly higher average in predicting their willingness to watch a television program about red wolves (4.38) compared to the visitors who were less satisfied (3.74, 3.62, and 3.55).

- **The relationship between intended behaviors and visitor satisfaction with view**

  There was a significant relationship between visitor satisfaction with view and responses to the intended behavior questions (Table 4.16 on page 90). The visitors indicated most satisfied with their view of the red wolves were the most willing to allow tax funds to be used to protect land for red wolves. There was a significant difference between those with the lower satisfaction scores when compared to the two highest satisfaction categories. Visitors with the highest degree of visitor satisfaction with the view (responded with either a “4” or a “5”) had the highest averages for likelihood of allowing taxes to be used to for red wolf habitat (4.00 and 3.80) compared to visitors who had lower satisfaction levels (3.18, 3.45, and 3.43). Similarly, visitors with the highest level of satisfaction with their view also had the highest average for perceived likelihood of making a visit to a library to learn more about red wolves (2.95) and to watch a television program about red wolves (4.27) compared to visitors responding with the least satisfaction with the view (1.77 and 3.41, respectively). These results suggest that visitors who are more satisfied with their view have more positive behavioral intentions in the future, which may in turn be an indication of actual behaviors. If visitor reports of their intended actions are consistent with their actual behaviors, then these findings are important because they indicate that visitor intended behaviors are related to visitor satisfaction.

**SUMMARY OF RESULTS**

The results of data collection and analysis indicate that the visibility of the animals on exhibit does affect visitor experience at the zoo. This section will summarize the results of this thesis concerning how animal visibility, the number of animals within view, and animal activity influence visitor behavior, visitor learning experiences, visitor attitudes, and/or visitor satisfaction. This section will also briefly discuss other factors which have had an effect on behavior, learning, attitudes, and satisfaction. Figure 4.1, on page 92, is presented so that the reader may better visualize the interrelationships which exist between both the visitor experience at zoological parks and animal visibility as well as between the visitor experience and other factors examined in this study.
VISITOR BEHAVIOR

The results of this thesis indicate that animal visibility and the number of animals within view have a significant influence on visitor sign readership behavior. The results also indicate that there may be a relationship between sign readership and animal visibility, animal activity, and the number of animals within view. These findings are important because signs are one of the primary methods used by zoos to educate the general zoo visitor. Only those visitors who read the signs can benefit from them, and the results of this study indicate that animal visibility influences sign readership. Therefore, this information provides zoo designers with more data concerning how to increase sign readership.

![Diagrammatic Summary of Results](image)

**FIGURE 4.1 - Diagrammatic Summary of Results showing the interrelationships between the view of the animals on exhibit and visitor experience**

There was also a significant relationship between visitor interactions and animal visibility. These findings are valuable because they provide additional support that animal visibility affects the visitor learning experience because, according to Screven (1979), "Such interaction reflects involvement -- a prerequisite to learning -- and is a useful indication that the conditions for learning are present" (pp. 152-153).

VISITOR LEARNING EXPERIENCE

Animal visibility also had a significant effect on the visitor learning experience as measured by visitor quiz scores, visitor perceptions of amount of knowledge gained, and the value visitors placed on the what visitors felt they learned. Not only did visitors learn more if they had a view of at least one red wolf, but those who had a view of a red wolf also felt they had learned more from the experience and placed greater
value on what they learned from the exhibit. These findings are meaningful because they provide evidence that there is a relationship between animal visibility and sign readership. This is information that may be used to increase the amount of sign readership at zoos, which is important because signs are one of the primary means currently used at zoos to communicate with zoo visitors. These findings are also significant because if people do visit the zoo with education as one of their primary goals, as previous studies have suggested (Kellert, 1979; Serrell, 1977; Birney, 1988), they will likely be much more satisfied with their zoo experience if they feel that they have successfully achieved this goal. Visitors who do not feel that they have learned as much from their experience, or who do not place as much value on what information they did learn, may be more disappointed in their visit. As a result, it is possible that these visitors will be less likely to soon return to the facility.

VISITOR ATTITUDES
Animal visibility, the number of animals within view, and animal activity also affected visitor attitudes. Visitors who had seen either a partial or full view of a red wolf indicated that they were more likely to either visit a library or watch a television program to find out more about the species. This is valuable information because of the potential that peoples' expressed attitudes toward a behavior might be able to be used to predict future behaviors (D'Agostino, Ross, and Webb, 1992; Ajzen and Fishbein cited in D'Agostino, Ross, and Webb, 1992).

VISITOR SATISFACTION
As expected, it was shown that visitors were increasingly more satisfied when they were able to see a partial or full view of a red wolf, and were more satisfied with greater levels of animal activity, and greater numbers of animals within view. These findings are important because people who are more satisfied with the exhibit at a zoo may be more likely to visit the zoo again, and may visit more often.

Furthermore, there were also found to be relationships between visitor satisfaction and quiz scores, attitude scores, and intended behaviors. These findings are significant because if visitors learn more from signs when they are more satisfied with the exhibit, this would provide further support for designing exhibits in which visitors have views of the animals.

ADDITIONAL INFLUENCES ON THE RESULTS OF THIS STUDY
There were numerous variables examined to determine their influence on visitor behavior, learning experience, and attitudes. The variables of greatest interest were visitors' perceived levels of crowding and number of previous visits. Sign readership behavior was significantly affected by these two variables. Two other variables had a significant effect on the results of this study. There was found to be a relationship...
between visitor quiz scores and visitor group type and age. Different group types and age categories were shown to have significantly higher quiz scores. These findings are important to note because they had a significant impact on sign readership behaviors and the visitor learning experience. Realizing that these relationships exists helps us to identify the limitations of the relationships between animal visibility and visitor behavior and learning experiences. Understanding these variables also further helps us to realize the reasons why some visitors read less or are less likely to stop to read.

CONCLUSIONS

The findings of this study suggest there is a significant relationship between animal visibility and visitor behavior, learning experience, attitudes, and satisfaction. Most importantly, the results of this study indicate that the design of animal exhibits, and the resulting visitor experience, can significantly influence how visitors use the associated interpretive materials. The design of the exhibit provides the setting for the animals and is a critical force in regulating whether or not the animals living in the exhibit will be visible and also partially affects the activity levels of the animals. Because of the strong influence the design of the exhibit has on animal visibility and activity, it also has a major bearing on how the interpretive signs located around the exhibit will be used. These results are important because a primary zoo objective is visitor education through sign readership, and this study shows designers that the design of exhibits, themselves, have a major influence on readership.

The final chapter, Chapter 5, will propose a theory of zoo design incorporating the findings from this study. The design implications of the findings discussed in this chapter on current exhibit design practices will be discussed along with a series of design recommendations with examples of how to incorporate these recommendations into actual design.
INTRODUCTION

The research questions in this thesis have focused on how zoo visitors are influenced by the visibility of the animals on exhibit. The analysis of the data collected for this study indicate that the view of the animals on exhibit does have a significant effect on visitor behavior, visitor learning experiences, visitor attitudes, and visitor satisfaction. These findings have implications for the way zoo exhibits are currently being designed.

The findings of this study provide insight into how to design exhibits which will enhance the visitor experience at zoos. However, zoo designers have other issues to consider when designing zoo exhibits. For example, zoos also have an obligation to provide a physiologically and psychologically healthy environment for the animals on exhibit. There can be conflicts which develop between the design objectives for zoo animals and zoo visitors. The implications of the findings of this study will address these conflicts and will provide suggestions concerning how to better satisfy both user groups.

This chapter will first propose a theory on zoo design based on the results of the data analysis from this study and concepts of attention, involvement, and anticipation developed by environmental psychologists, Stephen and Rachel Kaplan. The next portion of this chapter presents current practices in exhibit design and discusses the implications of the findings of this study, and the resulting theory, on these current practices. The following five popular design practices will be included in this discussion: naturalistic habitats, animal retreats, enrichment techniques, animal activity cycles, and multiple animal and mixed species exhibits. Each of these design practices affect visitors' view of the animals in exhibits. Some of these practices have positive impacts while others may have negative impacts on visitors' view of the animals on exhibit. Chapter 5 will conclude with a brief discussion of potential areas of future research.
TOWARD A THEORY OF ZOO EXHIBIT DESIGN

INVolVEMENT

Comments made by visitors to the red wolf exhibit indicate that visitors enjoy having to visually explore animal exhibits somewhat before getting a view of the animals in the exhibit. Several visitors who, whether or not they saw the animals, explained that, "It's more interesting if you have to look for (the animals)." Zoo exhibit designer, Jon Coe, has discussed the idea that providing zoo visitors with an obvious and immediate view of the animals on exhibit is too easy for the visitor and, therefore, provides a boring experience (1985).

However, it seems there is a limit to the amount of searching a visitor is willing to do. Approximately one quarter of the visitors who completed questionnaires for this study left the exhibit without having had a view of the animals in the exhibit. Many of those who were not able to see the animals expressed verbal dissatisfaction to other group members as well as to the research assistants administering the questionnaire. Analysis of questionnaire responses further supported what visitors had verbally expressed: visitors who did not see an animal were significantly less satisfied with their view compared to those who saw an animal.

Therefore, it seems that while visitors do enjoy the challenge of looking for animals “hiding” in naturalistic exhibits, the experience is greatly enhanced if they are rewarded with a view of the animal, particularly a full view of the animal. If unsuccessful in their search, visitors leave the exhibit significantly less satisfied with their view, compared to visitors who saw an animal, and significantly less likely to read interpretive signs.

These findings are supported in the literature. Stephen and Rachel Kaplan discuss a concept they refer to as "involvement" which provides support to the idea that visitors will be significantly less satisfied if they are not able to see animals within zoo exhibits. Although the Kaplans did not discuss this concept in the context of zoo exhibit design, it still applies to such a setting. According to the Kaplans, people prefer to test their capabilities and to be somewhat challenged by a situation, but not so much that they feel overwhelmed and confused. The same concept, it seems, could be applied to the visitor experience at zoo exhibits. Visitors enjoy being challenged to search for animals within their natural context, but are disappointed if they are not successful in their attempts to locate the animal.

Conclusion
ATTENTION

In order for visitors to decide to continue spending time at the exhibit, and to decide to read a sign, something must grab and hold the visitors’ attention. The results of this study indicate that visitors are most likely to be influenced the more fully the animal in the exhibit has caught their attention. For example, readership is most increased when visitors have a full view of an animal and when there is more than one animal within view and, possibly, when animals are more active. It seems reasonable to expect that visitors’ attention will be directed at exhibits in which several animals are within view and active: after all, one of their goals in coming to the zoo is to see the animals. The literature provides an additional explanation as to why peoples’ attention is more captivated by such views. According to the Kaplans, people are amazing information processing systems, but they have a limited capacity to the amount of information they can handle at any given moment. Therefore, people are unconsciously forced to determine where their attention must be directed.

A person is not a passive recipient of stimulation. Rather, people are selective in what they perceive, in what information they attend to. The issue, then, may be described better in terms of the requirements of attention, the demands to be selective in the face of a vast array of stimulation (1982, p.102).

One way people limit what they notice in their surroundings is by focusing on what, throughout evolution, would have been perceived as a potential threat or danger. The human processing system still reacts to these warnings of perceived threats and attention is automatically given to these potential dangers. The Kaplans describe this reaction as involuntary attention, “...attention [which] occurs in spite of ourselves. It not only requires no effort, it would take an effort not to attend” (1978, p.85). Therefore, one of the reasons visitors are fascinated by wild animals, particularly those that are moving, is because of the potential threat to people (Kaplan, 1978; Kaplan and Kaplan, 1982). Other literature further support the concept that live animals capture visitor attention (Bitgood, Patterson, and Benefield, 1988; Polakowski, 1987). The reasoning behind this fascination explains why a full view of an animal, a view of an active animal, and views with more than one animal, elicited the strongest responses from the visitors observed during this study.

AROUSAL/ANTICIPATION

Once an exhibit has captured visitors’ attention, visitor arousal and anticipation must be heightened in order to continue to hold visitors’ attention. However, visitor arousal is very complex and cannot be easily explained. Based on the results of this study, it seems that animal visibility, animal activity, and number of animals within view all have a similarly strong effect on visitors. However, it seems that, alone, these are not always enough to elicit full visitor interest. For example, a full view of a sleeping animal would not be as interesting as a partial view of an animal who appears to be preparing to pounce. It is not just that an animal is within view, it is also the anticipation of what may happen next which would seem

Conclusion
to be critical in keeping visitors' interest. Literature supports this notion. According to the Kaplans (1982), people are continuously making unconscious assessments concerning what benefits they may gain from continued involvement. If people anticipate that they will learn more or discover new things from a situation or environment, that environment will hold their interest longer and they are likely to remain and become more involved with that environment. This concept may be applied to the zoo environment in that visitors are more likely to remain involved at those exhibits which hold visitor attention and build anticipation. One way that visitors may become more involved with such exhibits is by reading the interpretive signs.

CURIOSITY

Therefore, it would seem that if an exhibit has successfully caught visitor attention, held that interest long enough for the visitors' arousal and anticipation to build, the end result is that visitors' curiosity will be sufficiently heightened to cause visitors to read the interpretive signs to help satisfy that curiosity.

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**FIGURE 5.1 - A diagrammatic summary of the proposed theory of zoo exhibit design**

**Conclusion** 98
QUALITY EXHIBITS FOR PEOPLE & ANIMALS

NATURALISTIC HABITATS

There is no doubt that naturalistic design has interpretive strengths. An exciting course of paths in the 'wild' that is full of surprises is definitely a good starting point for interpretation. But large complexes and habitat immersion exhibits have drawbacks. The animals are sometimes far away and often difficult to see, especially in indoor enclosures with dense vegetation (Andersen, 1991, p. 5).

Although visitors enjoy visually exploring naturalistic zoo exhibits for animals, visitor desire to remain involved with the exhibit continues only when the animals are within view. Furthermore, visitor curiosity is more likely to be heightened sufficiently to read signs when they have had a view of the animals in the exhibit. However, at many of the naturalistic exhibits, visitors are not able to see the animals. If zoos want to increase sign readership and visitor satisfaction with exhibits, exhibits must be designed to increase the visibility of the animals within the exhibits. These findings should not result in the proclamation that naturalistic exhibits are bad and should not be built any longer. In fact, previous studies also indicate that zoo visitors prefer to view animals within exhibits that simulate a natural environment (Shettel-Neuber, 1988). In addition to the benefits of naturalistic exhibits on visitor interest, enthusiasm, satisfaction, and education (Shettel-Neuber, 1988; Curtis, 1982; Bitgood et al., 1988; Shepherdson and Mellen, 1993), naturalistic exhibits also are psychologically and physiologically beneficial for zoo animals (Curtis, 1982; Hediger, 1964). The results of this study merely indicate that naturalistic exhibits should be designed to enhance the visibility of the animals on exhibit so that visitors are more likely to see the animals and, therefore, read the signs.

Design Recommendations

Use of Natural Features

One means of increasing animal visibility is through strategic placement of naturalistic elements to influence where the animals choose to be, thus affecting the view of the animals within the exhibit. One example, mentioned by Curtis (1982), is the use of vegetation to provide areas of shade to attract animals during the hot summer. Waterfalls or spray misters can be similarly used to lure animals within view of visitors. Another example involves an understanding of the behavioral characteristics of the species which occupy the exhibit. For animals which like to bask in the sun, it is possible to create an exhibit in which "a suitable easily seen basking site can be incorporated in the design and artificially heated for winter viewing" (Curtis, 1982, p. 61). Designers can use zoo keepers' understanding of the natural behaviors of a species to design exhibit elements to entice animals to be in places that are within view of zoo visitors. This increased animal visibility will, in turn, entice visitors to read the signs located around the exhibit.

Conclusion
**Life-Size Animal Replications**

Regardless of how well-planned the exhibit layout is in an attempt to lure zoo animals within view of visitors, there will likely be times when visitors are not able to see the animals in the exhibit. During these times, according to the results of this study, sign readership will decline. One potential method of reversing the effect of decreased readership may be to place life-size, three-dimensional versions of the animals on exhibit along visitor paths as a means of providing visitors the chance to see, up-close, a still-life version of what is in the exhibit. This idea takes one step further a concept mentioned in a study by Bitgood, Benefield, Patterson, and Litwak (1990). The study examined the use of life-size animal cutouts as an attention-getting background for the presentation of interpretive labels.

While these three-dimensional replicas would not be expected to excite visitors as would seeing the living animals, they would still be able to give visitors a close-up look at the shape and size of the animal, perhaps making up for the lack of view of the animals on exhibit. Plus, if the replicas are placed such that visitors happen upon them unexpectedly, the effect may be heightened even more. The surprise “encounters” would likely grab the attention of visitors, increase visitor arousal, and add to visitor anticipation of seeing the live animal. Therefore, these replicas may help to improve visitor readership and attitudes toward the animals on exhibit, during times in which visitors are not able to see the living animals within the exhibit, by helping to grab visitors’ interest and enhancing visitors’ curiosity.

**ANIMAL RETREATS**

At one time or another, most mammals need to be able to retreat from the visiting public, from cage mates or from some other negative environmental factor (Curtis, 1982, p. 63).

As much as visitors want to see the animals in the exhibit, there are times when zoo animals need a visual and auditory retreat from zoo visitors (Curtis, 1982). Thus, zoo animals and zoo visitors have two contradictory goals: visitors hope to see the animals while the animals do not want to be seen, or at least, do not want to see the visitors. However, because of the importance that visitors do see the animals, more ideas need to be developed to find new ways to allow visitors to view zoo animals while providing animals with visual and auditory relief from zoo crowds.

*Conclusion*
Design Recommendations

Animal Rotation

A potential solution for increasing animal visibility and activity, and yet providing zoo animals some time away from visitors, incorporates one of the new advances of exhibit design: the zoo animal rotation concept. Jon Coe defines the concept as "...the regular, controlled movement of individual or groups of animals through a series of enclosures by means of training and habituation" (1995, p.77). With the rotation concept, different species "...occupy the same enclosure consecutively" (Coe, 1995, p.77). Coe mentions that there are several advantages and disadvantages to animal rotation: the advantages are threefold: 1) "...animals that regularly rotate through or between several habitats display greater activity levels". 2) zoo animal rotation would result in "better conditioned animals" as a result of the increased activity, and 3) such a concept could provide the opportunity for "some display areas to be rested or fallowed, allowing plants to recover" (Coe, 1995, pp. 78-79).

However, Coe mentions two disadvantages to the zoo animal rotation concept: 1) more animal training may need to be implemented, particularly for more complex rotation exhibits and 2) animal rotation may increase the potential of parasite and disease transmission between species (1995, p.79).

The solution could be to incorporate the animal rotation idea into a single exhibit. In this scenario, exhibits would be composed of a minimum of two separate enclosures that would appear as one, or which might be divided by the path from which the visitors view the exhibit. The rotation would involve animals of the same species from one exhibit alternating between a "closer" and shallower viewing area to a larger and more spacious and/or secluded enclosure. Because the animals will have the scents of the previous animals to explore and will also have a change of scenery, this rotation may still provide the opportunity to increase animal activity, as mentioned by Coe. The increased animal activity may then result in increased animal visibility and visitors may have greater opportunities to have more views of animals close-up and at a distance. This increase in visibility and activity levels should lead to greater visitor interest in the exhibit resulting in increased readership and, therefore, more positive attitudes for the species.

Additionally, some of the problems of the original zoo animal rotation concept would be alleviated. The system would be able to be kept fairly simple, thus requiring less animal training and, at the same time, reducing the spread of disease and parasites to just those animals within the one exhibit. The rotation would also allow potentially greater stress alleviation as a result of providing the animals the opportunity to put some distance between themselves and the visitors when placed in the larger enclosure. However, one problem with this idea is that it requires greater amounts of space and larger numbers of animals per exhibit and many zoos currently have neither the space nor the money to implement such a design.

Conclusion
**Hidden Rooms and Unique Viewing Positions**

Another way to spark visitor interest and readership is to provide visitors with new and exciting views of the animals at the zoo. One example is by providing visitors the opportunity to view animals hiding in "secluded" areas of the exhibit. Such views could be achieved through the use of one or more "rooms" in structures camouflaged from visitors’ view by the use of vegetation or artificial rock; additionally, the structures could be disguised as architectural elements found within the animals’ native habitat. Visitors could view the animals through one-way viewing materials and/or through numerous smaller viewing windows placed at various heights for visitors of all ages. Additionally, for more of a unique "safari" type of experience, binocular-like openings could be used or, even better, several periscopes could be incorporated into the exhibit providing visitors with close-up views of the animals located almost anywhere within the exhibit. To ensure that a maximum number of visitors can benefit from the periscopes, what is viewed by the person using the scope could be presented on a television screen for other visitors to see. These are just a few examples of how visitors may be able to get the view they want while, at the same time, providing zoo animals with the break they need from the sight and sound of zoo crowds.

Joslin (1982) describes another method of providing visitors with an exciting view of the animals on exhibit without causing stressful conditions for them. Joslin explains an approach incorporated at Salt Lick Lodge in Tsavo National Park, Kenya, where visitors are able to view the animals from a position near a waterhole. A carpeted and lighted culvert pipe was placed below ground for visitors to walk to the viewing area. The visitors view the animals from just a few inches about ground-level. Joslin describes the experience further:

> From here the visitor has a dramatic view of the wildlife at sometimes little more than touching distance. From the animals’ point of view, because they cannot see the people, they are neither intimidated nor frightened. The turret, being restricted to an inferior position in height, further helps in enabling the animals to feel at ease. Translated into zoo context, such an approach means that it would be possible to construct large, spacious exhibits that would not limit visitors to distant viewing (Joslin, 1982, p.31).

This is an excellent example of how to increase visitor arousal and anticipation by providing visitors with an unusual and exciting view of the animals at the zoo, with increased readership as a potential result.

The ideas mentioned above also have the potential to increase visitor interest in the exhibit by introducing visitors to a new way of viewing the animals. There is another benefit of hiding visitors from zoo animals: If the animals are not presented with loud groups of people, they will be much less likely to feel the need to distance themselves from the situation, thus increasing the visibility of the animals for zoo visitors. Sign readership would then likely increase because 1) the visitors are excited by the unusual views and 2) the animal visibility should be improved as well.

**Conclusion**
ANIMAL ACTIVITY CYCLES

It is true that after conquering its original emotion and amazement, historically considered, the public has shown more interest in the active animal than in the one at rest, but for the wrong reasons. The public thought it had the right, once the entrance money was paid, to see every animal at all times, if possible at feeding time, or during some other vivid and entertaining activity (Hediger, 1964, p. 176).

It is not surprising to find that the results of this study indicate that zoo visitors want to see animals, particularly active animals. However, regardless of this finding, zoo animals cannot be expected to “perform” eight hours a day for the whim of zoo visitors (Hediger, 1964). One of the problems is that visitors go to see the animals during times that the animals are least active or asleep. Mammals are mainly active at night or only before sunrise or after dusk (Curtis, 1982). The result is that 1) visitors are often unable to see these inactive animals and 2) visitors are less interested in viewing inactive animals. Therefore, whenever possible, zoo visitors should be able to have the opportunity to visit exhibits when the animals are naturally more active. However, it is important to remember that visitors would prefer even a view of a sleeping animal to not seeing an animal at all.

Design Recommendations

Extended Hours

One means of keeping visitors interested in, and satisfied with, zoo exhibits is to provide people the opportunity to visit during less traditional times when the animals are more active, including during the evening and at night. “In this way it is possible to watch the true nocturnal animal in full activity and also get to know the individual sleeping habits of many day animals, provided of course these night visits are arranged so as not to disturb the animals” (Hediger, 1964, p. 178).

San Diego Wild Animal Park is one such facility which has had success with a night program (Joslin, 1982). Another zoo, the Night Safari project in Singapore, was designed as an “evening-only” attraction (Corder, 1995). According to Corder, “Since opening June 1994, it has attracted over 750,000 visitors and won several awards” (1995, p. 101). Corder explains that approximately 100 species are displayed within 47 exhibits and “all the exhibits and animals are only ever seen by artificial light” (1995, p. 101).

However, not all zoo facilities are able to have such late hours of operation on a regular basis. In these cases, the solution may be to offer special programs, perhaps once a week or less often, in which the hours of operation are extended. Such events would still provide the public the opportunity to view those animals during their times of activity.

Conclusion
Light Reversal Exhibits

Another means of providing visitors with an increased likelihood of viewing active animals is through the use of light reversal exhibits. Light reversal exhibits are one method which can be used to increase animal activity during traditional hours of operation. “The night-day cycle is actually reversed by substituting bright lights at night and subdued light in the daytime when zoo visitors are present” (Curtis, 1982, p. 62). These exhibits increase the possibility that visitors will see active animals and, therefore, become more excited about what they see. These exhibits also increase the likelihood that visitors will see the animals at all, which results in greater readership among visitors.

Views into Animal Resting Areas

Regardless of how the exhibit is designed, there will be times when the animals will choose to lie down and sleep. However, just because the animal wants to sleep does not necessarily mean that visitors should not be able to see them. The periscope idea mentioned earlier could also work in this case as long as they were strategically located so that visitors would be able to see the animals in their preferred resting areas. For those instances in which animals at rest may blend into their environment, a map of the exhibit could be used to highlight the animals’ favorite resting spots, provided that visitors may be able to get a glimpse of the animal, if they just knew where to look.

Likewise, there are many animals which prefer to sleep in the security of a burrow. For these species, visitors may be provided with a view into the burrow through one-way viewing materials and blue-lights which help people to see, but are not perceptible to many animals (Curtis, 1982). Although visitors may not be able to see the animals while they are active, they will be at least somewhat appeased by the opportunity to observe the sleeping habits of the animals.

ENRICHMENT TECHNIQUES

Exhibit design must be concerned about the techniques that will encourage and stimulate the animal to ‘perform’ as they would in the wild. This is surely not just for the sake of the audience but necessary for the well-being of the captive animal (Polakowski, 1987, p. 98).

Environmental (or behavioral) enrichment refers to the improvement of a captive animal’s quality of life by altering its environment to create behavioral opportunities (Hare and Worley, 1995, p.180).

Although used to improve the quality of life for animals in exhibits, the results of this study have indicated that active animals may also have the potential to significantly increase sign readership and do affect visitor satisfaction. The theory developed from these results also suggests that visitors are more interested in

Conclusion
active animals and are more likely to read interpretive signs when they have the opportunity to view active animals. These findings are supported by the results of other studies which provide evidence that visitors are not only initially more attracted to exhibits with active animals (Wolf and Tymitz, 1981), but also, visitors spend significantly more time watching active animals (Bitgood et al., 1988; Polakowski, 1987). Furthermore, literature indicates that animals engaging in their natural behaviors are not only more interesting, but are also more educational (Coe, 1985; Sommer, 1972). Literature also further reinforces the theory developed from the findings of this study and provides additional explanation:

From the standpoint of the visitor, it increases excitement to see an animal in a naturalistic setting, and it certainly contributes to the experience when plants and terrain similar to those native to the animal’s home in nature can be included. However, much of the beauty of the species involves their behavior, not just their “backdrop,” coloration, and physical features. Seeing a serval pounce upon ground prey or flush gamefowl from the brush and snare it on the fly cannot be paralleled by placing these beautiful African cats in an inanimate exhibit, no matter how lush the exhibit (Markowitz, 1982, pp.2-3).

Design Recommendations

Enrichment techniques are a valuable means of stimulating visitors and animals alike and should be implemented and experimented with as much as possible to develop new techniques which are novel (Bryant and Kinzley, 1994; Powell, 1994). Safe, easy for keepers to develop and use, yet durable, and which result in species appropriate behavioral responses from animals (Hare and Worley, 1995).

Because of the great diversity of species and species-specific behaviors which may be encouraged through enrichment techniques, it would seem more beneficial to provide a brief introduction to the categories of the many different types of enrichment techniques, along with some examples, rather than providing a series of specific design recommendations. Because of the many publications available on the subject, only a few examples of enrichment techniques discussed in the literature will be presented here. For more detailed examples, Shepherdson and Mellen list some of the publications in which environmental enrichment techniques and programs are addressed (1993):

- *The Shape of Enrichment*, an internationally circulated, quarterly publication
- *Animal Keepers Forum* - The Journal of the American Association of Zoo Keepers
- *International Zoo Yearbook*
- *Zoo Biology*
- *Animal Welfare* - a journal published by the Universities Federation for Animal Welfare

At the 1995 Annual American Zoo and Aquarium Association, Hare and Worley, co-editors of the publication *The Shape of Enrichment*, explained that the types of enrichment techniques can be divided into eight categories. The descriptions presented by Hare and Worley are summarized below, including examples of enrichment ideas sent in to the authors for publication.

*Conclusion*
**Novel Food Items**

Novel food items are described simply as “items that are not a normal part of the animal’s diet” (p.181). Specifically mentioned are squashes and melons, particularly pumpkins, which are popular among animals in different taxa. Also mentioned is the more controversial offering of carcasses to carnivores (p.181).

**Food Presentation**

Food presentation is explained as “food items presented in a novel, manipulable, or otherwise enriching manner...” (p.182). One example of an inexpensive yet novel presentation of food has been described by Shepherdson, Brownback, and James (1989). The three conducted a study in an attempt to encourage foraging behavior among a group of slender-tailed meerkats, *Suricata suricatta*. In this study, a mealworm dispenser was constructed out of plexiglass and suspended from the roof of an enclosure to provide a full-days worth of an unpredictable supply of food for the meerkats. The results of the study showed that the meerkats were more active and were more visible to the public for greater amounts of time during the day.

**Novel Items**

Novel items are defined as any item that is placed within the enclosure for the animal to interact with. As with most enrichment techniques, these items are kept within the exhibit only temporarily, in order to ensure the novelty of the items. Two “toys” mentioned by Hare and Worley include the “bleeding” BOOMER Ball [trademark (R)] and Christmas trees. The BOOMER Ball has proven to be popular among large cats and Christmas trees are popular among many taxa.

**Novel Experiences**

A novel experience is described as being “something of catch-all, including nonfood items such as audio and olfactory stimulation...[something] that gives an animal an unusual and stimulating experience without involving a particular ‘toy’” (p.183). Hare and Worley mention three examples of what might constitute a novel experience: Using different scents throughout the exhibit, using hoses to spray water and create artificial water currents in a penguin exhibit, and adding snow into indoor exhibits (p.183).

**Enclosure Furniture**

Enclosure furniture is described as “items that are placed ‘semi-permanently’ in the exhibit” (p.183). Two examples of enclosure furniture are provided: 1) Adding bungee cord to primate exhibits as a new and unusual type of climbing material and 2) “attaching broom heads and cocoa fiber mats to walls” for hoofed stock (p.183).

**Conclusion**
**Enclosure Design**

Enclosure design, another category mentioned by Hare and Worley, includes "Permanent parts of the enclosure that facilitate enrichment or are inherently enriching" (p.183).

**Control**

Hare and Worley mentioned the importance of providing animals with "some measure of control over their lives" (p.184). One of the ways in which this can be accomplished is by "providing visual barriers for animals, so they can 'escape' from the public and from each other" (p.184). Based on the results of this study, however, visitors should still be provided with a view of the animals, even if the animals do not have a view of the visitors.

**Intraspecific Interactions**

Intraspecific interactions is another category and "includes opportunities to interact with conspecifics" (p.184). One example of intraspecific interactions was studied by Shepherdson, Bermant, Carman, and Reynolds (1989). The goal of the study was to provide a pair of Lar gibbons, *Hyllobates lar*, with the opportunity to communicate with conspecifics. According to the authors, "For wild gibbons, auditory contact with neighbouring gibbon groups is an important aspect of their life" (p.256). Because only one pair of Lar gibbons was kept at the zoo in which the animals were being studied, recorded Lar gibbon vocalizations were played twice a day. "The results demonstrate that this pair of Lar gibbons responded with increased activity and song to the playing of conspecific duets and that this response was sustained over a period of several months" (p.259).

**Interspecific Interactions**

Interspecific interactions is the final category. Hare and Worley explain that these include opportunities to interact with other species, including humans. Animal training is mentioned as an example of interspecific interaction which not only provides challenge and stimulation for the animals but may also help to reduce stress and aggression during times in which humans are required to interact with the animals, for example during husbandry procedures. Another example of interspecific interaction, and food presentation, is described by Shepherdson, Carlstead, Mellen, and Seidensticker (1993). The four conducted a study in an attempt to decrease the amount of inactivity and pacing behavior in a fishing cat, *Felis viverrina*, by providing the animal with a live-fish as an addition to the animal's regular diet. "Presenting a fishing cat with a live-fish resulted in more activity (60% less sleeping), increased behavioral diversity, including previously unobserved hunting behaviors, and greater enclosure utilization. Effects persisted for at least 48 hours after presentation of live fish, and up to eight days" (p.203).

**Conclusion**
As mentioned by Polakowski (1987), environmental enrichment techniques may range from the very simple and relatively inexpensive to the very complex: “The techniques may be as simple as providing some rocks and clams for the sea otter to smash on its chest (Washington Zoo), or having a rain storm with recorded thunder occur three times a day as in the Denver Zoo’s Bird World, or more sophisticated as pumping honey to the edge of a tree branch that can be reached by the bears (Copenhagen Zoo)” (p.98). However, it is important to remember that enrichment techniques do not have to be elaborate to be effective.

**MULTIPLE ANIMAL AND MIXED SPECIES EXHIBITS**

Most of the past indigenous and exotic exhibits focused on single medium or large-sized mammals. More recent exhibits are trying to portray the wealth of biological and cultural diversity within an ecosystem by displaying mammals, birds, insects, amphibians, fish and man induced conditions in a biome. This approach most likely impacts zoo expository more than...any other recent development (Polakowski, 1993, pp. 189-190).

The results of this study have suggested that the number of animals within view not only influences visitor satisfaction, but also affects the number of signs read and may have the potential to influence the amount of time visitors spend reading. No studies were found which compared exhibits with one and with more than one animal of the same species and their effects on zoo visitors. However, it would seem that more animals would increase the likelihood that visitors would see an animal. Additionally, according to the theory presented earlier in this thesis, visitors would be even more aroused by, and interested in, the view of several animals, compared to the view of just one animal. This theory is supported by the results of previous studies which have indicated that multispecies exhibits may increase visitor curiosity and interest levels (Foster, Koran, Koran, Stark, Blackwood, and Landers. 1988).

Furthermore, animals also generally benefit from being a part of a larger social group. Hediger mentions that, “It is of fundamental importance for every species of animal in captivity to be kept in a natural family group or in larger social groups” (1964, p.104). Furthermore, Hare and Worley believe that “the opportunity for cultural transmission among conspecifics is vital to long term captive breeding and reproduction plans” (p.184). As a result, exhibits with social groups (providing the exhibits are of sufficient size), are beneficial both to zoo visitors and zoo animals, alike. Therefore, animals should be kept in social groups similar to those they would live with in their natural environment, as much as possible. Mixed species exhibits, on the other hand, are more complicated to design because of potentially greater stress levels and aggressive conflicts. However, because of the benefits of such exhibits to visitors, more research needs to be done on how to create successful mixed species exhibits.

*Conclusion*
CONCLUSION

The point of this thesis was not to suggest that zoos should be designed solely with the visitor in mind. While it is important that exhibits excite zoo visitors and encourage sign readership, they must also be designed with respect to the needs of the animals (Polakowski, p. 4). Zoo designers have a responsibility to meet the needs of the animals placed in their exhibits as well as enhancing the visitor experience at the zoo. As Shettel-Neuber has pointed out, it is important that the needs of the visitor and the needs of the animal not be taken into consideration separately because often times these needs may conflict.

If taken separately, therefore, the results of the various measures may lead to different conclusions, and they should be considered in toto... The effects of the exhibits may be more complex (e.g., the important differences may be qualitative rather than quantitative with the experience at the exhibit more important than the length of time at that exhibit) (1988, p. 471).

For this reason, this final chapter has combined discussion of zoo visitor and zoo animal considerations to develop suggestions and recommendations concerning zoo exhibit design.

FURTHER RESEARCH OPPORTUNITIES

During the process of completing this thesis, several additional potential topics for future research and study were noted. These research opportunities are listed below:

1) Some of the results of data analysis suggested, but did not confidently demonstrate, a number of relationships as being statistically significant. Further study with a larger sample size is needed to determine if there is a real relationship between the following:
   - Visibility of animals within view and knowledge gained from interpretive signs
   - Animal activity and amount of time visitors spent reading
   - Number of animals within view and sign readership
   - Number of previous visits to the exhibit and likelihood of stopping to read signs
   - Visitor satisfaction and visitor learning experience
   - Visitor satisfaction and visitor attitude toward the species on exhibit
   - Visitor satisfaction and visitor intended behaviors

2) This thesis focused on one exhibit located near the center of a large zoo. It did not look at the potential effects of animal visibility on visitor behavior or visitor experience at exhibits people see near the beginning or end of their visit to the zoo. Does a lack of animal visibility affect people differently at these exhibits?

3) Are visitors noisier when the animals are out of view or when the visitors are dissatisfied with their view? When animals are provided with only a visual, and not an auditory, retreat from zoo visitors, do they suffer more when they are not within view of zoo visitors compared to when they are within view of visitors?

4) Not only are animals more stressed as a result of loud crowds, but noisy people also seem to affect the visibility level of the animals. What are the most successful methods of quieting down zoo visitors to keep them from disturbing the animals?
5) This study looked, in part, at what visitors learned from the signs located around the exhibit when the animals were not in view compared to when the animals were in view. The study did not attempt to examine what visitors learned from the exhibit itself. Additional studies are needed to explore this complex topic concerning what visitors gain from viewing various types of animal exhibits, including: immersion exhibits, safari parks, and multiple species exhibits, for example.

6) What are other ways to further increase sign readership at zoos and related facilities?

7) What are other ways to get people to learn more from their visit at the zoo?

CONCLUSION

This thesis looked at the influence of animal visibility on zoo visitors. The findings of the study indicate that animal visibility does influence sign readership and visitors who read the signs learn more from their visit and have more positive attitudes of the species on exhibit. Additionally, the results of this study indicate that visitors who have had a view of the animals on exhibit have the perception that they learned more from their visit and what they learned was considered to be more important compared to visitors who did not see an animal on exhibit.

These results support the theory developed as a part of this thesis. According to this theory, the visibility of the animals on exhibit affects visitor involvement, attention, and curiosity, which in turn affect visitor experience and influence visitor willingness to read signs.

The findings of this study are important because of the emphasis being placed on the valuable role of zoological parks in educating the zoo-going public (Polakowski, 1987). One substantial method zoos depend on for educating the public is through the use of interpretive signs. These signs are considered by many as an essential part of the zoo exhibit and visitors must read these signs to benefit fully from their experience at the zoo. Visitors who do not read the signs are missing valuable information that cannot be learned from looking solely at the exhibit itself (Hirschi and Screven, 1988; Arndt, et al., 1993; Bitgood, et al., 1986).

Because animal visibility is regulated, in part, by the design of the exhibit, the results of this study have shown how exhibit design influences visitor use of interpretive elements. These findings can help guide exhibit designers to help ensure that visitors are getting the most from their experience at the zoo.
Appendix A
Description of Sign Content

Interpretive Sign #1
Located on the main path - To the left of the viewing area

(Left Section of Sign)
The Wolf Pack
Family Groups
Three or four wolves make up a pack, while gray wolves form groups of five to fifteen. The difference may relate to eating habits. Red wolves pursue small prey such as rabbits and rodents that can be caught by a single wolf. Gray wolves hunt in bigger packs that can bring down deer, moose, and other large prey.

(Right Section of Sign)
Wolf Talk
Wolves live, hunt, and raise young as a group, so they need to get along. A “pecking order” with one leader and a series of less dominant wolves helps keep the peace. Both red and gray wolves communicate using body language, voice, and scent.

Interpretive Sign #2
Located at the exhibit - To the left of the viewing area

Red Wolf
*Canis rufus*
Weight: 40-70 pounds
Welcome Back
In the 1970s, the few remaining red wolves were brought into captivity. Private, state, and federal organizations have worked to reintroduce this animal to North Carolina. In 1987, red wolves were released back into the wild in the eastern part of the state.

Serviceberry
*Amelanchier canadensis*
Height: up to 30'
Bloom: March-May
A Quite Serviceable Bush
The Serviceberry is known for its early bloom and early fruit. Because it has fruit before many other bushes, its berries are eaten by many animals. At least 22 bird species and 11 mammal species are known to feed on service berries.
Interpretive Sign #3
Located at the exhibit - To the right of the viewing area

Red Wolf
*Canis rufus*
Size 4'-5' nose to tail
Weight: 40-70 pounds

Brink of Extinction
Red wolves were once common in what is now the southeast United States. Early settlers regarded any wolf as a threat to their farm animals and killed wolves as pests. By the 1970s, hunting and habitat loss had nearly driven red wolves into extinction.

(Information that was added to Sign #3 for the study)

Red Wolves and Humans
Like any wild animal, a wolf can be dangerous, especially if it is threatened. However, left alone, healthy red wolves do not pose a threat to humans. In fact, there are no known cases of healthy red wolves attacking people. On the contrary, red wolves try to avoid human contact.

Interpretive Sign #4
Located on the main path - To the right of the viewing area

Red Wolf
Back Home?
Making a Comeback
At one time red wolves lived across the southeast, but their population declined greatly as pioneers settled the land. In the 1970's free-ranging red wolves were captured for a special breeding program. By 1980, the species was declared extinct in the wild. Places like this zoo are raising red wolves to restore them to their former range.

(Information that was added to Sign #5 for the study)

Room for Red Wolves
In the wild, red wolves require a large area to hunt for food and raise their young. If reintroduction efforts are to succeed, efforts are to succeed, the people of the southeastern United States will have to decide to share some of the wilderness with red wolves.
Appendix B
Description of Procedures for Volunteer Research Assistants
OEBSERVATION PROCEDURE
There will be one researcher and two volunteers present at the study site. The researcher will be responsible for visitor observations while the volunteers are responsible for the visitor questionnaires. By having two volunteers responsible for visitor questionnaires, observations can be made continuously. While Volunteer #1 approaches the first visitor to fill-out the questionnaire, the researcher will be able to begin observations on the next visitor selected to be observed. Volunteer #2 will then be available to approach this second visitor when the observation is complete. In this way, Volunteer #1 and #2 will alternate approaching visitors to complete questionnaires. Having two volunteers will allow the observations to continue if one volunteer needs to take a break. If at any time both volunteers are unoccupied, one will sit on the second bench in the viewing area with the researcher to wait for the next visitor to approach, the other will sit on the bench located on the main path. The procedure will continue as follows:

- The researcher will tell the volunteer the group number of the next V.U.O. (= Visitor Under Observation) so the volunteer may record the group number in the Survey Table.
- The volunteer will then read the time to the researcher so that the time may be recorded on both the observation form and in the survey table and, if applicable, on the questionnaire. At the same time, the researcher will record the name of this volunteer on the observation form.
- The researcher will randomly select the visitor under observation based on the technique discussed previously under Group Selection and Group-Member Selection.
- The researcher will provide a verbal description of the visitor under observation to the volunteer.
- The researcher will begin writing observations as the V.U.O. reaches the first sign on the main path. The researcher will continue to observe the V.U.O. until he/she walks past the last sign on the main path.
- Once the observation of the current V.U.O. is complete, the researcher will repeat the process with the next available volunteer.

PROCEDURE FOR APPROACHING VISITORS
- As the visitor under observation nears the last Red Wolf sign, back on the main path: The volunteer will catch up to the V.U.O. after he/she has walked PAST the last sign. It is very important that the visitors be stopped at least six feet away from the last sign; if a person or group is standing too close to the sign, their presence may prevent the next V.U.O. from reading that sign.

- The volunteer will introduce him/herself after the visitor has passed the last sign: “Excuse me...Hi, my name is _______. I am a student from Virginia Tech assisting with a research project on zoo exhibits. Would you be willing to spend a few minutes answering some questions about your visit to the Red Wolf exhibit? Your responses will be anonymous and your names will not be recorded.” It is very important that volunteers repeat the spiel the same way each time.

- If the group responds positively to the request: Each member who appears to be older than 15 will be handed a pencil and a questionnaire form on a clipboard. A total of eight clipboards will be available for distribution; four clipboards will be available for each volunteer.

- If the V.U.O. does not volunteer: The volunteer will direct the following question toward the visitor: “Would you mind also filling out a questionnaire? The more responses we get, the more accurate our results.” Again, it is very important that volunteers repeat the spiel the same way each time.
* After the questionnaires have been returned:
Be sure to thank the visitors for their assistance: “Thank you very much for your help! I hope you enjoy the rest of your visit here at the zoo!” The Volunteer will quickly mark the appropriate space on the questionnaire to indicate which questionnaire was completed by the V.U.O. The volunteer will also record the Group Number and Time onto the front of the questionnaire from the Survey Table. The Volunteer will also make note of any additional comments made by the visitors and will indicate which of those comments were made by the V.U.O. The Volunteer will then return to wait by the Researcher until the Researcher has completed observations. After the Researcher has finished the observations, the Volunteer will hand her the completed questionnaire forms so that it/they may be placed with the corresponding observation form.

• If the group responds negatively to the request:
If the group says they are not interested in completing the questionnaire form, the Volunteer will respond in the following manner:
“Oh, that’s fine. By the way, did you see any of the wolves today?”

IF NO:
“Oh, not even a partial view?”

IF YES:
“Oh, great! Did you get to see the whole animal, or was he partly hidden?”

AND:
“Did you see him doing anything?”

The volunteer will conclude with:
“Well, I hope you enjoy the rest of your visit!”

The volunteer will then write down the responses. Although all responses are important, it is very important that the Volunteer indicate which responses were made by the V.U.O.

MORE ABOUT THE PROCEDURE:
• The V.U.O. will not be included in the study if he/she does not look at the exhibit. For example, if a visitor stops to sit down on one of the benches in the viewing area, but does not move up to the railing located around the moat in the exhibit, the visitor will not be approached to fill out a questionnaire. The V.U.O. will also not be included in the study if he/she turns and walks back in the same direction in which they arrived.
• It is very important that Volunteers not guess or assume the V.U.O.’s view of the animal. If you forget to ask, please just write that down on the Survey Table.
• It is also very important that the Volunteers indicate in the shaded area on the cover-page of the questionnaire whether or not the V.U.O. filled out the questionnaire.
• If the V.U.O. does not fill out the questionnaire him/herself but does provide help in answering the questions, please indicate that on the form.
• Never leave your stuff (like your bookbag) unattended. I have been warned that even if you step away for just a moment, it will most likely disappear.
• Let me know if you have any questions about the questionnaire or the procedure.

VISITOR QUESTIONS:
• “Where are the closest bathrooms?” “Where can we buy food?”
Please be sure to pick up a map for yourself when we enter the zoo. Many of the questions raised by visitors may be concerning the zoo layout.
• “Why is the bear exhibit closed?”
The bears pulled out a lot of the vegetation that was in the exhibit. The zoo is currently in the process of revegetating the exhibit.

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MORE VISITOR QUESTIONS:

- "How long is the questionnaire?"
The questionnaire is three pages long (not including the cover sheet which has no questions for the visitor to answer).

- "How long will it take?"
It will not take very long to fill out the questionnaire; previous visitors have spent about five to ten minutes completing the questionnaire.

- "What kind of questions are on the questionnaire?"
The questionnaire is mostly composed of questions which use a rating scale of five responses - you circle the response which most closely answers the question for you.

- "What is the study about?"
The purpose of the thesis is to determine how to better design zoo exhibits.

- "Are you observing visitors?"
[Please do not point out to visitors that they have been observed; however, if they ask, be honest:]
Visitors are being observed so that sign readership patterns may be recorded.

- "Does the zoo know you are here?"
The zoo is aware of what we are doing and has given us permission to perform this study here. The questionnaire has been approved by zoo personnel.

- "I am interested in finding out more about this study. Can I take this top sheet of the questionnaire with the phone numbers on it?"
[Do not give the top sheet of the questionnaire away - it has important information on it that will be needed for the analysis of the study. Instead give the visitor an Information Card which provides the name of the study, the name and phone number of the researcher, and the name and phone number of the committee chair of the thesis. If the visitor insists on having the top sheet, let him/her have it BUT BE SURE TO COPY THE INFORMATION OFF THE TOP SHEET ONTO THE NEXT PAGE (i.e.: Group Number, V.U.O.?, and Time)]

- "I'll fill out the questionnaire if I can do it down at the snack area / bench"
Go ahead and let them fill out the questionnaire at the snack area or let them go to a bench to sit down.

WHAT TO BRING:

- You may want to bring a pillow for the car
- You may want to bring tapes for the car.
- Don't forget a can-opener if you need one while we're at the zoo
- Don't forget plastic utensils - they are not available at the zoo
- Sun block
- Comfortable shoes
- Dress in layers - it may start out cool and get hot. Since you'll be approaching the public, please wear something that is in good shape (i.e., avoid the jeans / shorts with holes or rips in them)

WHAT TO DO ABOUT FOOD:

- Breakfast:
  - Saturday - We'll be stopping at a McDonald's at about 8:30 am
  - Sunday - The hotel offers bagels, donuts, cold and warm cereals, coffee, apple juice, and o.j.

- Lunch:
  - Saturday - We will be near a snack bar, but food is EXPENSIVE. I have two extra coolers and ice packs for whoever needs them. It may be hot, so bring a water container - there are water fountains in the zoo.
  - Sunday - There is not a refrigerator at the hotel that we can use but we can add ice to the coolers. Peanut butter and jelly will make a cheap meal if you don't want to spend the money on the sandwiches at the deli across from the hotel.

- Dinner:
  - Saturday - There are several fast food places close to the motel. There is also a grocery store if you want to buy something that requires no cooking - the hotel has no kitchenettes.
  - Sunday - We can stop at a fast food place on the way home
**ITINERARY**

**Saturday**

4:30 am - Leave Blacksburg
7:30 am - Arrive in Greensboro - McDonald’s for Breakfast
9:00 am - Arrive at North Carolina Zoological Park
9:30 am - Begin observations
   Between arrival and lunch time - Volunteers can each take a little break, when needed - but one volunteer will need to remain at the exhibit while the other is on break so observations can still be made.
1:00 pm - Tentative Lunch Time (depends on when people get hungry)
   Between departure and lunch time - Volunteers can each take a little break, when needed - but one volunteer will need to remain at the exhibit while the other is on break so observations can still be made.
4:30 pm - Pack up to leave exhibit
6:45 pm - Arrive in Albemarle (Hotel)
???? - Dinner Time - we'll go to eat when people get hungry

**Sunday**

7:00 am - Wake Up Call
8:00 am - Breakfast (at Hotel)
9:00 am - Arrive at North Carolina Zoological Park
9:30 am - Begin observations
   Between arrival and lunch time - Volunteers can each take a little break, when needed - but one volunteer will need to remain at the exhibit while the other is on break so observations can still be made.
1:00 pm - Tentative Lunch Time (depends on when people get hungry)
   Between departure and lunch time - Volunteers can each take a little break, when needed - but one volunteer will need to remain at the exhibit while the other is on break so observations can still be made.
4:30 pm - Pack up to leave exhibit
   We can stop for food if anyone gets hungry
8:45 pm - Arrive in Blacksburg

**ADDITIONAL INFORMATION:**

- I'll call Friday nights if weather is going to be bad in Asheboro

**REFERENCE MAP:**

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<table>
<thead>
<tr>
<th>SIGN #1</th>
<th>SIGN #2</th>
<th>SIGN #3</th>
<th>SIGN #4</th>
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<tr>
<td></td>
<td>RED WOLF EXHIBIT</td>
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<td></td>
<td>VIEWING AREA</td>
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<td>PLANT BED</td>
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- Interpretive Sign
- Bench
Appendix C
Blank Observation Form
Observation #: _______  Volunteer: ___  Time: _______

Gender:  M  F

Group Type:  ALONE  COUPLE  FAMILY  PEER GROUP  MIXED GROUP

Group Size:  1  2  3  4  5+

Number of people in viewing area:  0-5  6-10  11-15  16-20  21+

SIGN #1
Time: ___
Others present: Y  N
Shade: Y  N

SIGN #2
Time: ___
Others present: Y  N
Shade: Y  N

VUO pointed: ______
Other pointed: ______

SIGN #3
Time: ___
Others present: Y  N
Shade: Y  N

SIGN #4
Time: ___
Others present: Y  N
Shade: Y  N

Direction of Travel:  <  >

Overall Weather Conditions:

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<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td>VERY UNCOMFORTABLE</td>
<td>NEUTRAL</td>
<td>VERY COMFORTABLE</td>
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</table>

Temperature: ___
Sunny: ____
Cloudy: ____
Rainy: ____

Wind:  ____STRONG  ____MODERATE  ____SLIGHT  ____NONE

Visibility Level:  NOT VISIBLE  PARTIALLY VISIBLE  CLEARLY VISIBLE

Activity Level:  LYING DOWN  SITTING/WALKING  PLAYING / RUNNING

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Appendix D
Coded Observation Form
CODING METHOD USED FOR OBSERVATION FORMS
(NUMBERS IN PARENTHESES ARE THE CODING NUMBERS USED)

Observation #:  Volunteer:  Time:

Gender:  (1) M  (2) F

Group Type:  (1) ALONE  (2) COUPLE  (3) FAMILY  (4) PEER GRP  (5) MIXED GRP

Group Size:  (1)  (2)  (3)  (4)  (5+)

Number of people in viewing area:  (1) 0-5  (2) 6-10  (3) 11-15  (4) 16-20  (5) 21+

CODING FOR MAP:

TIME RECORDED IN
NUMBER OF SECONDS

OTHERS PRESENT
(1)=Y
(2)=N

SHADE PRESENT
(2)=Y
(1)=N

VUO POINTED
=NUMBER OF TIMES THE VISITOR UNDER OBSERVATION POINTED

OTHER POINTED
=NUMBER OF TIMES OTHER VISITORS POINTED

Direction of Travel:  (1) < (FROM AFRICA ENTRANCE)  (2) > (FROM N. AMERICA ENTRANCE)

AFTER THE TRIAL TEST, IT WAS DECIDED NOT TO RECORD THE FOLLOWING INFORMATION BECAUSE THE VISITORS WERE RECORDING ON THE QUESTIONNAIRES THEIR PERCEPTION OF THE WEATHER AS WELL AS THEIR VIEW OF THE ANIMALS

Overall Weather Conditions:

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<td>2</td>
<td>NEUTRAL</td>
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<tr>
<td>3</td>
<td>VERY COMFORTABLE</td>
<td></td>
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</tbody>
</table>

_______ TEMPERATURE _______SUNNY_______CLOUDY_______RAINY

Wind:  _______STRONG_______MODERATE_______SLIGHT_______NONE

Visibility Level:  NOT VISIBLE  PARTIALLY VISIBLE  CLEARLY VISIBLE

Activity Level:  LYING DOWN  SITTING WALKING  PLAYING / RUNNING
Appendix E
Blank Questionnaire Form for Visitors Leaving the Red Wolf Exhibit
RED WOLF EXHIBIT SURVEY:
A STUDY AT THE NORTH CAROLINA ZOOLOGICAL PARK

The purpose of this questionnaire is to develop an understanding of the factors which affect visitor experience at zoological parks. By understanding these factors, zoo designers may be better able to create more enjoyable and informative zoos.

The survey is being conducted by Michelle Plaatsman, a graduate student in landscape architecture at Virginia Tech. We would greatly appreciate your assistance in answering the questions provided in the questionnaire form. Please do not write your name on this form so that the responses may remain anonymous.

If you have any questions about this study, please contact Michelle Plaatsman (540) 961-2613, or her major professor, Dr. Patrick Miller (540) 231-5506.

THANK YOU FOR YOUR HELP!!!

PLEASE DO NOT MARK IN THE SHADED AREA:

GROUP #

V.U.O.? YES NO

TIME OF INTERVIEW:_:_
The purpose of questions 1-5 is to gather general information about your visit to the red wolf exhibit:

1. At about what time did you arrive at the zoo today? ________________

2. How many times have you seen the red wolf exhibit at this zoo (including this visit)? ________________

3. Did you see any of the red wolves today?
   __________ YES - FULL VIEW  __________ YES - PARTIAL VIEW  __________ NO VIEW
   a. IF YES, How many wolves did you see? __________ ONE  __________ TWO
   b. AND What were the wolves doing? (Please mark all that apply)
      __________ SLEEPING  __________ SITTING  __________ WALKING  __________ RUNNING / PLAYING

4. How do you feel about the number of people you saw at the exhibit today?
   1  2  3  4  5
   __________ EXTREMELY  __________ VERY  __________ MODERATELY  __________ SLIGHTLY  __________ NOT AT ALL
   CROWDED  CROWDED  CROWDED  CROWDED  CROWDED

5. How do you feel about the overall weather conditions at the exhibit today?
   1  2  3  4  5
   __________ VERY UNCOMFORTABLE  __________ NEUTRAL  __________ VERY COMFORTABLE

Questions 6-8 ask your feelings toward different aspects of the red wolf exhibit. Please give us your reaction to each of the statements by circling the appropriate number on the one-to-five rating scale:

6. Were you satisfied with your view of the red wolves today?
   1  2  3  4  5
   __________ VERY DISSATISFIED  __________ NEUTRAL  __________ VERY SATISFIED

7. Were you satisfied with the distance from which you viewed the red wolves?
   1  2  3  4  5
   __________ VERY DISSATISFIED  __________ NEUTRAL  __________ VERY SATISFIED

8. How do you feel about the appearance of the exhibit?
   1  2  3  4  5
   __________ DO NOT LIKE IT AT ALL  __________ NEUTRAL  __________ LIKE IT A LOT

The red wolf exhibit has five interpretive/informational signs. The seven statements below refer to these five signs. Please circle the number on the scale following each statement that most closely describes your reaction to the interpretive signs.

9. How many of the signs did you notice?
   1  2  3  4  5
   __________ ONE  __________ TWO  __________ THREE  __________ FOUR  __________ FIVE

10. How much of the signs' information did you read?
    1  2  3  4  5
    __________ NONE:  __________ A LITTLE  __________ SOME  __________ A LOT  __________ ALL

The signs are:
11.  __________ VERY UNAPPEALING  __________ NEUTRAL  __________ VERY APPEALING
12.  __________ VERY UNINFORMATIVE  __________ NEUTRAL  __________ VERY INFORMATIVE

Please continue to the next page...
The next three questions ask you to rate your understanding of red wolves. Please circle the number which most closely reflects your answer.

16. How would you rate your knowledge of the characteristics and behavior of red wolves prior to your visit to the North Carolina zoo?

1. NO PRIOR KNOWLEDGE
2. LEARNED LITTLE
3. LEARNED A LITTLE
4. GREAT DEAL OF KNOWLEDGE
5. VERY GOOD KNOWLEDGE

17. How much did you learn from your visit to the Red Wolf exhibit?

1. NOT IMPORTANT
2. NEUTRAL
3. SOMEWHAT IMPORTANT
4. IMPORTANT
5. VERY IMPORTANT

18. How do you feel about what you learned about red wolves today?

1. NOT IMPORTANT
2. NEUTRAL
3. SOMEWHAT IMPORTANT
4. IMPORTANT
5. VERY IMPORTANT

The following five statements address your feelings about red wolves and their habitat. Please indicate the extent of your agreement or disagreement with each of the following items:

19. The natural habitat of red wolves should be protected from development:

1. STRONGLY DISAGREE
2. AGREE
3. NEUTRAL
4. DISAGREE
5. STRONGLY AGREE

20. Red wolves should be reintroduced into the wild areas of North Carolina:

1. STRONGLY DISAGREE
2. AGREE
3. NEUTRAL
4. DISAGREE
5. STRONGLY AGREE

21. Red wolves are a threat to farm animals:

1. STRONGLY DISAGREE
2. AGREE
3. NEUTRAL
4. DISAGREE
5. STRONGLY AGREE

22. Red wolves are a threat to humans:

1. STRONGLY DISAGREE
2. AGREE
3. NEUTRAL
4. DISAGREE
5. STRONGLY AGREE

23. Red wolves should be reduced in number in the wild:

1. STRONGLY DISAGREE
2. AGREE
3. NEUTRAL
4. DISAGREE
5. STRONGLY AGREE

The following three questions address the likelihood of your engaging in certain behaviors in the future. Please indicate the likelihood of your taking each of the following actions:

24. How likely is it that you would support a decision to use a portion of your tax dollars to buy land to be reserved for red wolves?

1. VERY UNLIKELY
2. UNSURE
3. LIKELY
4. VERY LIKELY
5. STRONGLY LIKELY

Please continue to the last page...

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25. How likely is it that you will seek out more information on red wolves at the library within the next three months?

1 2 3 4 5
VERY UNLIKELY NOT SURE VERY LIKELY

26. If there is an evening television program on red wolves within the next three months, how likely is it that you would watch it?

1 2 3 4 5
VERY UNLIKELY NOT SURE VERY LIKELY

The following questions are based on the information presented on the signs. Without going back to the signs, please circle the appropriate response to the questions below:

27. Red wolves are currently extinct in the wild.
   ____ TRUE  ____ FALSE

28. What caused red wolves to become nearly extinct in the wild by the 1970s? [Please mark all correct answers]:
   ____ WILD PREDATORS HUNTED THE WOLVES
   ____ HUMANS HUNTED THE WOLVES
   ____ LOSS OF HABITAT
   ____ LOSS OF PREY
   ____ DISEASE

29. Red wolves were once common throughout what region of the United States? [Please mark the one most correct answer]:
   ____ ENTIRE U.S.
   ____ WESTERN U.S.
   ____ SOUTHEASTERN U.S.
   ____ SOUTHEAST AND NORTHEAST
   ____ SOUTHEAST AND SOUTHWEST

30. Name two ways wolves communicate: ___________________ and ___________________

31. What kinds of prey do red wolves pursue?
   ____ LARGE PREY THAT MUST BE BROUGHT DOWN BY A PACK
   ____ SMALL PREY THAT CAN BE CAUGHT BY A SINGLE WOLF
   ____ BOTH OF THE ABOVE

32. What is currently being done in an attempt to help the red wolves recover from near extinction? [Please mark the one correct answer]:
   ____ REMOVING PREDATORS WHICH PREY UPON RED WOLVES
   ____ GAME WARDENS FEEDING RED WOLVES IN THE WILD
   ____ CLOSING THE SEASON ON WOLF HUNTING
   ____ BREEDING IN CAPTIVITY
   ____ NOTHING

Finally, to help us understand those who visit the exhibit, please mark the appropriate response:


34. Gender:  ____ MALE  ____ FEMALE

Additional comments are welcome and can be made on the back of this form...

THANK YOU VERY MUCH FOR YOUR HELP!!!
Appendix F
Coded Questionnaire Form for Visitors Leaving the Red Wolf Exhibit
CODING METHOD USED FOR QUESTIONNAIRES COMPLETED BY VISITORS LEAVING THE RED WOLF EXHIBIT

(NUMBERS IN PARENTHESES ARE THE CODING NUMBERS USED)

1. At about what time did you arrive at the zoo today? __________: THE NUMBER OF HOURS THE VISITOR HAD BEEN AT THE ZOO WAS CALCULATED BY USING THIS RESPONSE WITH THE TIME OF "INTERVIEW" RECORDED ON THE TITLE PAGE OF THE QUESTIONNAIRE.
   (0) = NO RESPONSE / DON'T KNOW
   (1) = 0-1 HOURS
   (2) = UP TO 2 HOURS
   (3) = UP TO 3 HOURS
   (4) = MORE THAN 3 HOURS

2. How many times have you seen the red wolf exhibit at this zoo (including this visit)? __________
   (1) = ONCE
   (2) = TWICE
   (3) = THREE OR MORE TIMES
   (4) = DO NOT KNOW

3. Did you see any of the red wolves today?
   (3) YES - FULL VIEW  (2) YES - PARTIAL VIEW  (1) NO VIEW
   a. IF YES, How many wolves did you see?  (1) ONE  (2) TWO  (0) = NO VIEW
   b. AND What were the wolves doing? (Please mark all that apply)
      (1) SLEEPING  (2) SITTING  (3) WALKING  (4) RUNNING / PLAYING  (0) = NO VIEW

4. How do you feel about the number of people you saw at the exhibit today?
   (1) EXTREMELY CROWDED  (2) VERY CROWDED  (3) MODERATELY CROWDED  (4) SLIGHTLY CROWDED  (5) NOT AT ALL CROWDED

5. How do you feel about the overall weather conditions at the exhibit today?
   (1) VERY UNCOMFORTABLE  (2) NEUTRAL  (3) VERY COMFORTABLE

6. Were you satisfied with your view of the red wolves today?
   (1) VERY DISSATISFIED  (2) NEUTRAL  (3) VERY SATISFIED

7. Were you satisfied with the distance from which you viewed the red wolves?
   (1) VERY DISSATISFIED  (2) NEUTRAL  (3) VERY SATISFIED

8. How do you feel about the appearance of the exhibit?
   (1) DO NOT LIKE IT AT ALL  (2) NEUTRAL  (3) LIKE IT A LOT

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9. How many of the signs did you notice? (0) = NO RESPONSE
   (1) ONE  (2) TWO  (3) THREE  (4) FOUR  (5) FIVE

   ALTHOUGH THERE WERE FOUR SIGNS INCLUDED IN THE STUDY, ONE INTERACTIVE SIGN WAS ADDED BY THE NORTH CAROLINA ZOO HALF-WAY DURING THE STUDY. FOR THIS REASON, THE SCALE FOR THIS QUESTION INCLUDES UP TO "FIVE SIGNS NOTICED" AS A RESPONSE.

10. How much of the signs' information did you read?
    (1) NONE  (2) A LITTLE  (3) SOME  (4) A LOT  (5) ALL

   The signs are:
   (1) VERY UNAPPEALING  (2) NEUTRAL  (3) VERY APPEALING
   (4) VERY UNINFORMATIVE  (5) VERY INFORMATIVE

   (1) VERY DIFFICULT  (2) NEUTRAL  (3) VERY EASY
   TO UNDERSTAND  (4) TO UNDERSTAND

   (5) TOO FEW  (4) JUST THE RIGHT NUMBER  (3) TOO MANY
   (2)  (1)

   (1) NOT AN IMPORTANT PART  (2) NEUTRAL  (3) A VERY IMPORTANT
   OF THE EXHIBIT  (4) PART OF THE EXHIBIT  (5)

16. How would you rate your knowledge of the characteristics and behavior of red wolves prior to your visit to the North Carolina zoo?
    (1) NO PRIOR KNOWLEDGE  (2)  (3)  (4)  (5) GREAT DEAL OF KNOWLEDGE

17. How much did you learn from your visit to the Red Wolf exhibit?
    (1) LEARNED LITTLE  (2)  (3)  (4)  (5) LEARNED A LOT

18. How do you feel about what you learned about red wolves today?
    (1) NOT IMPORTANT  (2) NEUTRAL  (3)  (4)  (5) VERY IMPORTANT

19. The natural habitat of red wolves should be protected from development:
    (1) STRONGLY DISAGREE  (2)  (3) UNDECIDED  (4)  (5) STRONGLY AGREE

20. Red wolves should be reintroduced into the wild areas of North Carolina:
    (1) STRONGLY DISAGREE  (2)  (3) UNDECIDED  (4)  (5) STRONGLY AGREE

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21. Red wolves are a threat to farm animals:

1. STRONGLY DISAGREE
2. UNDECIDED
3. STRONGLY AGREE

QUESTION #21 WAS NOT INCLUDED IN DATA ANALYSIS. THE PURPOSE OF THIS QUESTION WAS TO AID IN MEASURING VISITOR ATTITUDES TOWARD THE SPECIES. HOWEVER, AFTER COLLECTING THE DATA, IT SEEMED UNFAIR TO USE THIS AS AN INDICATION OF ATTITUDE, BECAUSE VISITORS WHO HAVE HIGHLY POSITIVE ATTITUDES MAY Respond IN A “NEGATIVE” MANNER (“STRONGLY AGREE THAT RED WOLVES ARE A THREAT”) BECAUSE RED WOLVES Can BE A THREAT TO FARM ANIMALS. ALTHOUGH THIS IS NOT INDICATED ON THE SIGNAGE. BECAUSE THIS INFORMATION WAS NOT PRESENTED ON THE SIGNS. THIS INFORMATION ALSO COULD NOT BE USED AS A “QUIZ” QUESTION. THEREFORE. THE QUESTION WAS NOT INCLUDED IN THE ANALYSIS.

22. Red wolves are a threat to humans:

1. STRONGLY DISAGREE
2. UNDECIDED
3. STRONGLY AGREE

23. Red wolves should be reduced in number in the wild:

1. STRONGLY DISAGREE
2. UNDECIDED
3. STRONGLY AGREE

24. How likely is it that you would support a decision to use a portion of your tax dollars to buy land to be reserved for red wolves?

1. VERY UNLIKELY
2. NOT SURE
3. VERY LIKELY

25. How likely is it that you will seek out more information on red wolves at the library within the next three months?

1. VERY UNLIKELY
2. NOT SURE
3. VERY LIKELY

26. If there is an evening television program on red wolves within the next three months, how likely is it that you would watch it?

1. VERY UNLIKELY
2. NOT SURE
3. VERY LIKELY

CORRECT ANSWERS ARE MARKED WITH AN “X” - CODING METHOD IS DESCRIBED

27. Red wolves are currently extinct in the wild.

TRUE
FALSE

(0) = BLANK OR INCORRECT
(2) = CORRECT RESPONSE

28. What caused red wolves to become nearly extinct in the wild by the 1970s? [Please mark all correct answers]:

- WILD PREDATORS HUNTED THE WOLVES
- HUMANS HUNTED THE WOLVES
- LOSS OF HABITAT
- LOSS OF PREY - EITHER RESPONSE WAS ACCEPTABLE FOR THIS ANSWER
- DISEASE

(0) = BLANK OR INCORRECT
(1) = ONE CORRECT (EVEN IF ONLY ONE RESPONSE WAS MADE OR ONE WAS INCORRECT)
(2) = CORRECT RESPONSE
29. Red wolves were once common throughout what region of the United States? [Please mark the one most correct answer]:
   ___ ENTIRE U.S.
   ___ WESTERN U.S.
   X_ SOUTHEASTERN U.S.
   ___ SOUTHEAST AND NORTHEAST
   ___ SOUTHEAST AND SOUTHWEST
   (0) = BLANK OR INCORRECT
   (1) = ONE CORRECT (EVEN IF MORE THAN ONE RESPONSE WAS MADE)
   (2) = CORRECT RESPONSE

30. Name two ways wolves communicate: ________________________ and ________________________

   ACCEPTABLE RESPONSES:
   BODY LANGUAGE
   VOICE (ALSO, EITHER BARK OR HOWL)
   SCENT
   (0) = BLANK OR INCORRECT
   (1) = ONE CORRECT (EVEN IF ONLY ONE RESPONSE WAS MADE OR ONE WAS INCORRECT)
   (2) = CORRECT RESPONSE

31. What kinds of prey do red wolves pursue?
   ___ LARGE PREY THAT MUST BE BROUGHT DOWN BY A PACK
   X_ SMALL PREY THAT CAN BE CAUGHT BY A SINGLE WOLF
   ___ BOTH OF THE ABOVE
   (0) = BLANK OR INCORRECT
   (1) = ONE CORRECT (SELECTED “BOTH OF THE ABOVE” AS A RESPONSE)
   (2) = CORRECT RESPONSE

32. What is currently being done in an attempt to help the red wolves recover from near extinction [Please mark the one correct answer]:
   ___ REMOVING PREDATORS WHICH PREY UPON RED WOLVES
   ___ GAME WARDENS FEEDING RED WOLVES IN THE WILD
   ___ CLOSING THE SEASON ON WOLF HUNTING
   ___ BREEDING IN CAPTIVITY
   ___ NOTHING
   (0) = BLANK OR INCORRECT
   (1) = ONE CORRECT (EVEN IF MORE THAN ONE RESPONSE WAS MADE)
   (2) = CORRECT RESPONSE

33. Age: (1) 15-19, (2) 20-29, (3) 30-39, (4) 40-49, (5) 50-59, (6) 60-64, (6) 65 & above

34. Gender: (1) MALE (2) FEMALE
Appendix G
Blank Questionnaire Form for Visitors Entering the North Carolina Zoological Park
RED WOLVES: A STUDY AT THE NORTH CAROLINA ZOOLOGICAL PARK

This study is being conducted to help researchers understand how zoo visitors feel about red wolves. Another purpose of the study is to find out what zoo visitors know about red wolves.

The researcher conducting the study is Michelle Plaatsman, a graduate student in landscape architecture at Virginia Tech. We would greatly appreciate your assistance in answering the questions provided in the questionnaire form. Please do not write your name on this form so that the responses may remain anonymous.

If you have any questions about this study, please contact Michelle Plaatsman (540) 961-2613, or her major professor, Dr. Patrick Miller (540) 231-5506.

THANK YOU FOR YOUR HELP!!!
The following five statements address your feelings about red wolves and their habitat. Please indicate the extent of your agreement or disagreement with each of the following items:

1. The natural habitat of red wolves should be protected from development:
   1  2  3  4  5
   STRONGLY DISAGREE  UNDECIDED  STRONGLY AGREE

2. Red wolves should be reintroduced into the wild areas of North Carolina:
   1  2  3  4  5
   STRONGLY DISAGREE  UNDECIDED  STRONGLY AGREE

3. Red wolves are a threat to farm animals:
   1  2  3  4  5
   STRONGLY DISAGREE  UNDECIDED  STRONGLY AGREE

4. Red wolves are a threat to humans:
   1  2  3  4  5
   STRONGLY DISAGREE  UNDECIDED  STRONGLY AGREE

5. Red wolves should be reduced in number in the wild:
   1  2  3  4  5
   STRONGLY DISAGREE  UNDECIDED  STRONGLY AGREE

The following three questions address the likelihood of you engaging in certain behaviors in the future. Please indicate the likelihood of you taking each of the following actions:

6. How likely is it that you would support a decision to use a portion of your tax dollars to buy land to be reserved for red wolves?
   1  2  3  4  5
   VERY UNLIKELY  NOT SURE  VERY LIKELY

7. How likely is it that you will seek out more information on red wolves at the library within the next three months?
   1  2  3  4  5
   VERY UNLIKELY  NOT SURE  VERY LIKELY

8. If there is an evening television program on red wolves within the next three months, how likely is it that you would watch it?
   1  2  3  4  5
   VERY UNLIKELY  NOT SURE  VERY LIKELY

Please continue to the next page...
The purpose of the following seven questions is to determine the average zoo visitor's knowledge about red wolves. Please circle the appropriate response to the questions below:

9. How would you rate your knowledge of the characteristics and behavior of red wolves?

<table>
<thead>
<tr>
<th>KNOW VERY</th>
<th>KNOW A LOT</th>
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<td>LITTLE ABOUT</td>
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<tr>
<td>RED WOLVES</td>
<td>RED WOLVES</td>
</tr>
</tbody>
</table>

10. How many times have you seen the red wolf exhibit at this zoo?

___ NEVER ___ ONCE ___ TWICE ___ THREE OR MORE TIMES ___ DON'T KNOW

11. Red wolves are currently extinct in the wild.

___ TRUE ___ FALSE

12. What caused red wolves to become nearly extinct in the wild by the 1970s? [Please mark all correct answers]:

___ WILD PREDATORS HUNTED THE WOLVES
___ HUMANS HUNTED THE WOLVES
___ LOSS OF HABITAT
___ LOSS OF PREY
___ DISEASE

13. Red wolves were once common throughout what region of the United States? [Please mark the one most correct answer]:

___ ENTIRE U.S.
___ WESTERN U.S.
___ SOUTHEASTERN U.S.
___ SOUTHEAST AND NORTHEAST
___ SOUTHEAST AND SOUTHWEST

14. Name two ways wolves communicate: _______________ and _______________

15. What kinds of prey do red wolves pursue?

___ LARGE PREY THAT MUST BE BROUGHT DOWN BY A PACK
___ SMALL PREY THAT CAN BE CAUGHT BY A SINGLE WOLF
___ BOTH OF THE ABOVE

16. What is currently being done in an attempt to help the red wolves recover from near extinction? [Please mark the one correct answer]:

___ REMOVING PREDATORS WHICH PREY UPON RED WOLVES
___ GAME WARDENS FEEDING RED WOLVES IN THE WILD
___ CLOSING THE SEASON ON WOLF HUNTING
___ BREEDING IN CAPTIVITY
___ NOTHING

Finally, to help us understand those who visit the zoo, please mark the appropriate response:


18. Gender: ___ MALE ___ FEMALE

THANK YOU VERY MUCH FOR YOUR HELP !!!

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Appendix H
Coded Questionnaire Form for Visitors Entering the North Carolina Zoological Park
CODING METHOD USED FOR QUESTIONNAIRES COMPLETED BY
THE CONTROL GROUP
VISITORS WHO HAD NOT YET SEEN THE EXHIBIT THAT DAY

NUMBERS IN PARENTHESES ARE THE CODING NUMBERS USED

1. The natural habitat of red wolves should be protected from development:

   (1) (2) (3) (4) (5)
   STRONGLY DISAGREE UNDECIDED STRONGLY AGREE

2. Red wolves should be reintroduced into the wild areas of North Carolina:

   (1) (2) (3) (4) (5)
   STRONGLY DISAGREE UNDECIDED STRONGLY AGREE

3. Red wolves are a threat to farm animals:

   1 2 3 4 5
   STRONGLY DISAGREE UNDECIDED STRONGLY AGREE

   QUESTION #3 WAS NOT INCLUDED IN DATA ANALYSIS. THE PURPOSE OF THIS QUESTION WAS TO AID IN MEASURING VISITOR ATTITUDES TOWARD THE SPECIES. HOWEVER, AFTER COLLECTING THE DATA, IT SEEMED UNFAIR TO USE THIS AS AN INDICATION OF ATTITUDE, BECAUSE VISITORS WHO HAVE HIGHLY POSITIVE ATTITUDES MAY RESPOND IN A "NEGATIVE" MANNER ("STRONGLY AGREE THAT RED WOLVES ARE A THREAT") BECAUSE RED WOLVES CAN BE A THREAT TO FARM ANIMALS. ALTHOUGH THIS IS NOT INDICATED ON THE SIGNAGE. BECAUSE THIS INFORMATION WAS NOT PRESENTED ON THE SIGNS, THIS INFORMATION ALSO COULD NOT BE USED AS A "QUIZ" QUESTION. THEREFORE, THE QUESTION WAS NOT INCLUDED IN THE ANALYSIS.

4. Red wolves are a threat to humans:

   (1) (2) (3) (4) (5)
   STRONGLY DISAGREE UNDECIDED STRONGLY AGREE

5. Red wolves should be reduced in number in the wild:

   (1) (2) (3) (4) (5)
   STRONGLY DISAGREE UNDECIDED STRONGLY AGREE

6. How likely is it that you would support a decision to use a portion of your tax dollars to buy land to be reserved for red wolves?

   (1) (2) (3) (4) (5)
   VERY UNLIKELY NOT SURE VERY LIKELY

7. How likely is it that you will seek out more information on red wolves at the library within the next three months?

   (1) (2) (3) (4) (5)
   VERY UNLIKELY NOT SURE VERY LIKELY

8. If there is an evening television program on red wolves within the next three months, how likely is it that you would watch it?

   (1) (2) (3) (4) (5)
   VERY UNLIKELY NOT SURE VERY LIKELY
9. How would you rate your knowledge of the characteristics and behavior of red wolves?

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<th>(1) KNOW VERY</th>
<th>(2) KNOW A LOT</th>
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<td>RED WOLVES</td>
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</tbody>
</table>

10. How many times have you seen the red wolf exhibit at this zoo?

(0) NEVER (1) ONCE (2) TWICE (3) THREE OR MORE TIMES (4) DON'T KNOW

CORRECT ANSWERS ARE MARKED WITH AN "X"

AND CODING METHOD IS LISTED BELOW EACH QUESTION

11. Red wolves are currently extinct in the wild.

___ TRUE ___ FALSE

(0) = BLANK OR INCORRECT
(2) = CORRECT RESPONSE

12. What caused red wolves to become nearly extinct in the wild by the 1970s? [Please mark all correct answers]:

___ WILD PREDATORS HUNTED THE WOLVES
___ HUMANS HUNTED THE WOLVES
___ LOSS OF HABITAT
___ LOSS OF PREY - EITHER RESPONSE WAS ACCEPTABLE FOR THIS ANSWER
___ DISEASE

(0) = BLANK OR INCORRECT
(1) = ONE CORRECT (EVEN IF ONLY ONE RESPONSE WAS MADE OR ONE WAS INCORRECT)
(2) = CORRECT RESPONSE

13. Red wolves were once common throughout what region of the United States? [Please mark the one most correct answer]:

___ ENTIRE U.S.
___ WESTERN U.S.
___ SOUTHEASTERN U.S.
___ SOUTHEAST AND NORTHEAST
___ SOUTHEAST AND SOUTHWEST

(0) = BLANK OR INCORRECT
(1) = ONE CORRECT (EVEN IF MORE THAN ONE RESPONSE WAS MADE)
(2) = CORRECT RESPONSE

14. Name two ways wolves communicate: ________________ and ________________

ACCEPTABLE RESPONSES:

BODY LANGUAGE
VOICE (ALSO, EITHER BARK OR HOWL)
SCENT

(0) = BLANK OR INCORRECT
(1) = ONE CORRECT (EVEN IF ONLY ONE RESPONSE WAS MADE OR ONE WAS INCORRECT)
(2) = CORRECT RESPONSE

Appendices 139
15. What kinds of prey do red wolves pursue?
   
   - [ ] LARGE PREY THAT MUST BE BROUGHT DOWN BY A PACK
   - [X] SMALL PREY THAT CAN BE CAUGHT BY A SINGLE WOLF
   - [ ] BOTH OF THE ABOVE
   
   (0) = BLANK OR INCORRECT
   (1) = ONE CORRECT (SELECTED "BOTH OF THE ABOVE" AS A RESPONSE)
   (2) = CORRECT RESPONSE

16. What is currently being done in an attempt to help the red wolves recover from near extinction [Please mark the one correct answer]:
   
   - [ ] REMOVING PREDATORS WHICH PREY UPON RED WOLVES
   - [ ] GAME WARDENS FEEDING RED WOLVES IN THE WILD
   - [ ] CLOSING THE SEASON ON WOLF HUNTING
   - [X] BREEDING IN CAPTIVITY
   - [ ] NOTHING
   
   (0) = BLANK OR INCORRECT
   (1) = ONE CORRECT (EVEN IF MORE THAN ONE RESPONSE WAS MADE)
   (2) = CORRECT RESPONSE

17. Age: Age:  (1) 15-19,  (2) 20-29,  (3) 30-39,  (4) 40-49,  (5) 50-59,  (6) 60-64,  (6) 65 & above

18. Gender:  (1) MALE  (2) FEMALE
Appendix I
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Bibliography


Bibliography


Bibliography


Vita

Michelle Plaatsman was born in Bethesda, Maryland, on May 8, 1970. The daughter of an army officer, she has lived on both the Pacific and Atlantic coasts, and has traveled extensively within the United States. Michelle attended Radford University, in Radford, Virginia, for four years and graduated with a Bachelor of Science in Biology in 1992. She returned to school in 1993, as a graduate student in the Landscape Architecture program at Virginia Tech. Degree requirements for the Master of Landscape Architecture were completed in September, 1996. Michelle expects to eventually focus on the design of zoological parks and related facilities.